

Episode 238

Making Passive House homes affordable – with Adam Cohen

The show notes: www.houseplanninghelp.com/238

Adam: I received a degree in architecture from the University of Maryland thirty-five years ago, roughly. I'm dating myself a bit. In high school, I was into things like Ken Kern, owner-built home, owner-built homestead and Michael Reynolds. I was really into his Earthships. Malcolm Wells, the US father of the modern earth sheltering movement, I was a big fan of his.

I went to architecture school and I basically was in architecture school at a time when they were doing post-modernism and everything was supposed to have stepped facades and punched openings and little triangular roofs with flags on top, and I was designing earth sheltered churches and national park bathrooms that collected their own water and made their own energy.

It was not a good fit. I barely passed out of architecture school, and I said the last thing I want to do is be an architect. And I went out in the first part of my career, and I started building what I called 'healthy homes,' which was no glues or chemicals, off grid, first generation Arco fifty-five-watt solar panels, composting toilets that we made on site – I was way into it.

What happened here in the US is that we got an administration change between Jimmy Carter and Ronald Reagan that basically quashed any kind of real interest in what I was passionate about. I then went along for a number of years beating my head against a brick wall trying to find people who wanted these healthy homes.

I had very little luck with that and then eventually I found myself eight years later with a family of five, no money and decided I had to do something more traditional. And I started a design build which I ran for twenty years. We had forty-three employees, we were designing what we built and built what we designed.

I was doing anything I could to make money and I would say things like, 'we could change these windows in your package for your house and increase the efficiency of the envelope by fifteen to

twenty percent, and it will only cost you ten-thousand bucks.’ That person might say, ‘I’m not really interested in that, but let’s spend another seventy-five-thousand to build a wine room.’ I’d be like, ‘okay, let’s go ahead and do that.’

Then ten years ago, I was sitting at the dinner table with my family, and my middle son, Zev, said, ‘dad, we’re doing carbon footprints in school.’ So, we started talking about our family’s carbon footprint and that was kind of cool, and then he turned to me – he was twelve at the time, he says really innocently, like a twelve year old kid, ‘dad, how long have people known about climate change, global warming and that kind of thing?’ I said, ‘well, Zev, in the seventies and eighties we were talking about ecology and the environment and humankind’s effect on it. In fact, in the seventies, we were worried about nuclear winter.’ We started talking about what I had been through, and he just looked at me with this totally innocent little kid face, and he said, ‘you mean forty years, and nobody’s done anything?’

It felt to me like he had gotten up from the table, walked up to me and just slapped me in the face. Because I realised I had a company I had built with forty-three employees and we were making all kinds of money, more money than I could shake a stick at, and I had completely given up my principles. I had sold out completely. I was building metal buildings, I was building strip malls, I was building office buildings. Nobody had any interest in the energy efficiency, so I just put it on the back burner.

So, I realised just then and there, it was an awakening and I said, ‘I’ve really not done well. I need to atone for all these sins.’ I’ve put a lot of potential carbon in the atmosphere by creating crappy buildings.

And I dived back in with both feet, started looking around at what’s the latest and greatest, and found Passivhaus in 2008, and by 2009 I was one of the first people taking training in Passivhaus in the US. Because my company did seventy-five percent commercial work, only twenty-five percent residential, I said really residential Passivhaus is the hardest because the skin to volume ratio for a fabric first approach makes a big difference, and for houses you have a lot of skin and a little bit of volume, but commercial buildings have a little bit of skin to a lot of volume.

So, I wanted to do commercial Passivhaus and there wasn’t anybody really training or doing that so, I got my international certification. I spent a month in Europe, two weeks with Passivhaus architects and two weeks with Passivhaus builders, because I’m a

design builder – architect and builder – I wanted to get the flavour from those people who had been doing it for ten to fifteen years.

I came back to the States and started building Passivhaus using a design-build methodology. We built the first public school project, the first dormitory, the first medical office, the first assembly building, the first commercial kitchen – there was a bunch of stuff that we did, and everything we did was at market rate.

Then what happened is that people started noticing in about 2012 and I started being asked to help other teams do this. I was like, ‘oh, yes. It’s super simple to do it,’ but I realised once I got into the real world of design and construction, I realised that I had built myself this wonderful little bubble in south-west Virginia, in my little design-build firm where you’d walk in and you had architects, engineers, builders and everybody’s all there working together. We would design and build, and build and design and it was super simple and easy, but when I got out into the real world, I realised how fragmented and dysfunctional the design and construction world really was.

So, I’ve made it my mission over the last few years since I sold my business, I’m devoting myself in the waning part of my career to education, to try to help the industry move forward. I’ve recently relocated to Canada and I’m helping Passive Buildings Canada put together an education programme to raise awareness, and my basic message to people is if you’re building new construction today, you need to build it to a carbon neutral standard. Our species is on the precipice of fairly exponential change in our climate and it’s going to put a lot of stress on us. We have the choice now to be proactive, or we have the choice later to be reactive.

I think people should be proactive. So, if they’re building a new building, it needs to be built with those same dollars, but it needs to be built with the carbon crisis in mind. They need to reduce their embodied energy and they need to reduce their operational energy and then they need to offset their carbon with either credits, site generation or local generation of energy.

So, that’s what I’m doing now. I’m helping Passive Buildings Canada put together this education programme.

Ben: You’ve covered a lot of ground there. One thing I wanted to pick up on, going right back to the beginning, you had this mission and then it fell on deaf ears really. Then you had that epiphany moment that brought you back. Do you actually think things have changed in the market now?

Adam: In the US, not so much. There are regional portions of the US where there is change – the Pacific North-West and New England states particularly have been at the forefront. So, on a provincial or state level, yes there has been change in the US, but it's been very scattered.

I'd say right now, I'd compare to what's going on with the current federal administration to what happened in the Reagan years. I think it's actually worse than the Reagan years. So, at the federal level, it's actually going backwards pretty quickly. But in the US, there's still state level.

Now, in Canada here, the federal, provincial levels and the municipal levels are pretty well aligned in terms of being tuned in to the climate change emergency. The problem, I think, is within the design and construction industry, we have not raised the consciousness of both the consumers, the owners, and then of the producers, the architects and builders, that this is an important thing.

So, I think it's very niche. I think it's in its infancy in North America and Canada. When I travel to Europe, I see much better awareness amongst the general population. My feeling is that within the European design and construction community, especially Britain, North European, Scandinavian countries, Germany, not so much in France, Belgium for sure, Austria, there's a lot of awareness.

Now, the place that this is really going to make a difference, truly make a difference, is China. In the next twenty years, China has a mission to bring about a third of their population from poverty to the middle class, which is basically equal to the population of the US or the population of Europe, and they're going to be moving them forwards very rapidly to give them housing and services. So, in the design and construction community, the potential for having the greatest impact on the future through the use of low-energy design and construction techniques, I think the greatest potential is what's going to happen in the next twenty years in China.

They've got a long way to go, but they understand that for every kilowatt hour they save, that's going to go towards helping them reduce the load and thus making the generation easier. So, I think they will change.

The other thing is that I have a theory that I've written, called the Integrated Modular Design Theory for High Performance. Basically, my concept is that where we need to go as an industry in the design and construction world is more towards a modular component

model of design and construction where you're designing and optimising small components for putting together into a larger building, and these components maximise and optimise the manufacturing process and simplify the assembly process so that we're able to create buildings more efficiently using standardised metrics of both size and R-value, structural value.

I think where we're going to end up as a species if we don't end up wiping ourselves out, is an approach like you'd have to a space station. Building modular components that you can put together in different ways and could be manufactured efficiently and assembled easily. But that's visionary. That's not quite happening yet. It's happening somewhat, but not so much.

Ben: Let's dig in to a little bit of your experience. I'm rewinding right back to the beginning. You talked about cost parity with a lot of your commercial projects. Is there a sense that this doesn't quite work when it comes to housing? How are we looking?

Adam: One of the things that was really interesting for me is, when I started doing the Healthy Homes thirty-five years ago, I was living in south-west Virginia where people were not interested in energy efficiency at all, or Healthy Homes. In south-west Virginia, you'd say, 'you have really good indoor air quality' and they'd say, 'you mean that I smoke on the porch?' It's not in the top of everybody's minds. They don't get it.

When I got away from that and started going down the traditional route and then I learned how to run a large business with forty employees, one of the things I did was I got educated in business. I'm just a dumb builder at heart. And so when I got back into the Passivhaus world, or back into energy efficiency and really made that a passion, I said to myself, my experience thus far in this area that I'm in is that unless I can make an economic argument for it, it's not going to go anywhere.

The commercial stuff was actually fairly easy to do because of these very advantageous skin-to-volume ratios plus there are other things about commercial construction that make it actually quite simple to get to cost parity in the US and Canada.

In residential, it took me a lot longer. There's actually an article which was in Energy Smart Homes, I think it was called. It's Fine Home Building put out by Taunton Press. It was winter 2014 and there's an article in there where they wrote about the process I went through to figure out how to get to cost parity on residential projects.

So, we were able to get to cost parity on residential projects for single family homes, and we were able to get people moved over from building a regular home to building a passive home. But the trick was that I had to start with the energy savings, and basically the concept was most people we were building for, they had a mortgage and they had an energy bill. So, what I would ask them is, 'on any particular month, which one of those two bills will you elect not to pay? Would you not pay your mortgage or would you not pay your energy bill?' And they'd say, 'I like my house, I'm going to pay my mortgage. I like my lights, I'm going to pay my energy bill.' Then I would point out that what you're actually doing is your cost of ownership of your home is equal to your mortgage plus your cost of energy.

What I was able to do was to define for them, taking a simple example, a two-thousand square foot, two storey standard colonial looking building with an attached garage. In south-west Virginia, when we built Passivhaus, that building would save roughly sixty-five to seventy dollars a month in energy. We could finance with that up to about twenty-five-thousand, twenty-four-thousand dollars. All of the numbers are in the article.

So, we figured out what the bandwidth of the savings was and then it and then it became a question of, if you're going to be paying eleven-hundred dollars a month for energy and mortgage and I can deliver you a building that's more comfortable, that uses less energy, and it's going to cost eleven-hundred dollars a month or less, the difference being that in the code-built home, you're going to be buying an electron, then a nanosecond later buying another electron, and a nanosecond later buying another electron, and all these electrons get used, go away and the money goes into the pocket of the electric utility, if I could take some of that money that you're spending on those electrons and put them into your mortgage so that when you're spending that money on your mortgage you're building equity and wealth rather than just spending money, but the net monthly cost is the same, why would you not do it? That was the value proposition that worked really well for the new homes that we were building.

The trick and the hard part was actually getting the Passivhaus delivery within that market rate. But we were able to do it. When I started doing it, it was really hard because we had to import windows from Europe and there were very few mechanical systems that would work for this. Everything was really expensive. But now, there's all kinds of stuff in the US that allows you to do it.

One of the things I invented for the commercial building industry are these Lego-like pieces that snap together and can basically make a Passivhaus envelope very simple. People have started to use those Lego-like pieces that I designed for very specific low-rise multi-family buildings, and they're now using them for homes too. That's knocking out even more of the cost. So, that was kind of cool.

But that was the value proposition for single-family homes. It was mortgage plus energy is equal to or less than with a passivhaus than what you would pay for a code house.

Ben: Are there any pitfalls then, as an owner-builder, that you should avoid, that you see people make and you think, 'you've just wasted your money'?

Adam: Yes. One of the first pitfalls is owner-builders typically don't have any idea what they're doing.

If you're an owner-builder and you haven't built before, or you have very little experience building and you have no real connection with subcontractor trades and stuff like that, generally things are going to be more time consuming, more expensive. I would say for an owner-builder, getting a good understanding of what they're actually doing is probably the biggest impediment to delivering something for a reasonable amount of money.

I was at a conference a number of years ago, and I was the keynote. I was talking about four examples of built projects that were delivered for market rate. One of the sessions I attended later on in the conference was these folks who had built a passivhaus. It was an owner who had never done anything like that, a Passivhaus consultant who had never done a passivhaus before, a builder who had never done a passivhaus before, and an architect who had never done a passivhaus before. They ended up with a twenty-five percent premium on their building because nobody knew what they were doing, and everybody was using the owner's money to learn. Their experience was not very good.

I came up to them afterwards and I said, 'the reason it cost you twenty-five percent more was because you didn't know what you were doing. You had no guide.'

So, what I've tried to do is encourage people who are starting out on the process like this and really don't have any experience, to go and find people who do. Don't work with a team of people who are completely inexperienced in delivering what you're trying to deliver,

because if you do that, you're probably going to end up wasting a lot of money while people learn.

Ben: And we should underline that. Very good advice.

Adam: Yes. But the other thing potentially, I know in the UK you probably have this. If they were in the US, they could use this Lego system. A couple of different owner-builders this year have used my Lego system and built passivhaus by themselves and hit their airtightness and their thermal continuity first shot out of the gate.

The system that I designed, it's a Passivhaus certified building system. I believe there are two or three of them, not exactly like mine but similar, that exist in the UK, where you can buy an envelope kit. So, it might be that that's a smart way to go.

Ben: You're certainly seeing more of those on the market, a guaranteed shell and then you do the rest of it. That's one way of tackling it.

What about these different buckets then? Let's go into this. You told me a little while ago that you can get carried away in certain places. So, tell us about your bucket system and which buckets we need to be wary of.

Adam: The way I like to simplify the thought process for owners is that when you're approaching a home, you have different buckets that you put money in. One bucket is going to be site acquisition; how much is my lot going to cost.

Another bucket is site development; how much will it cost to clear the lot, grade the lot, do any retaining walls I need, put in sewer and water, bring electricity to the site, pave a driveway if it's going to be paved, put landscaping in. So, this other bucket over here is the site development bucket.

Then you've got two other buckets. One is the sticks and bricks bucket, or what it takes to get the shell up, enclosed and tested for airtightness and thermal continuity; and then you've got the last bucket which is for finishes. That's your interior and exterior finishes, your mechanical, electricals – everything that goes in beyond the shell.

When you start approaching this, if you've got an overall price that you want to pay at the end – I've got x amount of pounds that I'm ready to spend on building a building – you need to understand that these buckets are not fixed. You can move money around within the buckets.

So, I would have people come to me and say, 'I just spent a wad of money on this beautiful lot. It's an acre and it's completely wooded.' I would say to them, 'you've just spent a bunch of money premium for this beautiful wooded lot, but by the time I clear for your driveway, clear for your house, clear for your septic system and clear for your well, you're going to spend fifteen thousand dollars taking down the beautiful trees that you paid for.'

So, understanding that there's an inter-relation between lot and site development and the cost of the lot and the cost of the site development needs to be looked at before you ever start putting your buckets together for your building because the site bucket is somewhat changeable. We can grade a slope rather than put in a retaining wall, potentially. We can put gravel on the driveway rather than pave a driveway. We don't have to use sod, we can use seed and straw and you just have to water it.

There is a certain amount of money that you can save within that bucket and redo, but there's a certain amount that's fixed. Getting your sewer, water, electrics, clearing the site, grading, backfilling – all of that is going to be a fairly static number and there's not a lot of choice that the owner will have in that basic cost.

So, that site bucket needs to be balanced with the site acquisition bucket, so that you understand what the cost of the site development will be, so you know how much you have left over for the other two buckets, the sticks and bricks and the finishes.

Within the sticks and bricks bucket, there are things that you can do, and because Passivhaus is a fabric-first building approach where you start with the envelope, that's all about sticks and bricks. You can do intelligent things, you can design simple structures with fewer corners and fewer fancy rooflines and less room for error. You can optimise your glazing so you're not spending too much on that. But at the end of the day, the sticks and bricks bucket has got a little bit of flexibility in it in terms of, if I want to do four corners over four corners, that's going to be a lot different than twenty-seven corners with some curves all on one floor and then a really complicated roofline. That's easy to understand, that there's some flexibility within that bucket.

But at the end of the day, you might make, in US dollars, ten or fifteen, twenty dollars per square foot difference in terms of something really simple to something more complex, but that sticks and bricks bucket is not really that large. In general, if you're going to design a house and you're going to be an owner-builder, you're probably going to design a fairly simple house because if you're

going to build it yourself, you're probably not going to get into a lot of complexity, especially if you haven't done it before.

The last bucket – and this is the one that really makes a huge difference – is what goes in and what are you going to put on the exterior, on the interior, what kind of lighting and electricals are going in, what kind of plumbing, what kind of mechanical system.

In Passivhaus, your mechanical system is pretty simple. You've got an air exchanger, heat and cooling or dehumidification. I know in our market we've got a fairly good selection of machines to choose from and I know in Europe you've got a really nice selection of different mechanical systems. But beyond the mechanical system for the passivhaus, that's really the only thing that's different in the overall low-energy passivhaus build.

Within the building systems, those two systems, envelope and mechanical systems, are the ones that really are bespoke in terms of Passivhaus. You've got to do this type of envelope and you've got to have this type of mechanical system. So, those two things have to be tackled and you've got to understand what those numbers are, but all the other things in that bucket – electrical, plumbing, floor finishes, wall finishes, cabinetry, appliances, exterior roofing and the type of exterior finish, all of that is really a decision driven by taste and by budget.

So, when you start to create your balance of how do I make all these pieces balance in this budget, I want people to understand that you need to separate out your thinking so that you understand, if I go spend a quarter of my budget on the site and then I spend another quarter of my budget on site development, so I have actually half of my budget to build the building with, is that realistic that I can actually get that building built?

I don't know the British market at all, but in terms of dollars and cents, or pounds, I do know that the concept is the same.

Ben: And it's one that is very tricky to get right for a first-timer, may I add?

Adam: Oh, yes.

Ben: What about in terms of design then? You talked about simple form. Are there other things that would help us on this journey or is that not really what you're hinting at?

Adam: Well, you can save some money in design for sure. If you want to do something that has corner windows, that's going to be a lot more

expensive than doing something that's got two windows that approach the corner but don't touch it. There are some silly things that we do that tend to run up the cost.

One of the things that's really interesting, the Lego system that I created, we put the Lego pieces into CAD, like Revit, AutoCAD, ArchiCAD, but one of the things that we also did was I put it in Sketchup, which is a free program that anybody can download and use. It's been really interesting because the owner-builders that are using our Lego system that I developed for multi-family are using the Sketchup blocks that I created, the Sketchup Lego blocks, to design their houses. And that's kind of cool because all of a sudden they can do a free program and start their design, they use the modules and that leads them to an affordable solution.

So it may be that the British folks who are doing these kits, they may have similar things where people can put them together in simple forms and start to let the manufactured products help you generate what's going to be an efficient form. Rather than taking a design and saying, 'here's my design, now make it fit your manufactured system,' if you're thinking about using a manufactured system so that you get the consistency of airtightness and the consistency of thermal continuity, then rather than starting from 'here's my design, make it fit your system,' start with, 'here's the system, now let's design to the system.' That can really help to keep costs down, at least in the system that we have. I would assume that's similar in other systems.

Ben: We're just about out of time, but any final thoughts or anything you haven't mentioned that you want to quickly get in before the end?

Adam: Yes. One of the things I want to mention is that this is very, very doable and I would hope that anybody considering a new build would try to work their way through to figure out how to build that building with the lowest impact possible. Because as a species, it's critical that each of us make the right decision every day in everything we do, and if you're building a building that's going to saddle your grandchildren with ongoing operational energy that's going to be carbon intensive, you've kind of just slapped your grandchildren in the face.

I'm speaking from someone who has to atone for the sins of my – well, I'm Jewish. I atone for my sins. That's what I do. So, I'm well-trained in that and I know that the millions of square feet where I've built really bad buildings, I'm now approaching about a million square feet of Passivhaus buildings. So, not that I'm offsetting them, but at least I'm reducing my impact long-term.



So, I would encourage all of the individuals listening to this to consider their actions when building a new building, and how it will affect their grandchildren.

Ben: Adam, I really enjoyed our chat. Thank you very much.

Adam: Thank you. I appreciate it.