

Episode 2

The House Design You Want And The Low Running Costs

The show notes: www.houseplanninghelp.com/2

Ben: Today I'm with Martin Evans from Malthouse Consultancy in Hampshire and as we do on this each time we interview someone we just like a bit of background first of all. So how did you become interested in the energy efficiency field?

Martin: Well, I've been in construction all my life. I started as a civil engineer and moved from civils into building. Probably about twenty years ago we started experimenting with solar panels and higher levels of insulation in houses that we were building for spec, for sale in other words, and developed that process through to the point where we got to building the house that we are sat in, which is an example of a country house that is not compromised by any design constraints but is built to be as energy efficient as possible.

Ben: Is this your dream home?

Martin: I guess it is, really. It's the house we always wanted to build for the family and it's been a wonderful place to live and it's been interesting to see how low we can drive the energy costs.

Ben: So maybe it's a good idea for you to tell us what we've got here in front of us and the designs that you have built into your home.

Martin: Well, the house is about 6,500 ft² so it's a reasonably large country house. The design is not compromised by energy constraints so we set about designing the house that best suited the site, to extract the most from the site. It's got lovely views. So there are huge amounts of glass, floor to ceiling glass in many rooms. But having worked out the optimum design we then set about trying to work out how we could make it use the least energy possible.

The main considerations are very high levels of insulation, so a long way above building regulation standards. The house is very carefully air sealed so that there is very little ingress of cold air from the outside during the winter and one of the disadvantages with that can be that you get stuffy rooms, stuffy atmosphere, so the Canadians have always been very good at mechanical ventilation systems. In fact they heat and cool their houses in much higher extremes than we're used to, of course, using their systems. I actually imported a Canadian system for the mechanical ventilation for the house.

So it's very carefully sealed, a very efficient heat exchanger for the fresh air, so it's bringing fresh air into the house all the time but pre-heating it with the outgoing air. We get a very high quality atmosphere but using very little energy. Then we've used under floor heating throughout the whole house, which is fed from a ground source heat pump, which takes the heat from the field. We're lucky here we're in quite a lot of ground, so we're able to lay ground loops out in the field and that provides the main energy source for the heating and for the hot water for the house.

It's five bedrooms, five bathrooms, 6,500 ft² and the total running costs for the house are less than £2000 a year, but that's everything including lighting, heating, ventilating, cooking... well everything!

Ben: Is this a lifestyle choice or is this something that you think will become a standard way of living in the future?

Martin: I think it is really going to become standard. People are beginning to understand the art of the possible. We haven't been good with energy in this country. We've not built houses that are deliberately low energy, other than rather odd-looking houses. The thing that I was keen to demonstrate with this house was that you don't need to compromise on the look or the amount of glass or things like that. You just need to be careful about the way you specify and the way you build and use common sense in many cases.

It's interesting that you can do a lot with lighting. It's moved on. This house was built nearly five years ago now but of course in that time LED lighting has become much easier to get really good quality LED lighting, so although this is a very low energy lighting system in this house, which has proper dimming control. People don't often know that when you dim a light it doesn't use less energy in many cases. But if you use properly controlled lighting systems when you reduce the light to half, it's actually only using half the energy. So it's understanding those issues but it's probably true that we don't run the lights here in any room above 30% or 40% except in very unusual circumstances. If you're reading or something then obviously you need more light locally but you find you run a lot of the lighting much below the full level.

So I think there is an element of lifestyle to it. It is what we wanted to create here, but not compromised by anything to do with energy. But we have managed to drive it down to be a very energy efficient house as well.

Ben: So your company, your consultancy, you will get asked for advice on certain builds. Is it always new build?

Martin: No, no. One of the mysteries of ground source is people will often tell you, you can't use a ground source heat pump or that sort of renewable technology very easily in old houses but we've got good examples of Tudor houses and many very old houses that can be very efficiently and effectively heated by these sorts of renewable technologies. It's a question of making sure that they're done properly in recognising what the house needs to make it run well.

Probably the biggest frustration with this industry is you often see a disconnect between the energy supplier, the person who's putting in the heat pump or... well, let's stick with ground source heat pumps as a good example. You can put in a very good ground source heat pump, which in theory can deliver the right energy for the house, but if the heat emitters within the house aren't matched to give the optimum performance in that heat pump, you very quickly get a big drop in performance of the heat pump. So you'll still get the house warm but it'll cost you a lot more in energy and that's just about not understanding the full process of extraction of energy from the ground and delivery of energy into the houses. If you get the match right with the whole system, right from ground extraction, through heat pump specification, through to deliver into the house, then I believe you can make pretty much any house very efficient.

Clearly if you've got a very old house where you can't double glaze the windows and you may not be able to change leaded lights, for example, that are a planning constraint, you have to keep them because they are listed. It will have different requirements as to how much heat you put into the house, but it's still perfectly possible in most cases to do it with renewable technology.

Ben: With an energy efficient house, is it only really energy efficient once it's built or what about the process? Is this a much more sustainable system that we're setting up?

Martin: Well, certainly with new builds, I'm personally a big fan of timber frame, mainly because there's very little embodied energy in a timber frame structure. It's sustainable in that places like Canada now have a fantastic system of growing the same amount of wood as they extract. So you know for absolute certainty when you buy Canadian wood that it's a completely sustainable process. That may not be quite so true in other places in Europe but we're moving in that direction and I think the concept is right that we can grow as much soft wood as we need for construction if we build these methods. The potential is there for us to make ourselves truly sustainable and that's much more difficult when you start looking at brick and concrete products because they've got a lot more embedded energy in them.

Having said all that when you actually look at the energy lifetime of a building, the energy we put into heating it and ventilating it and living in it, it makes the energy involved in the actual construction look relatively insignificant. It's probably right that we should focus more on what the building uses once it's completed than worrying so much, perhaps, about how much is embedded in the building process.

Ben: In that respect, it's a logical conclusion, isn't it that people are going to want homes that don't cost that much to run? Surely.

Martin: I think so. I think all the predictions are that fuel costs are going to go up and up, and I hope that the government will move away from trying to support certain technologies which has been a temptation. We've seen it with feed in tariffs for certain technologies. If that approach is made much more

general and it is just applied as an energy tax, which encourages us to do the right thing then people will become more and more incentivised to reduce the energy that their buildings or their companies... I do quite a lot of work for big organisations, corporates, hotel groups and things where their energy their energy use is huge and because of the carbon tax which is being introduced, they are now looking much harder at how they reduce their energy costs. That to me is the right incentive to help us all. We may want to do it for altruistic reasons but it needs also to be financially the right thing to do.

Ben: Are we using Passivhaus technology here or not quite?

Martin: Pretty much this house is largely based around the principles of Passivhaus and one of the things that is rather disappointing, for me anyway looking back, is the way people have tried to re-invent different codes, different systems for achieving what we're all trying to achieve which is lower energy housing. Actually Passivhaus was there a long time ago and I still think has the bones of a lot of very good things that we should be applying to all our structures that we build. So I'm a big fan of Passivhaus. We didn't actually certify this building as a Passivhaus building but we used many of the technologies, or approaches, and in fact when you look at the energy use of this house it exceeds the Passivhaus standard quite significantly.

Whether you use a standard like that absolutely or use it as a guide, there are lots of learnings to be had from things like Passivhaus.

Ben: Are there technologies that you avoid at all, that aren't proven in your mind, or would you widely use everything that's on the market?

Martin: I think the thing that I do tell people to avoid are things that are done purely for financial reasons and I'll give

an example of the feed in tariffs associated with photovoltaics. Many of us, and I'm one, put in a photovoltaic array but I'm being paid 43½ pence per kilowatt hour by the government for that array and I only pay 10 pence for a kilowatt hour that I buy from the grid. So without that huge level of funding I wouldn't have done it and what I think we need to get to is being able to access what technology delivers the best answer for a particular project. That's not going to be the same on every scheme. That's the problem with governments picking a particular technology and saying I'm going to support that one. It's not one size fits all and most of my work is spent with clients working out where they can most or best apply their energy and efforts and money.

There are many simple, simple things that, if I talk about hotels for a minute. Hotels are interesting because they're such high-energy users and we've done hotels which have been designed and built from the outset to be the lowest energy we can make them without changing the customer experience, so nobody would know they've been in an eco hotel. If you compare the energy take of that compared with a top end, luxurious hotel that energy is no object approach, we're looking at multiples of carbon footprint for a night's stay of 50 times the carbon footprint which is I think pretty staggering. As people start to understand the choices that they've got to make, you know, would I stay in a hotel that I knew was going to be 50 times the carbon of another one down the road, okay it might be a bit simpler and a bit plainer but still provides me with everything I need. I think those sorts of things will come into people's decision-making and it should do. I think organisations will also start to include overnight stays in people's carbon footprint. We often carbon footprint our travel but at the moment we don't carbon footprint our overnight stays and things. I think that'll come.

Ben: I wonder whether to a large degree it's because people don't know. I've started out from a position of little

knowledge and tried to learn as much as I can, and to speak to lots of interesting people, who are experts in their individual fields, but you can't tell by looking at something, necessarily.

Martin: No, I think that's exactly right. The more we understand about the choices that we have and the real impact. We've got it right in many cases, things like transport, we know when we buy a car very clearly, there may be a bit of room for manoeuvre but not much, you know pretty much what you're getting. When you buy a house or you stay in a hotel, you rent an office block, it's much more difficult, the rating system that we have is rather crude and really probably doesn't tell you enough about it to make a particularly well-informed choice. It's moving in that direction but an A, B, C, D type approach is probably not sophisticated enough to give you the right level of information.

I think the good operators and employers and perhaps the good house buyers and house owners will start to understand enough to be able to work out for themselves and benchmark what they're doing themselves. There are very good information databases now available on the Carbon Trust website, for example, where you can start to benchmark your energy usage for whatever type of building we are talking about compared with what are industry standards and also to see what the potential is, at least in theory, of where you should be aiming. The more information we give people the better enabled they'll be to make informed decisions and I think we'll be surprised that people will be more inclined to make the right choice based on some of these issues than perhaps we expect they would be.

Ben: What is the uptake like? Is it increasing, as we might hope?

Martin: I think it is but the problems are there's lots and lots of examples of these things having gone wrong, where people have spent quite a lot of money and not had the right results. That's usually about not getting the right advice from people who are properly getting under the skin of what the client wants to achieve and perhaps not actually being tied in to those achievements.

If I'm asked to install an air source heat pump for a client because that's what he thinks he wants, then the simplest answer may be to go on and install it. I'm not an installer, obviously, but if a client had gone to somebody as a green supplier of heat pumps and things and asked for a particular solution he will probably get given it, whether it's the right thing for them or not, and the quality of installation vary so dramatically that I think that's where the biggest resistance or problem is for people buying at the moment. Most are clear we'd like to do the right thing but we're not clear how you get there and until we are able to demonstrate better that we can achieve certain things rather than just having a piece of paper with a coefficient of performance (COP) written on it and saying that's what you're going to get. In practice that's not achieved in many, many cases.

So I'm a big fan of everybody being able to see how installed projects have actually worked, how well they've worked and to do that you need proper data that shows you the energy you've put into the scheme and the energy you've got out of the scheme, so you can see how efficient the whole project or installation is. Unfortunately not much of that information is around. I wouldn't buy from companies who can't demonstrate to me seasonal figures showing how well their installations have performed.

Ben: Well, it's interesting that you have just mentioned that because I plan to build my own energy efficient house in the next four years and that's why I'm building up all

this knowledge, but in my particular case I'd just be after a little bit of advice about how you think that I should go about it. So maybe first if I was going to pick someone who knew about energy efficiency, how do I know that they're not one of those people that won't actually install it properly? How do I pick?

Martin

Well, as I say, a starter for 10 for me is that you wouldn't pick a contractor unless they can show you some good, real data of installations that they've done, but actually I think going back before that, you don't want to be talking to people who are trying to sell you a technology. Your initial exercise should be done from unbiased advice that's not facing in any particular direction.

So when you've picked a site, the site in itself will have some opportunities. You may have opportunities to orient the house in a particular way or, for example, to increase the eaves overhang so that you don't get so much solar gain. More and more houses in modern times are looking for cooling to be incorporated, which if you do that with air conditioning flies in the face of everything we're all trying to do because air conditioning is not good news for energy take and I think in places like America they now spend more money and more energy on cooling than they do on heating and we shouldn't be heading in that direction. We could design that out but also there are ways of making very efficient levels of comfort cooling in a house without actually using much energy and I mean simultaneous heating and cooling.

We all use quite a lot of hot water and if at the same time as generating hot water we're generating cold water then it's a free by product of the process if we do it right. So you don't want a gas boiler heating your hot water cylinder and an air conditioning unit cooling your lounge, for example. We can be much smarter about that and the whole efficiency of the whole system

becomes dramatically better once we capture those sorts of benefits.

Ben: Do I think about house design first or energy efficiency design?

Martin: Well I think it's a good principal to have energy as one of the bullets on your early meetings when you sit down to think of this project. Energy should be a consideration right from the outset. I don't support the fact that you have to design the building to be the smallest external wall for the internal space that you're trying to get because that would compromise too much the design. The design needs to maximise the benefits that the site has. That's top of my list is to say, when we build houses, particularly housing, you're trying to make the very best of the site you have available to you.

Once you've started to do that then there are things you can do in the design process to make sure that that house will be very energy efficient. If it's a house like this where you've got lots of views and you want lots of glass, then the specification of the windows and the doors becomes much more important.

It's interesting that there are some fantastic products out there now which are not a substantial premium above what would be a traditional window. If I give an example of many people would specify a window with a U value of 1.5 or so, and say that's a good window. Actually now we can buy windows that maybe cost 20% more but lose half the energy that that window would lose if you'd stuck with that specification. So by searching around and finding good suppliers and there are quite a lot of them now who do these really high quality, low energy loss units, you can improve... And of course they last a huge amount of time. We should be talking about a product that'll still be performing well in 40 or 50 years time, so in house where you've got

lots of windows if you can half the energy loss through the windows that's a big step in the right direction.

Technology is quite a long way down the list of things you do when you're developing your ideas for your house. You design it right, you specify it right, you insulate it as highly as you possibly can, you seal it as best you can, you mechanically ventilate it with the most efficient system you can find and none of those things cost a lot of money. They are all relatively small cost items and at the very end of that falls out the energy requirement that the house has, which will then be a lot less than it would've been if you hadn't followed that sort of process.

So you end up with a much lower energy requirement and then you can then look at the best most efficient way I can produce that and that might be an air source heat pump or a ground source if you have room or it may be a very small gas boiler is the most efficient solution to that particular house. There's no one size fits all. It's a question of following the common sense path to getting the right answer for a particular project.

Ben: And finally, do you think there's anyone else that I should be speaking to? It doesn't necessarily have to be along the energy efficiency lines but knowing that you have done this, you've built your own house, I suppose you've been in construction before that for a long time, who do you think might be worth or what type of person worth speaking to?

Martin: I think people who have data, real data about how things perform are very useful. There's a huge range of people out there now who actually do know how things have performed in their own houses and are usually quite keen to share that information. You have to be a little cautious because people are always very keen to show what they did was right rather than accept that it may not have been the perfect answer. An interesting

little example, I visited someone who had some solar panels and because he had solar panels he'd turned off his boiler and he was heating his water by electricity. That's a rather bizarre set of, showing the way that people interpret things they've done and maybe believe some of the jargon they've been told or the information they've been fed along the way.

It's really important to understand what you are generating, if you're generating, how you can use that and what percentage of the overall it delivers. In the case I'm talking about the solar panels were not doing anything like enough for the whole house, so it would still have been the right thing to have the boiler running the water, of course, much lower carbon footprint if he'd done that, but that was just because he didn't understand. Getting out and talking to people who have tried things, looking at their data, making sure you understand their data and are able to interpret it and get a really feeling for how that has benefited the particular project is quite important.

I don't know. Honestly it is quite difficult finding good places to get information because most people are out there trying to promote some particular technology and that's not where you want to be focussed. You need to be above that level, working out what you want and then finding the best people to supply it. I'm not giving you many places to go, am I.

Evidence based design is one of my fundamentals and properly presented evidence based information is hugely valuable. So there are lots of places to dig around for that but scrutinise it with real care before you believe it.

Ben: Well, some brilliant advice there. Martin, thank you very much.

Martin: My pleasure. Good luck.