The 8 questions you should ask your architect before building your sustainable home

The Self-Build Series by Chris Brookman (July 2015)

This is the second in a series of brief guides designed to help first time self-builders navigate through the enormous amount of information available and help them achieve their goals for sustainable construction. Our aim is to answer some of the questions that are not often answered by the main sites and forums covering sustainability.

These guides are for those new to construction, embarking on a sustainable building project. It's based on my personal experience of building a certified Passivhaus family home and 14 years of being a running a eco building company.

Overview:

This guide has been put together for a single purpose; to give you a comprehensive list of the questions to ask your architect about the sustainability of your building project. If you're interested in your new home's sustainability, we'd suggest you take this guide along with to your next meeting with the architect.

The following questions are covered:

1. What's the best location for my home?
2. Which experts do I need to get involved?
3. Why is the control of air infiltration/airtightness so important in my home?
4. What is energy efficiency and why is heat recovery ventilation important?

Material considerations:

1. What type of insulation should I use?
2. How do I protect my home's internal environment?
3. How do I control heat within my sustainable home?
4. How do I avoid thermal bridges?

What's the best location for my home?

This is a very personal question for most people as the desirability of a location is affected by popularity, access to facilities and road networks, cost of land, views from the plot, etc. However, from a sustainability point of view there are few points worth considering.

Orientation of the site makes a big difference to how much heating you'll need over the year. In the UK, our coldest nights tend to have clear skies which are then followed by sunny mornings. This heat from the sun, even in the depths of winter, makes a big difference to your heating requirement.

A south facing site will allow you the best opportunity to take advantage of the Sun's energy. That might be in the form of simple heat gain through the windows, heating of water in roof mounted panels or in the form of electricity from PV.

Exposure of the site is also a big consideration from an energy perspective. If the area receives strong winds you'll need to make sure your building is very airtight so you don't lose your heat from draughts. Exposure also determines the best design for a location. Bigger roof overhangs and more robust wall finishes protect from heavy rain and are important to reduce the need for maintenance.

Access to facilities, services, road networks and amenities are also aspects that can make a big difference to the impact of living in a particular location. The less driving involved the better and usually, the closer the building to conurbations, the cheaper services are.

Which experts do I need to get involved?

Before you start getting anyone involved speak to as many other people that have built similar buildings as possible. Find out what was easy, what was difficult, who helped, who hindered and how they built their home. You'll need to guide the design process and becoming an expert in what you like and don't like will give everyone a clear idea of what you want.

Once you have this montage of information you can start talking to an RIBA chartered architect about your requirements, how you want to use the building, what materials you might use and what features you might include. Make sure you feel comfortable with them personally and that their idea of design matches your expectations. Your architect will be fundamental to the design process so it is important they they understand your needs and aims before any designs are started.

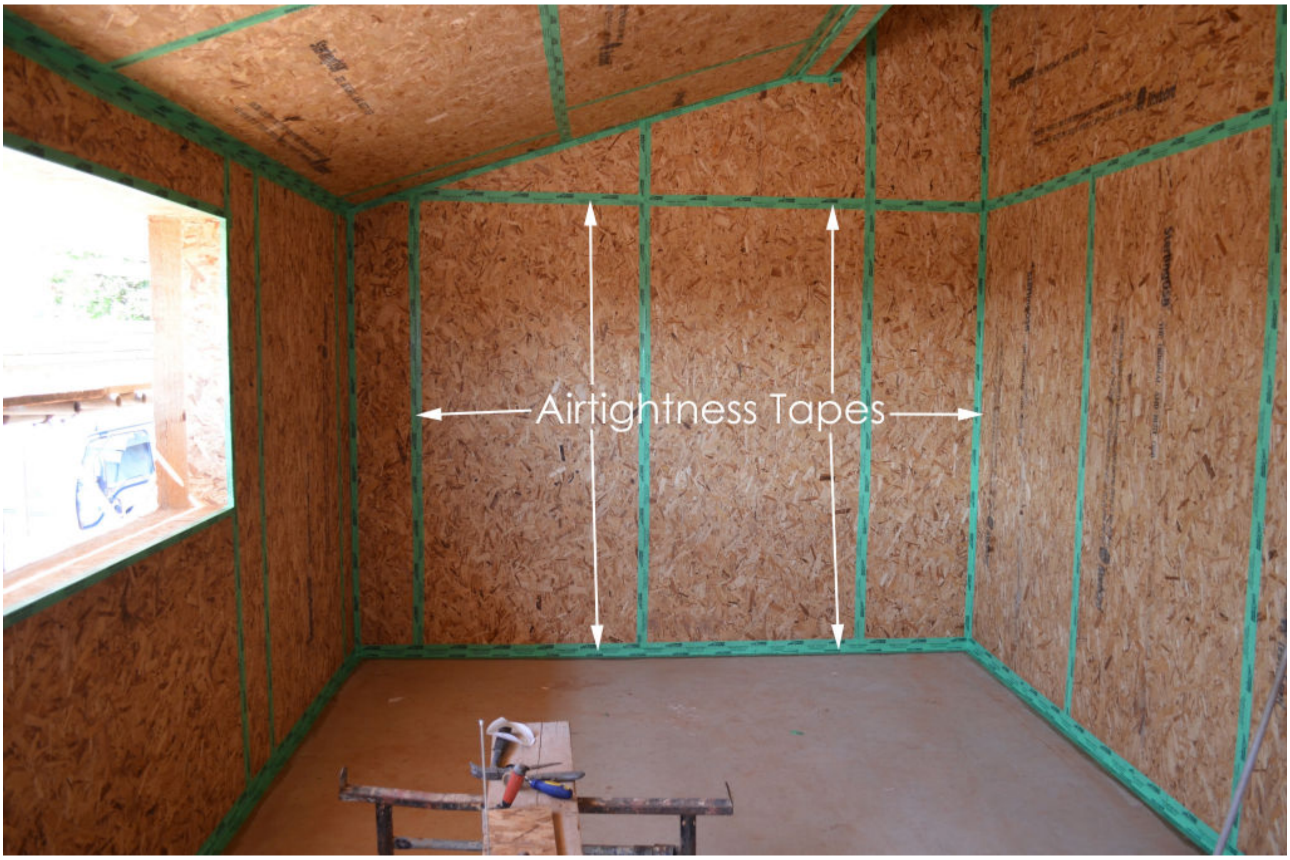
Your architect should be able to give advice on shape, form, glazing ratios and, most importantly, what will work from a cost and practicality point of view.

Once you have a basic design outlined it is worth getting information from Structural engineers, mechanical and electrical engineers and information from specialist suppliers. Your architect should be able to guide you through this.

Finally, I would always recommend you keep your architect on board to get you the initial Building Control sign off but also to sign off each stage of the construction and the final sign off. There will invariably be details for which there are no drawings or need reconsidering and without input from the architect you run the risk of expensive errors.

If you've not built a home before, using a Project Manager could be useful. On the face of it they seem to cost a lot of money but over the course of the build it is easy for the inexperienced to waste more than this cost in errors or poor planning.

Why is the control of air infiltration/airtightness so important in my home?



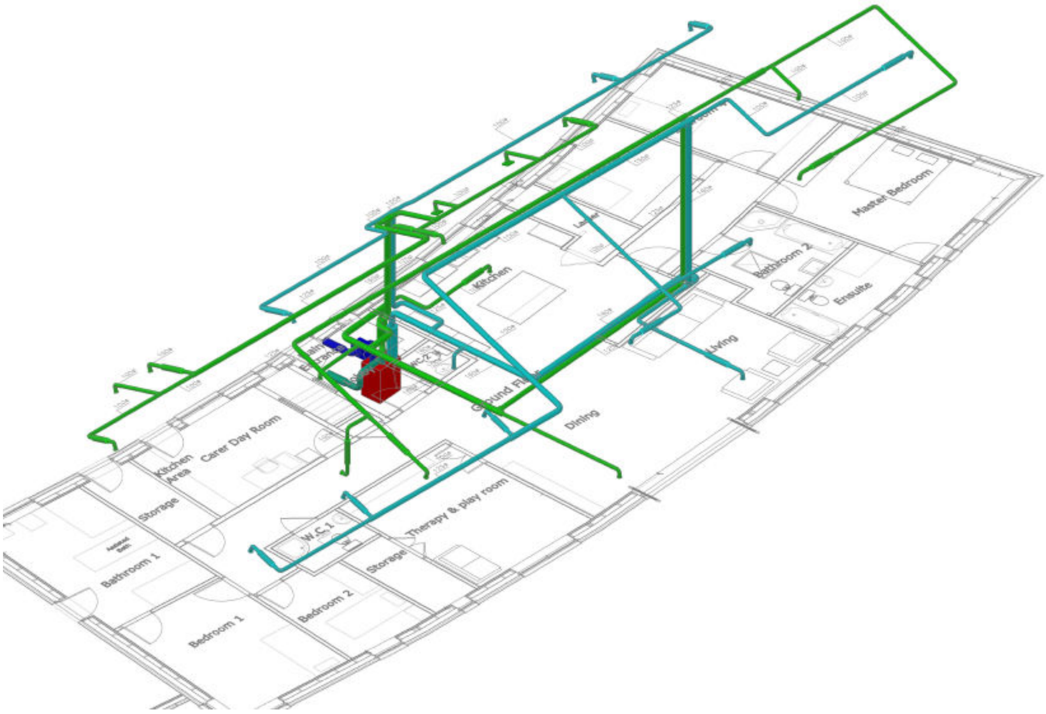
(Green airtightness tape in use)

Every day we breathe around 11,000 litres of air, which comes out very moist. We shower, producing lots more moist air (at least the same amount again), we cook and we boil kettles for our tea. In short we produce huge amounts of warm, moist air which needs to be removed to keep the indoor environment healthy and free from mould. The only effective way to achieve this is by incorporating a mechanical ventilation system (unless you live outdoors permanently), guaranteeing a continuous supply of fresh air and removal of stale, moist air.

Indoor air quality is an important consideration but equally as important is how the moist air that we produce affects the structure of the buildings in which we live. In the winter, this moist air leaks in to the cold building fabric and condenses, causing timber to rot, metal to corrode and mould to grow. As we insulate more, the colder the outer layers of our buildings become and the more they are prone to condense any air leaking from inside.

This means that high levels of insulation, very good airtightness and good ventilation must go hand in hand to produce low energy sustainable homes.

What is energy efficiency and why is heat recovery ventilation important?



(Ventilation system design)

Energy efficiency of appliances within sustainable homes is very important as they are a significant source of heat as insulation levels increase. This may seem unimportant during the winter months as they are an extra source of heating, reducing the load on your heating system. However, during the warmer months of the year they can contribute to an overheating risk and consume unnecessary energy.

Heat recovery ventilation is a very important part of low energy sustainable construction. It allows the continuous supply of fresh air without losing the heat from the air that is extracted from bathrooms and kitchens. In the middle of winter some systems return 10 kWh of heat in the incoming air for every 1 kWh that used to run the fans, efficiencies that heat pumps can only dream of!!

In a ‘conventionally’ ventilated home the ventilation comes from drafts, open windows, trickle vents and extractor fans. These methods are occasionally effective at providing the required amount of fresh air but they do not recover any of the heat lost from the outgoing air. This means that just to heat up the incoming fresh air your heating system may be supplying several kilowatts of heat, before accounting for the heat lost through the doors and windows, walls and roof.

What type of insulation should I use?

(Wood fibre insulation)

Fundamentally, more insulation is better than less. The more you can afford to use, the less heating will be required and the more sustainable your house will be, with a few caveats such as good airtightness, etc.

From an environmental perspective it is worth considering what insulation materials are made of, how recyclable they are, how polluting they are and how long they last. These aspects determine their environmental impact and their sustainability. Beyond this there are other properties of insulation materials which make some more useful than others at creating healthier and more comfortable indoor environments.

Generally, creating buildings with more thermal mass (ability to store heat in the fabric of the building) is an effective way to reduce the heating requirement of a building. High mass insulation materials such as wood fibre insulation and other natural fibre insulations store and release heat in such a way that keeps buildings at a steady temperature, often with no input from a heating system.

Natural fibre insulations are generally denser than synthetic, high performance insulations and so are very good at absorbing sound, helping to create quiet indoor space. As they are made from plant fibres they also disperse moisture very effectively, helping to keep buildings dry and improving the longevity of the structure of the building.

This is not to say synthetic insulation is not as good as natural fibre insulation. Underground or below damp proof course, you need to use synthetic materials because they do not biodegrade. In certain areas of a building you may need to use mineral fibre to provide a fire break or extruded polystyrene to insulate in frost prone areas.

To create the best environment internally you'll need a combination of different insulation materials and make use of their different characteristics. Try to bear in mind that the cheapest, thinnest insulation may not save you the most money in the longer term or create the most comfortable buildings.

Organisations like the AECB (Association for Environment Conscious Building) http://www.aecb.net or the Passivhaus Trust http://www.passivhaustrust.org.uk are great sources of relatively impartial knowledge.

How do I protect my home's internal environment?

As we spend more and more time at home or indoors, the environment that we experience within these areas becomes more important.

The use of lightweight insulation materials and building systems has allowed more sound penetration from traffic or weather. It has also meant that buildings can heat up very quickly and overheat, creating an uncomfortable living and working space.

Buildings are now ever more airtight due to better construction processes and the greater emphasis on this during construction and so ventilating indoor spaces is also a priority.

The use of heavy insulation materials, such as wood fibre insulation, monolithic clay blocks and other natural materials can be a very effective way of improving the sound insulation of well insulated walls. These materials are also very effective at preventing buildings from overheating as they can store large amounts of heat so act as a buffer.

Ventilation systems are relatively new to the domestic market in the UK but are becoming ever more popular. Some people fear that these systems are noisy, intrusive and expensive to run. In actual fact they can save huge amounts of energy, provide a continuous supply of fresh air and create a much healthier and more comfortable indoor environment. All this for less than the cost of a second class stamp each day.

How do I control heat within my sustainable home?

Checkout the video above for a comparison between wood and polystyrene insulation.

Heating systems control the temperature in your home when the weather is cold. Some people use air conditioning to cool their homes when the weather is hot but in well insulated, low energy homes using the right materials can reduce or remove your need for both.

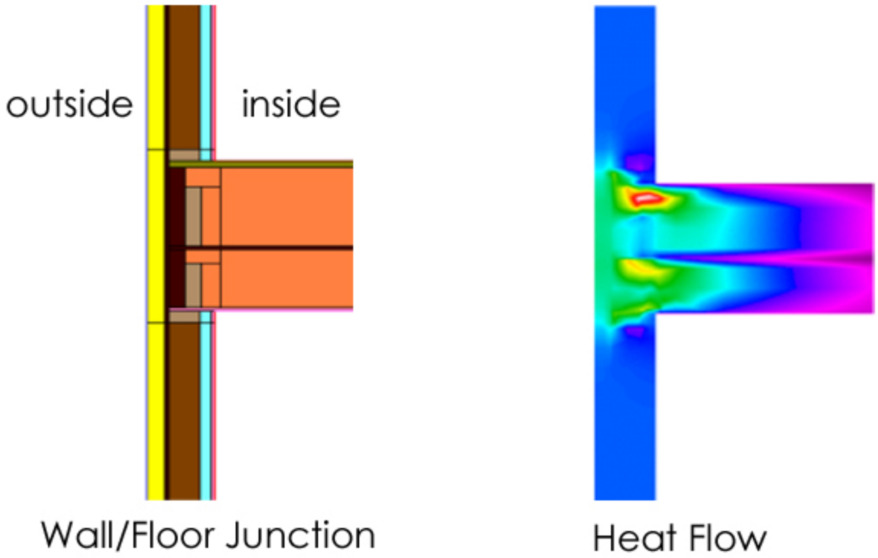
Adding thermal mass by using dense insulation or heavy weight materials in the interior of your sustainable home is a very simple way to reduce your heating requirement. These materials absorb heat and slow any rise in temperature creating a stable internal environment. This allows the building to make the most effective use of the sun's heat, providing warmth once the sunlight has gone.

Very lightweight buildings are unable to store this heat and to prevent overheating it is dumped by opening windows or by the ventilation system. As the building cools, heating may then be required to keep it warm during the evening and night.

It can buffer spikes in temperature, such as when the sun shines in through large glazed areas. This process, called solar gain, is one that can cause lightweight, highly insulated buildings to overheat, requiring the opening of doors and windows to cool the building.

Thermal mass is one way to buffer spikes in heat so long as there is also a way to remove the heat afterwards.

How do I avoid thermal bridges?



(Graphic showing heat loss as a result of thermal bridging)

Thermal bridges are relatively easy to design out but it generally involves using systems and techniques which are inherently thermal bridge free in the first place.

In solid ground floors this can most easily be achieved by using a concrete raft which 'floats' on a layer of insulation, normally polystyrene. The concrete raft is load bearing, so will take the load of internal and external walls to be built upon it. Whilst this is the easiest way it is not necessarily the cheapest way.

Standard masonry construction (suspended beam and block, block foundations) can achieve very low levels of bridging if detailed well but this often requires the use of insulation blocks or foam glass to prevent heat loss in to the foundations or ground. Because timber doesn't conduct heat as much as concrete (around 1/4 of that of concrete blocks) it can be used very successfully to create floors with minimal thermal bridges. Both of these methods may be cheaper than using a raft but both are also much more difficult to make air tight.

With walls it is easier to avoid thermal bridges by using timber frames with external insulation, such as wood fibre insulation, which can then be rendered or clad. Cavity masonry can also be used to avoid thermal bridges by using full fill cavities of the appropriate width and also the correct insulating lintels over the window and door openings.

Most roof structures are made from timber which is inherently insulating but the more complex the structure is the harder it becomes to make it thermal bridge free. Again, wood fibre insulation boards can be used over the rafters to prevent thermal bridging and insulate against summer sun.

What's next?

Did you find the guide useful? If so and you'd like to stay up-to-date with Chris' latest resources and the next guide in this Self-Build Series, check out the Back To Earth Supplies website and signup to receive updates.