
HOW TO DESIGN A GREEN HOME - WITH ALLAN CORFIELD
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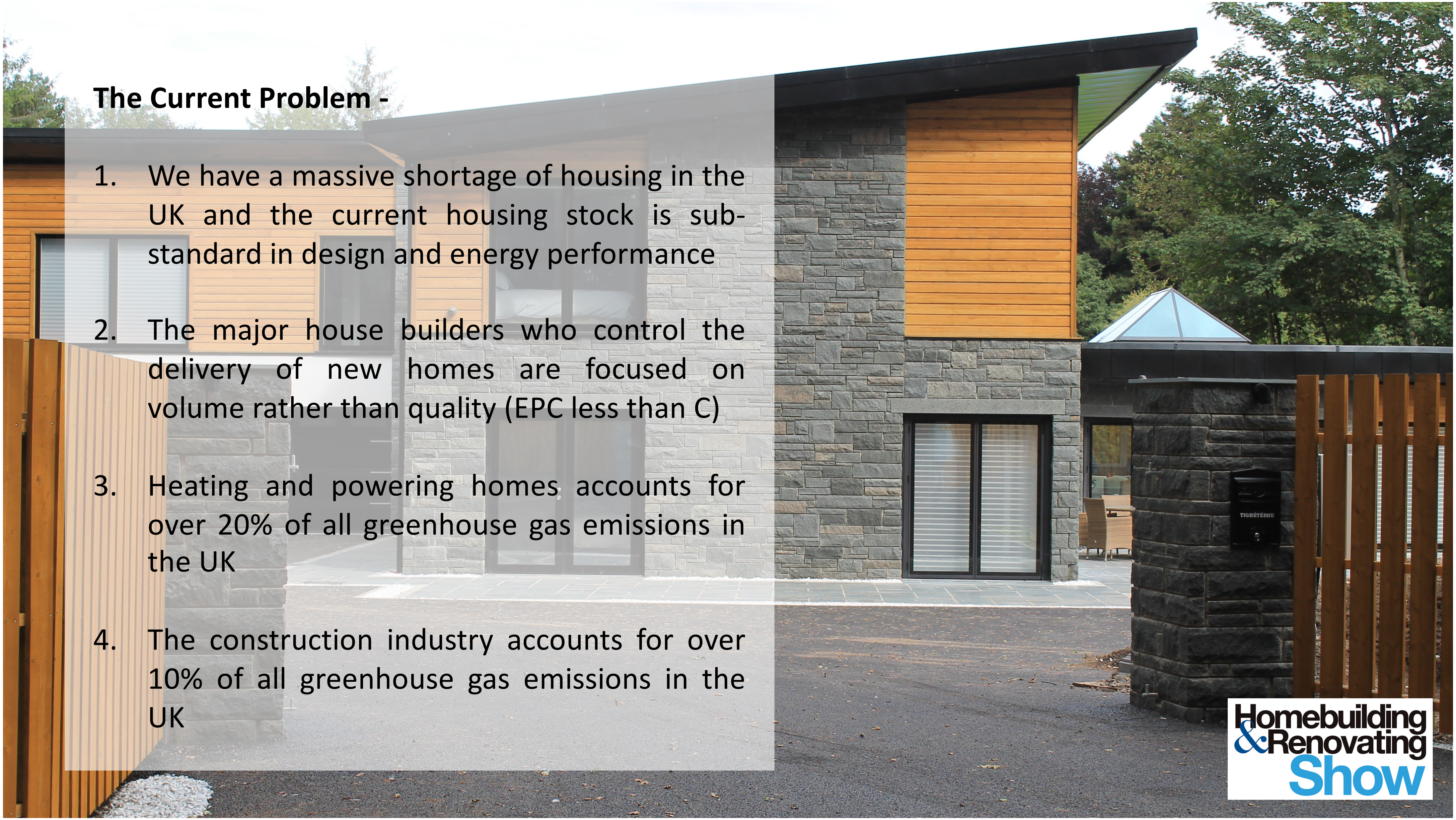
How to Design a Green Home –

1. The current problem
2. The Future Homes Standard
3. Passive House
4. The Fabric First Approach
5. The Design Process
6. Summary


# The Current Problem



**The Current Problem -**

1. We have a massive shortage of housing in the UK and the current housing stock is sub-standard in design and energy performance

2. The major house builders who control the delivery of new homes are focused on volume rather than quality (EPC less than C)

3. Heating and powering homes accounts for over 20% of all greenhouse gas emissions in the UK

4. The construction industry accounts for over 10% of all greenhouse gas emissions in the UK

"Put simply a green or low energy home that from design, technologies and construction method uses less energy, from any source, than a traditional or average new house."

# What do we mean by a Green Home

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**These are examples of low energy homes-**


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**These are examples of low energy homes-**

**These are examples of low energy homes-**


This is not -
THIS IS NOT GOOD ENOUGH......
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The Future Homes Standard
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**The Future Homes Standard -**

1. We need 250,000 new homes per year

2. Custom & Self build's lead the way in design and energy performance

3. Future Homes Standard 2025 –
   - A major review of the Building Regs
   - Drive towards Net Zero Carbon dwellings
   - Remove fossil fuel boilers
   - Improvement in U values

4. RIBA Climate Challenge 2030 –
   - 50% Reduction in Operational Energy & Carbon Emissions
   - 40% Reduction in Embodied Energy & Carbon Emissions
   - 40% Reduction in potable water usage
   - Low Carbon Heating, no fossil fuel boilers


**The Future Homes Standard -**

1. Its better for the environment, by reduced carbon emissions during construction

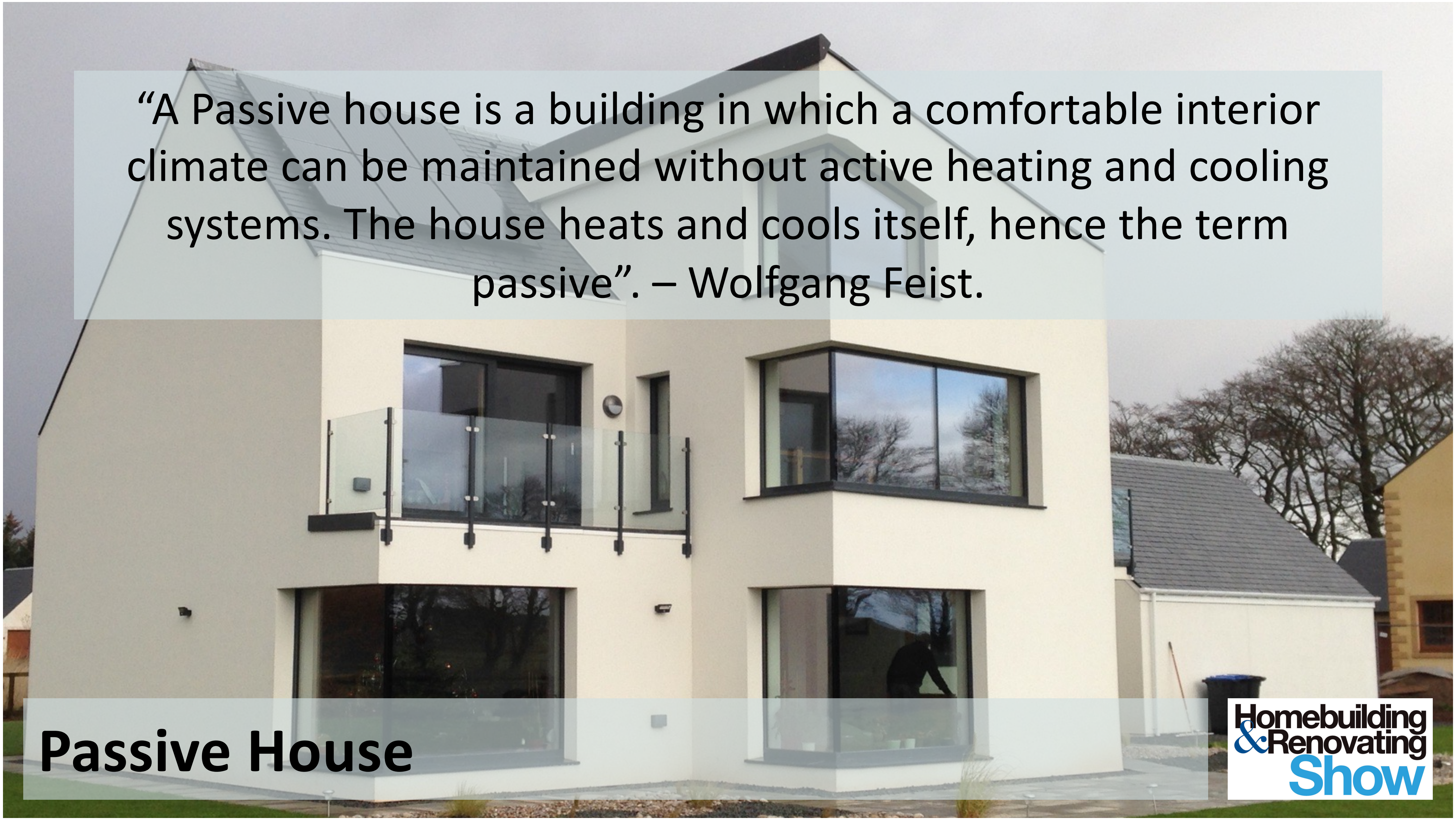
2. Its better for the environment, during operation due to the reduced energy demand

3. Typically 40-80% betterment in building standards than current housing stock

4. Reduced running costs over the life of the house

5. Potential for zero or positive energy bills

6. A more comfortable, healthy built environment



“A Passive house is a building in which a comfortable interior climate can be maintained without active heating and cooling systems. The house heats and cools itself, hence the term passive”. – Wolfgang Feist.

# Passive House

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**The background to Passive House Design -**

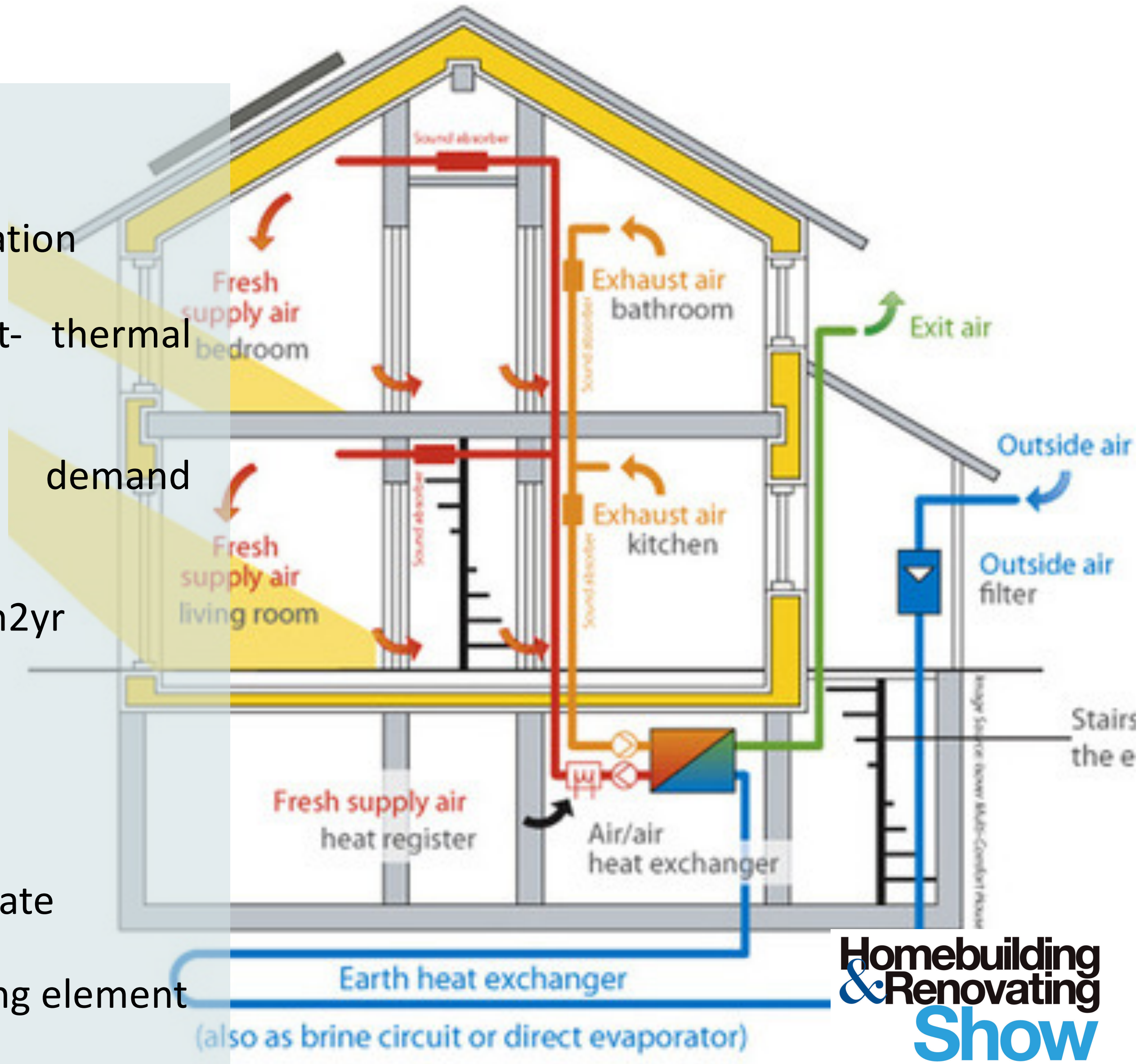
1. The Passive House standard was developed in Germany in the early 1990s by Professors Bo Adamson of Sweden and Wolfgang Feist of Germany and the first dwellings to be completed to the Passivhaus Standard were constructed in Darmstadt in 1991.

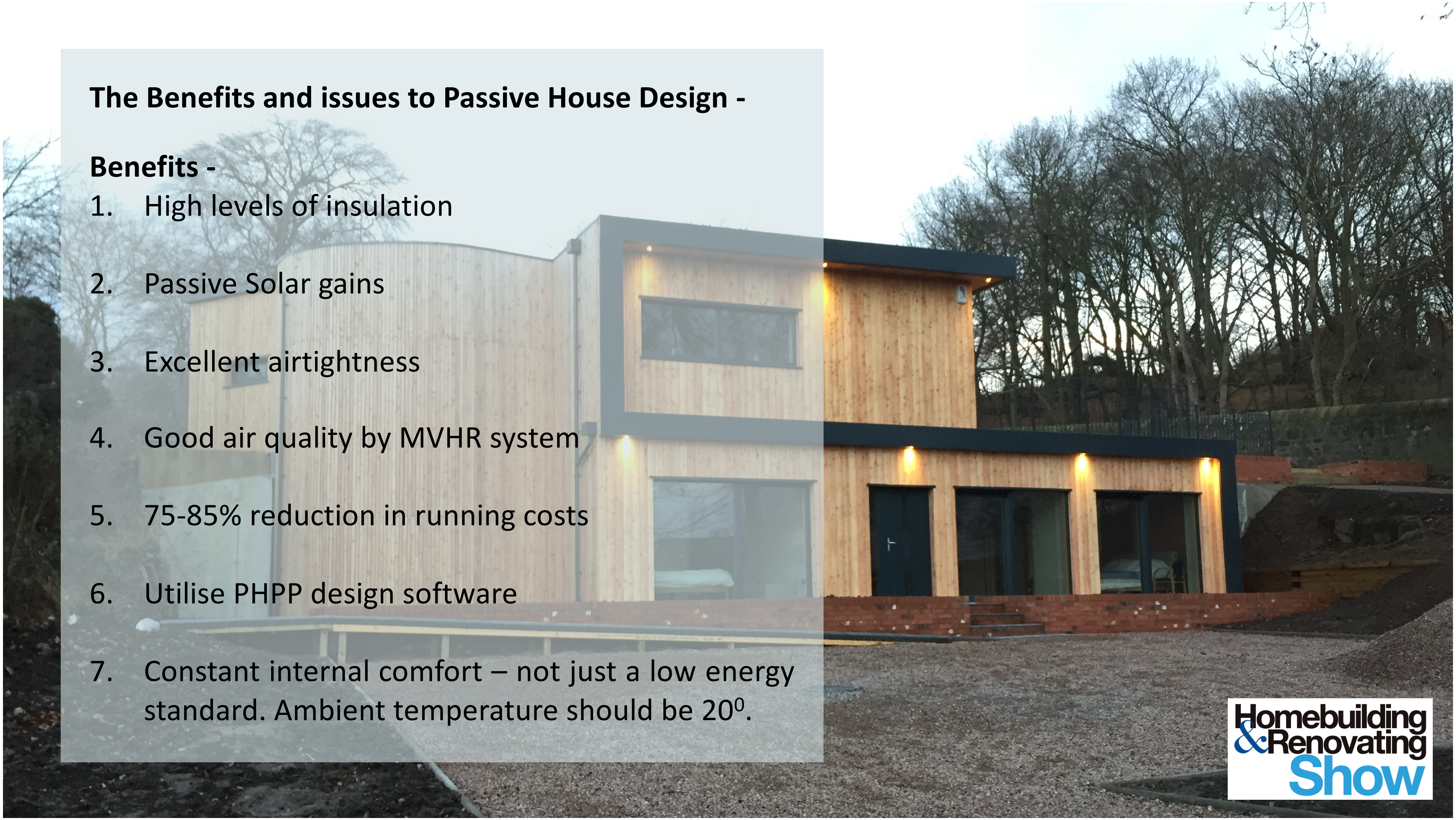
2. Passive House is the fastest growing energy performance standard in the world with 65,000 buildings realised to date.

3. The Passive House standards strengths lie in the simplicity of its approach; build a house that has an excellent thermal performance and high airtightness with mechanical ventilation.

**Passive House Design Principles -**

1. A robust energy performance specification
2. Holistic low energy design concept- thermal comfort
3. Maximum Heating & Cooling demand <15kW/m2yr
4. Maximum Energy demand <120 kW/m2yr
5. High specification insulation levels –
    1. Walls, roof & floor <0.15 W/m2k
    2. Openings <0.8 W/m2k
6. Airtight Construction <0.6 air change rate
7. Highly efficient MVHR with post heating element





**The Benefits and issues to Passive House Design -**

**Benefits -**

1. High levels of insulation
2. Passive Solar gains
3. Excellent airtightness
4. Good air quality by MVHR system
5. 75-85% reduction in running costs
6. Utilise PHPP design software
7. Constant internal comfort – not just a low energy standard. Ambient temperature should be $20^0$.


**The Benefits and issues to Passive House Design -**

**Issues -**

1. Increased Design fees from specialists & certification route (approx £5,000)

2. Cost increase in construction costs (between 8-15% increase)

3. It is still very much a niche area - ***There are more Certified Passive House Designers in the UK, than there are completed houses!***

"Is a back to basics approach where you concentrate on the fabric of the building before throwing eco bling, in order to make it work."

# The Fabric First Approach

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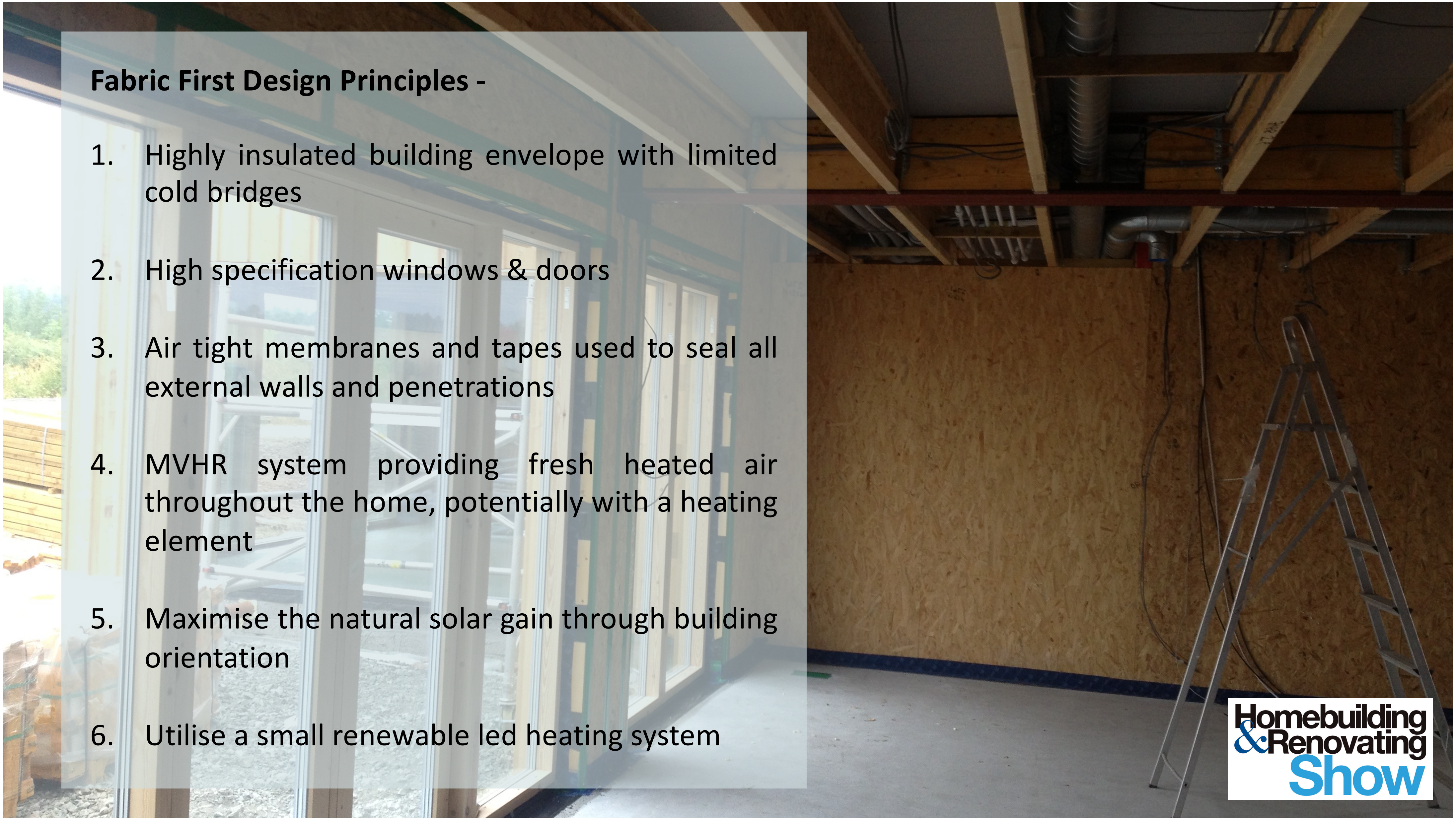

**Fabric First Design Principles -**

1. Highly insulated building envelope with limited cold bridges

2. High specification windows & doors

3. Air tight membranes and tapes used to seal all external walls and penetrations

4. MVHR system providing fresh heated air throughout the home, potentially with a heating element

5. Maximise the natural solar gain through building orientation

6. Utilise a small renewable led heating system

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THE KEY ELEMENTS
1. Solar Gain
2. Construction Type
3. Air Tightness
4. Limit Cold Bridging
5. Ventilation Strategy
6. Heating Systems
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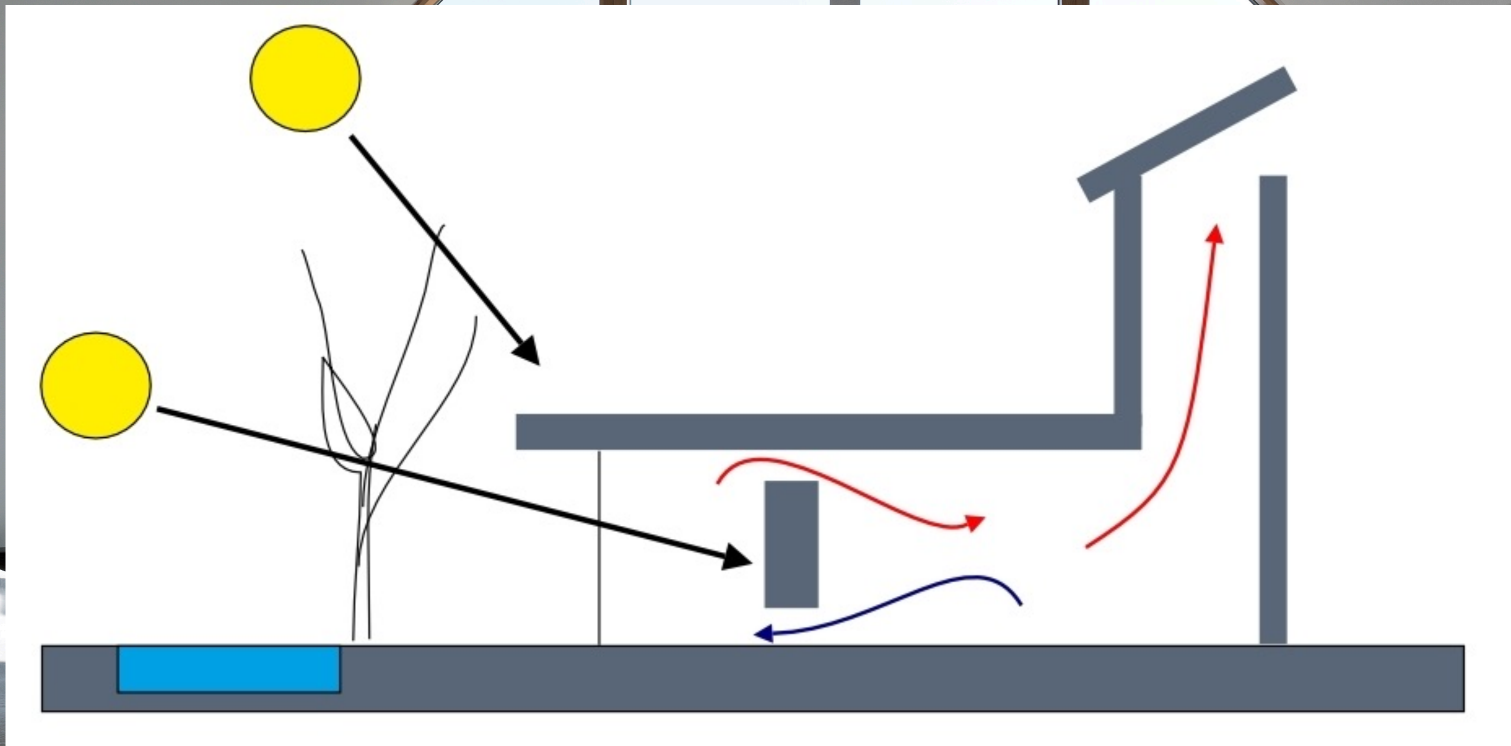
**1. Solar Gain -**

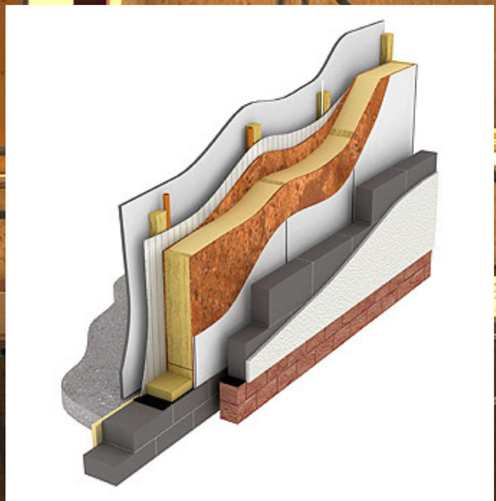
1. Consider orientation of the building to maximise gains
2. Large windows on Southerly elevations and small windows on the North
3. Accommodate shading or bries soleil to limit summer overheating



## 2. Construction Types -

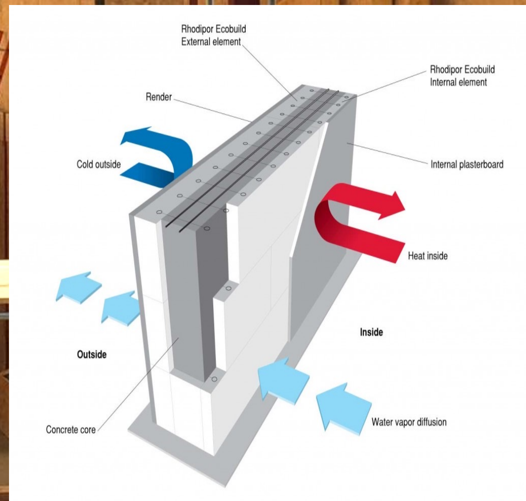
1. Choose a Construction type that is naturally airtight
2. Highly insulated
3. Ideally to a Factory tolerance

**Timber Frame**



**SIPS**

**ICF**




All can achieve a U-value of 0.10 to 0.15 W/m2k

**3. Air tightness -**

1. Tape all external joints & around windows
2. Use airtight membranes and vapor control layers
3. Tape or seal all service penetrations

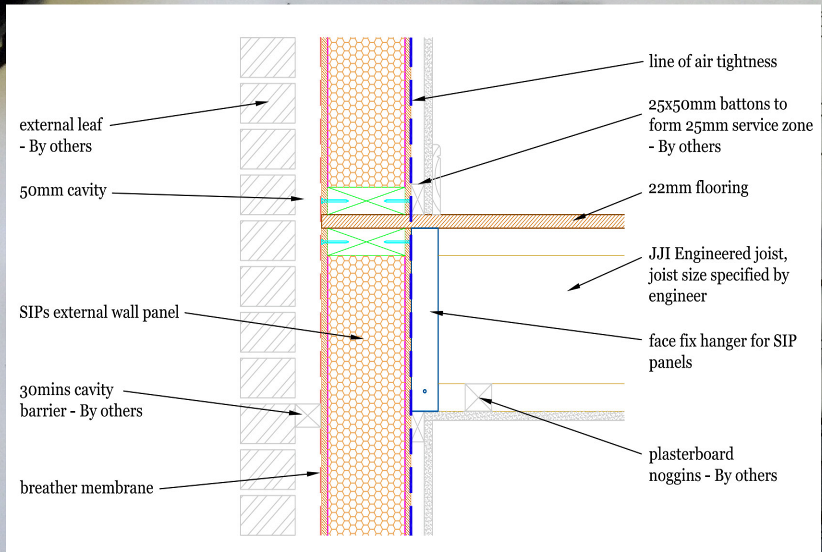
**Proctor Wraptite breather membrane**

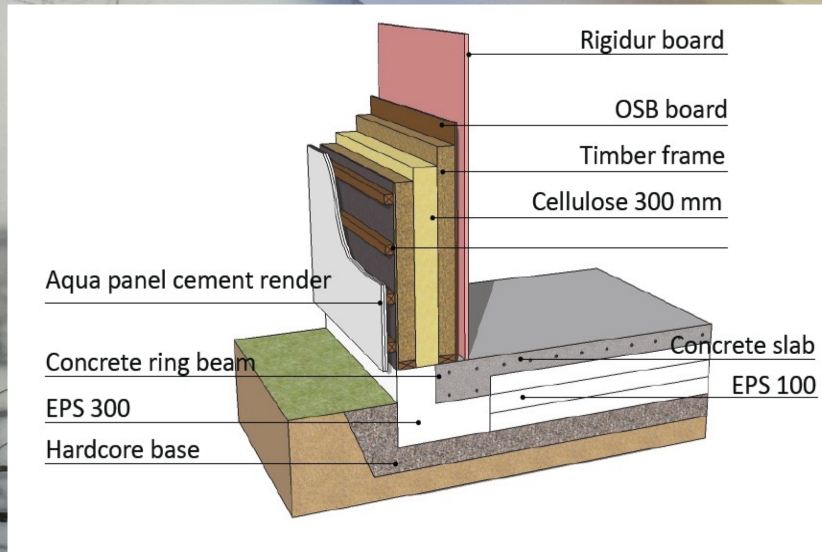
**Internal airtight tape**

**Blower door test**

## 4. Limit Cold Bridging -

1. Architect to detail all parts of the building's connections & linear cold bridging
2. If using timber frame try and increase centres from 600mm to 1,200mm cc
3. Poor detailing can cost up to 28% in SAP calculation

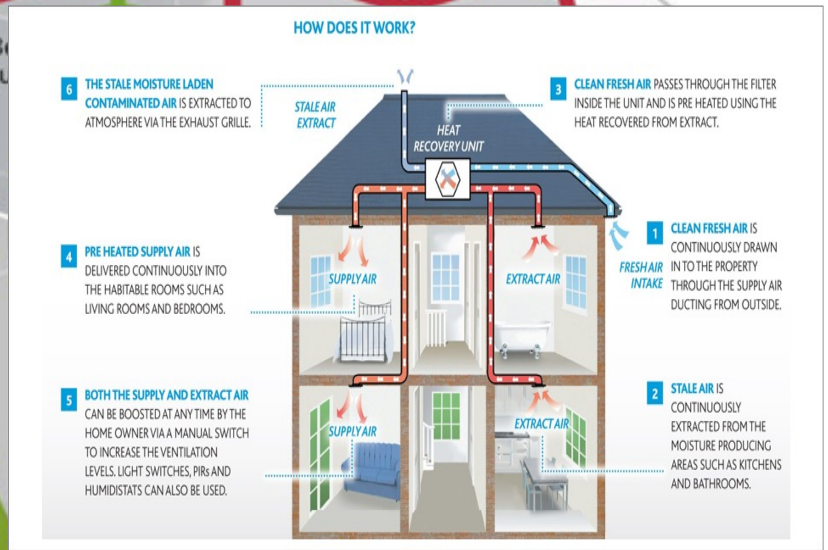


## 5. Ventilation Strategy -

1. Consider all of the available options however MVHR seems to be the most suited
2. Consider pre and post heating, also summer bypass mode
3. Make sure the system is designed and commissioned by a professional

Fresh Air inlet
Exhaust outlet
Warmed, filtered fresh air
Stale air
Extracted cooled stale air
Bedroom supply
Kitchen extract



**6. Heating Strategy -**

1. Limit heating demand by sticking to Fabric first approach
2. Consider the most cost effective solution first, this may be mains gas & a small boiler
3. Utilise SAP calculation software to work out best solution

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The Design Process
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**Appoint the best team -**

1. Interview at least 3 of each profession required, **ask for references** and look into their previous work.

2. Provide your **detailed brief & Pinterest board** to anyone you require a quote from.

3. Obtain **written quotes** & ensure they are **fixed fees** – don't go for % of construction cost quotes!

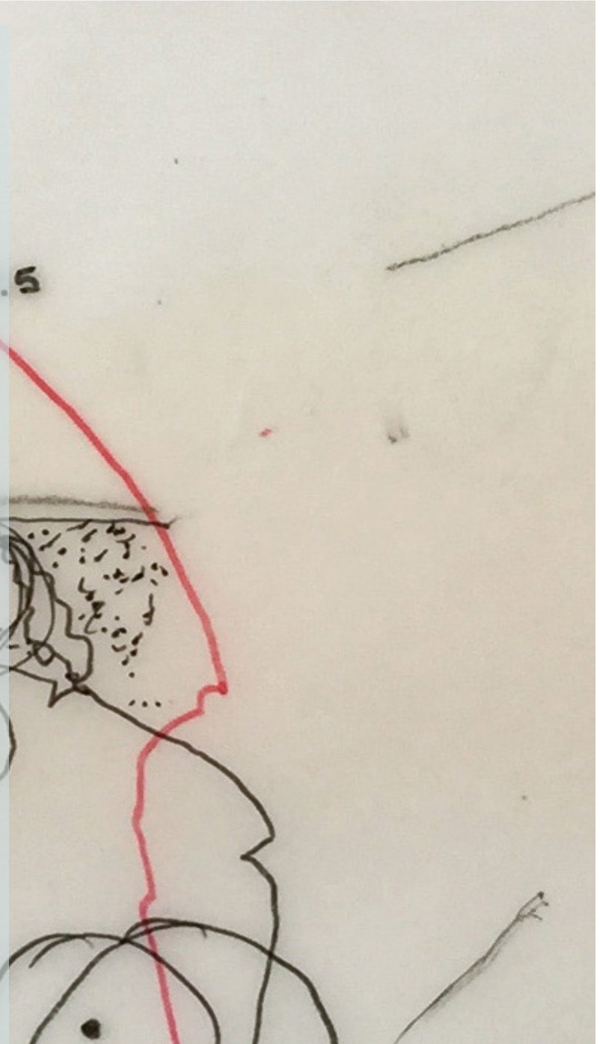
4. Speak to professionals who regularly handle your type of project – **Self Build, low energy or PH specialists** can give you the best advice!

**Site Appraisal -**

1. Complete Site review, including topo, soil investigation & percolation test
2. Check major connection costs
3. Review the current planning approval (if any) & any implications regarding conditions
4. Assess external landscape features
5. Assess internal landscape features
6. Site and building orientation
7. Weather data and sun path analysis

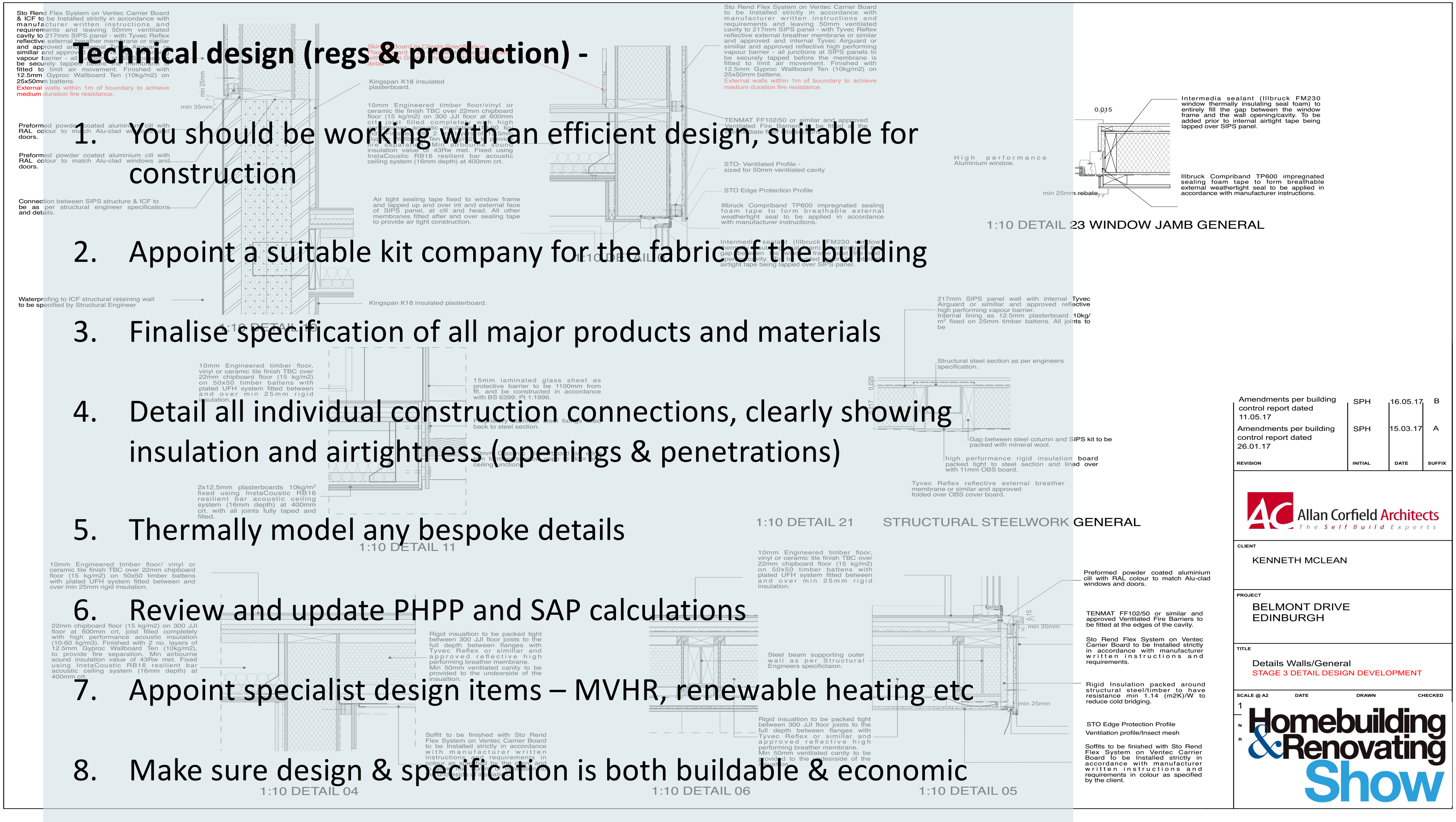
**Initial design & planning stage -**

1. Initial design ideas should be a response to the site and your brief (function before form)
2. Orientate habitable rooms due South to maximise solar gain, with utility/plant/service zones to the North
3. If going for Passive then large windows to South none on the North, also compact simple form
4. Larger more complex forms will cost more and have more junctions which will impact thermal bridging factor
5. Design with a construction method in mind
6. Limit overheating at design stage, ideally outwith building envelope
7. Once design is frozen complete initial PHPP and SAP calculations



# Technical design (regs & production) -

1. You should be working with an efficient design, suitable for construction
2. Appoint a suitable kit company for the fabric of the building
3. Finalise specification of all major products and materials
4. Detail all individual construction connections, clearly showing insulation and airtightness (openings & penetrations)
5. Thermally model any bespoke details
6. Review and update PHPP and SAP calculations
7. Appoint specialist design items – MVHR, renewable heating etc
8. Make sure design & specification is both buildable & economic



**On site -**

1. Before you start make sure you discharge any planning or regs conditions. Also put in place any warranty or insurance policies

2. What procedures do you have agreed for managing quality on site

3. Every trade that comes on site needs to know about airtightness

4. If you are using inexperienced trades then consider Pasive House Toolbox talks, at key stages –
    1. Kit sign off
    2. Window fitting
    3. Airtightness layer (VCL)
    4. Pre airtest

5. **Tape everything**

6. Any onsite changes to be run passed the design team

# IN SUMMARY

1. The biggest impact on your low-energy home is during the initial design stages
2. Review & research all options, principles and construction methods for low energy homes
3. Decide how energy efficient you want your home to be; Zero / Passive or Fabric First
4. Detail out all of the poor traditional construction details, ie limit areas of cold bridging
5. Strive for Passive House standard Airtightness results
6. **Remember none of this matters if your designers/builders don't follow these principles!**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