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BEGINNERS' GUIDE TO BUILDING A LOW ENERGY HOME, FROM ZERO CARBON TO PASSIVE

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Beginners guide to building a low energy home –

1. **What do we mean by low energy home?**
2. **Why build a low energy home?**
3. **The most common types of low energy homes in the UK – Zero Carbon & Passivhaus**
4. **The Fabric First Approach**
5. **The key elements within Fabric First**
6. **Summary**

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"Put simply a low energy house 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 low energy home?

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These are examples of low energy homes-


These are examples of low energy homes-
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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 majority of the current new-build housing stock is substandard. Both in terms of what the end user actually wants & in energy performance.”
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Why build a low energy home?
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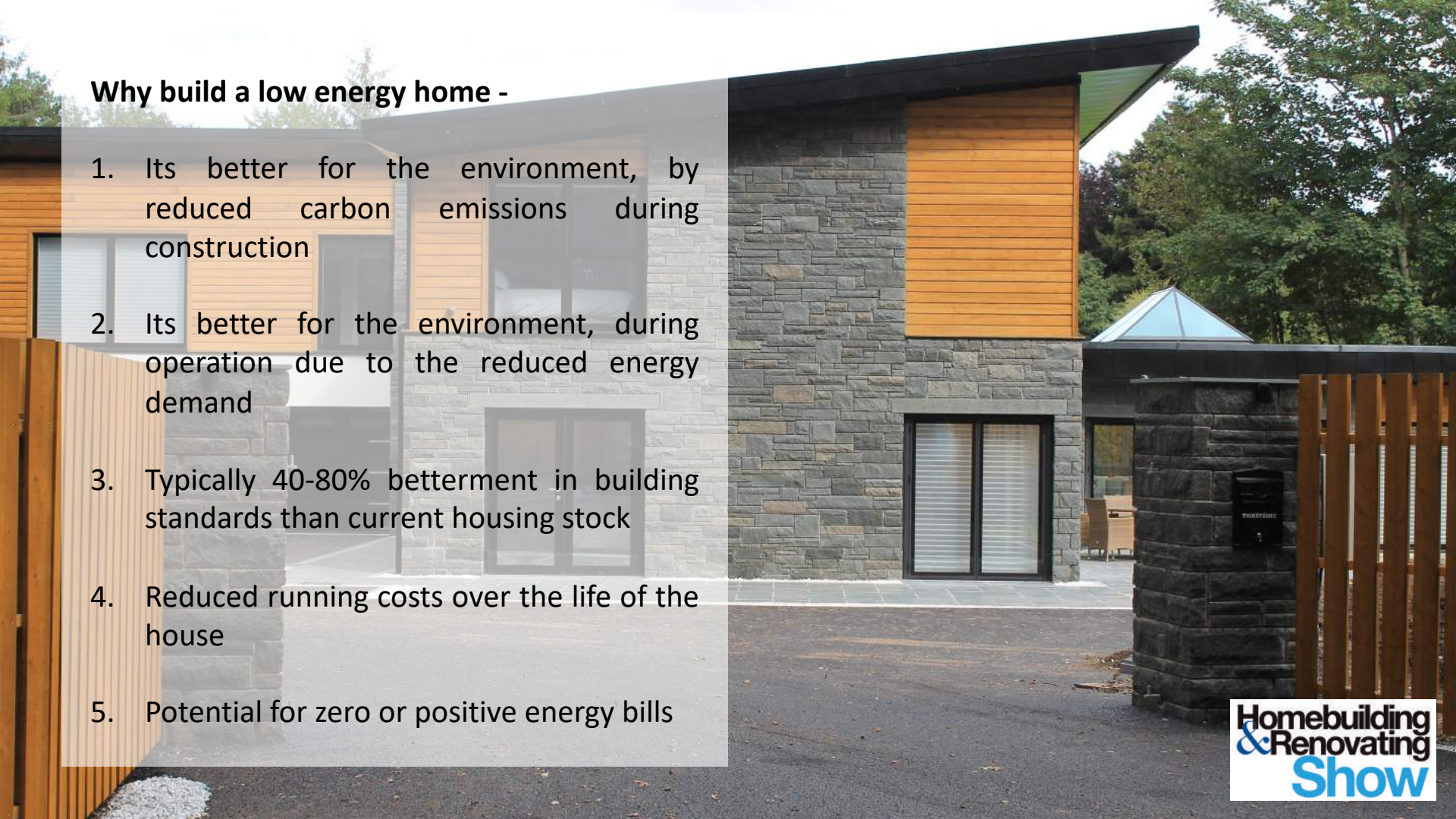

Why build a low energy home -

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

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Why build a low energy home -

6. We need 250,000 new homes per year.

7. We must achieve carbon savings in buildings of an 80% reduction – in order to comply with the legally binding carbon emissions target by 2050.

8. 18% of UK carbon emissions come from buildings.

9. Need for a new “2050 ready” standard, which is being reviewed currently within the industry and Government.

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The most common types of low energy homes in the UK

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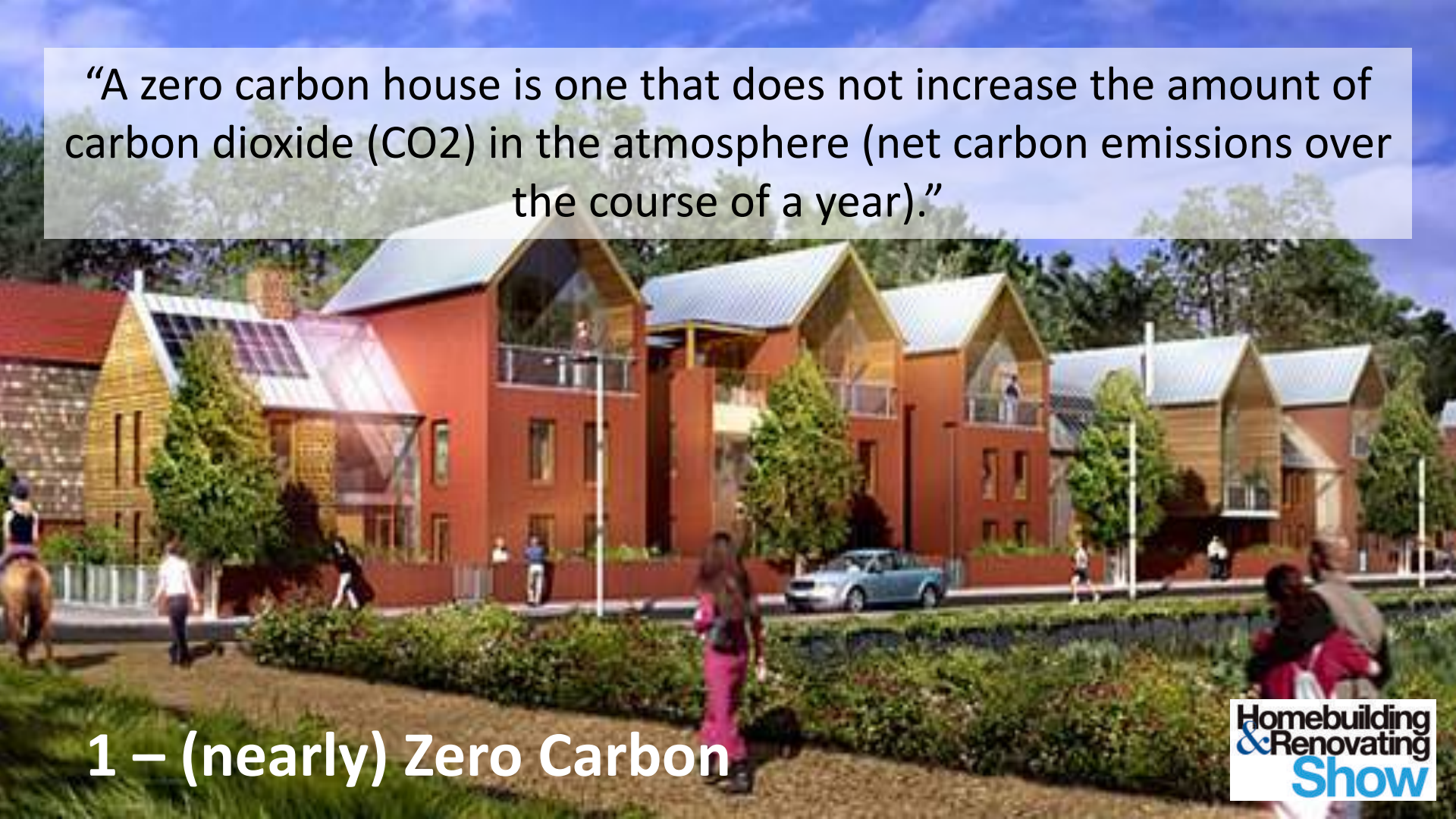

"A zero carbon house is one that does not increase the amount of carbon dioxide (CO2) in the atmosphere (net carbon emissions over the course of a year)."

1 – (nearly) Zero Carbon

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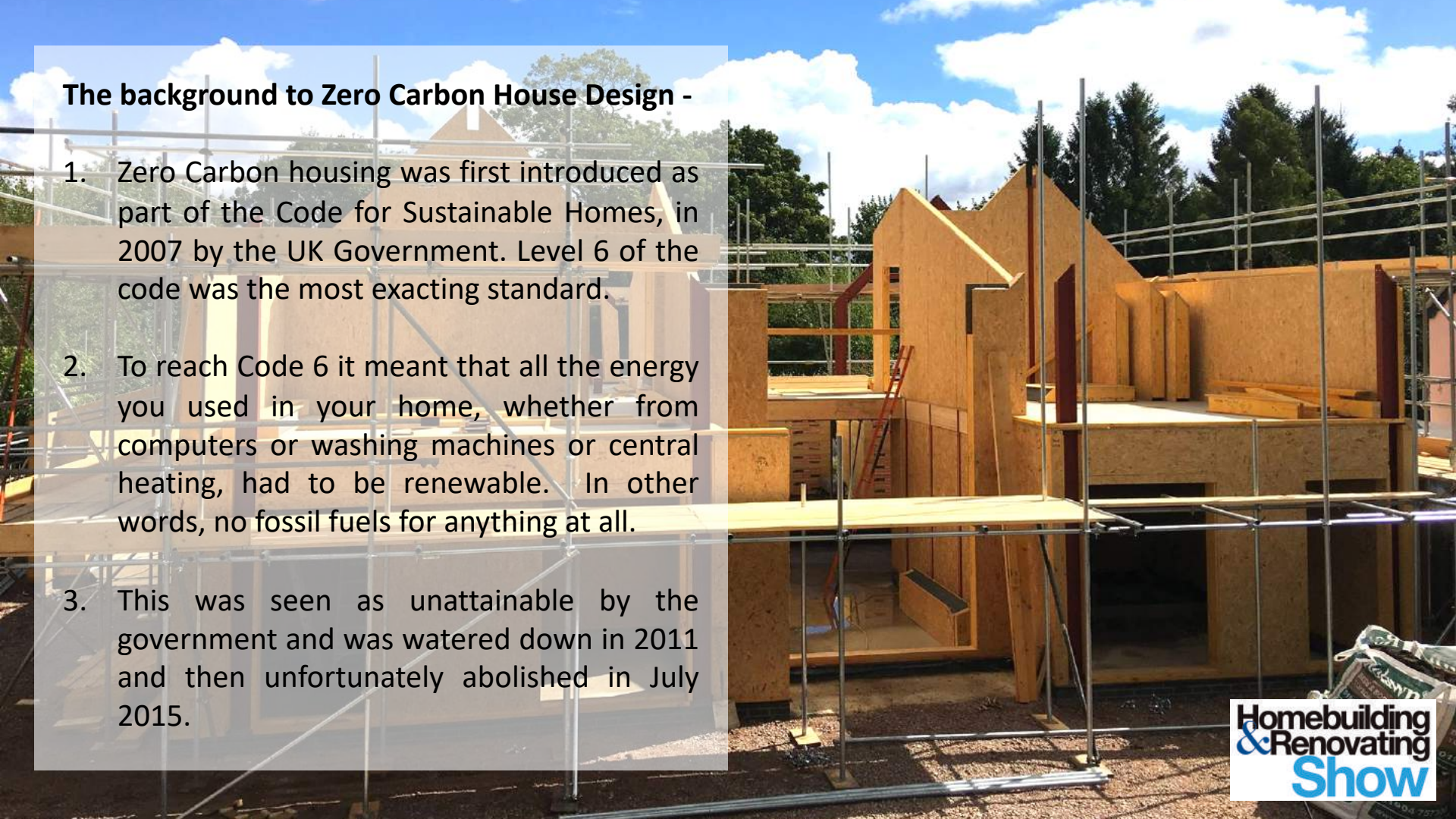
The background to Zero Carbon House Design -

1. Zero Carbon housing was first introduced as part of the Code for Sustainable Homes, in 2007 by the UK Government. Level 6 of the code was the most exacting standard.

2. To reach Code 6 it meant that all the energy you used in your home, whether from computers or washing machines or central heating, had to be renewable. In other words, no fossil fuels for anything at all.

3. This was seen as unattainable by the government and was watered down in 2011 and then unfortunately abolished in July 2015.



Zero Carbon House Design in 2019 -

4. A home which has a net-zero (neutral) impact on greenhouse gas emissions, not absolute zero. That means they do actually emit some carbon emissions, but they offset them – usually by generating clean green energy.

5. Only emissions during occupancy are counted. Inc, heating, cooling, ventilation & lighting are counted.

6. ‘Nearly Zero Carbon’ buildings have be adopted by Greater London Authority by 2020.

7. Energy Saving Trust’s - Ambitious “2050-ready” highly energy efficient & near-zero-carbon homes policy.

Common features of Zero Carbon House Design –

1. Energy efficient design features

    1. Large south facing windows with louvres
    2. Highly insulated walls and roofs
    3. Airtight construction
    4. Low flow water taps
    5. 100% LED lights throughout

2. Renewable energy technologies

    1. Solar Thermal Panels to provide domestic hot water
    2. Solar PV to provide the electricity
    3. Biomass boilers or Airsource Heat Pumps

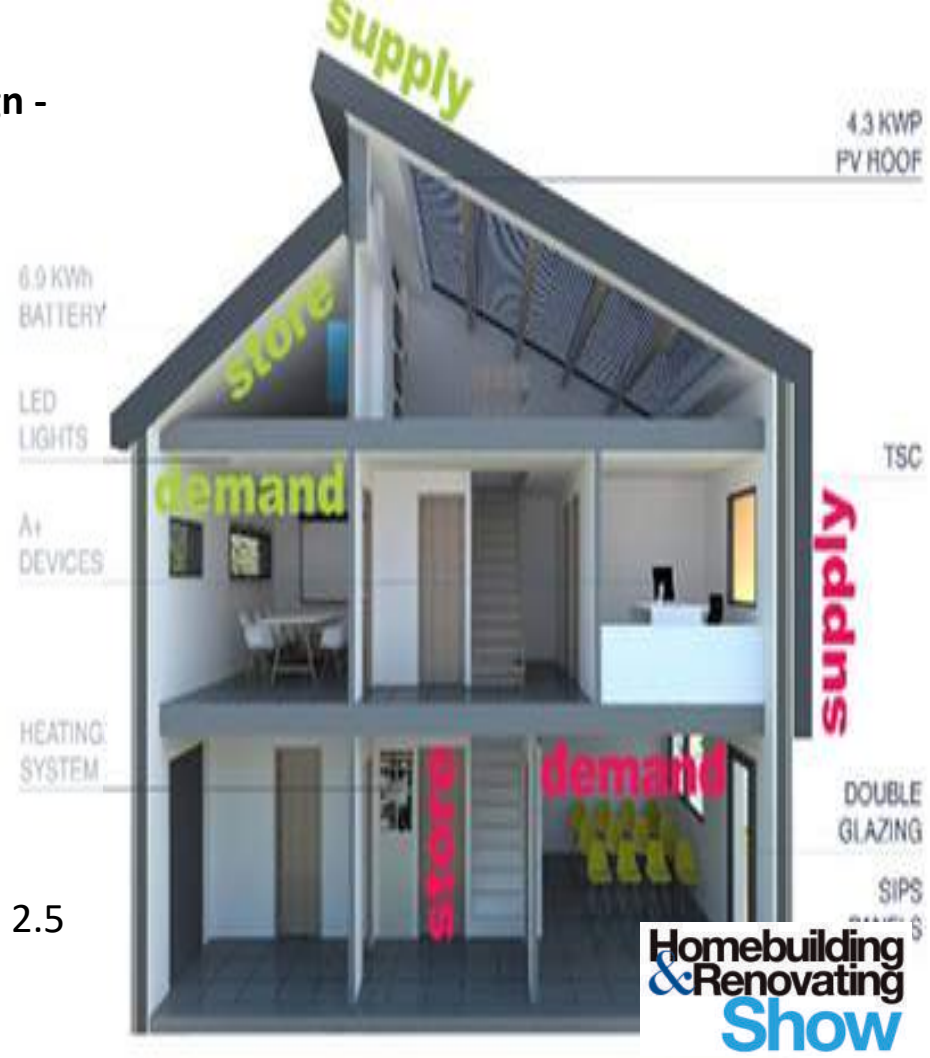
The Benefits and issues to Zero Carbon House Design -

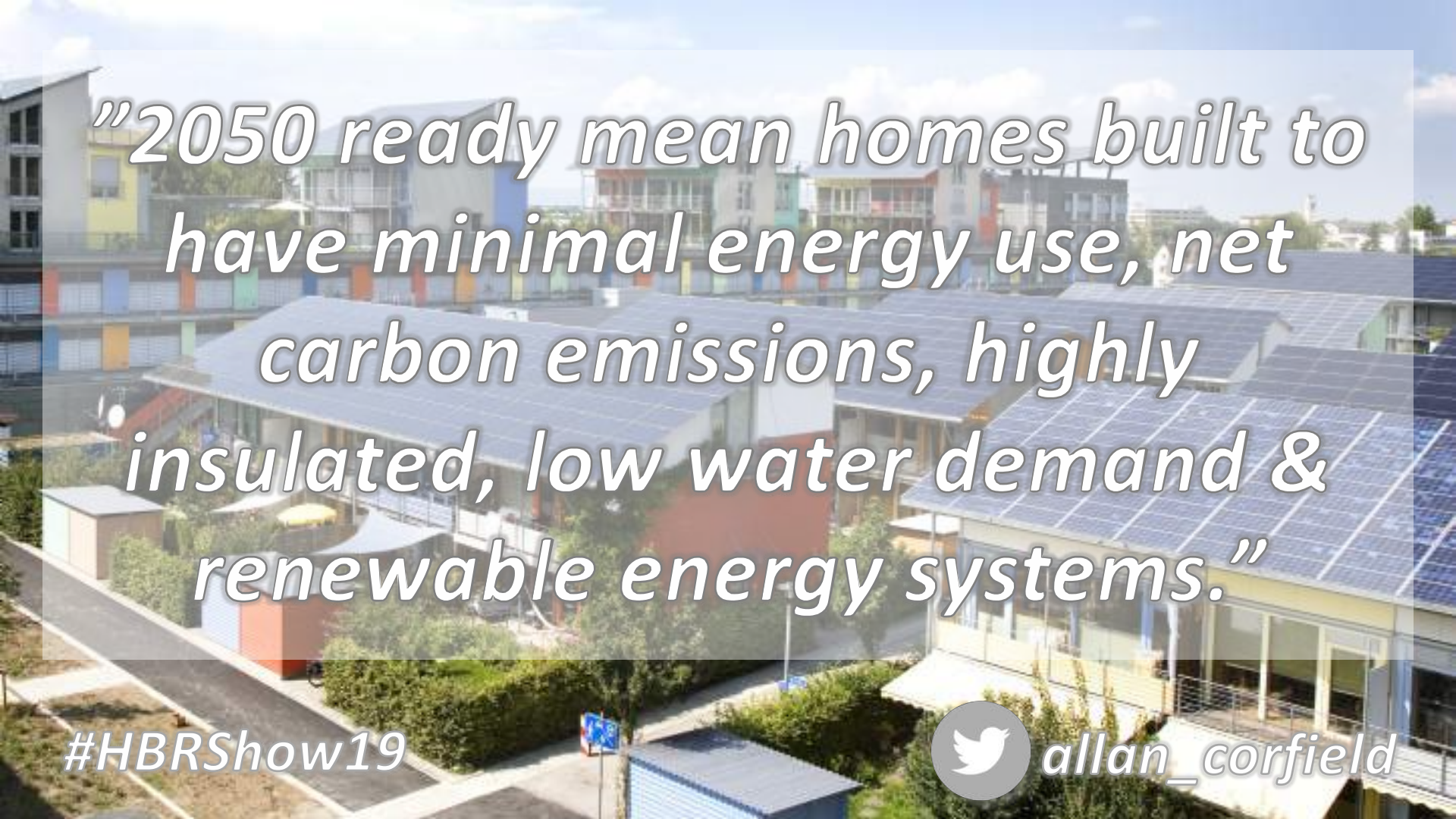
Benefits –

1. Reduced CO2 emissions
2. Better for the planet
3. No dependency on Fossil fuels
4. Significantly reduced energy bills
5. Better thought out and designed buildings

Issues –

1. Increased Design fees from specialists
2. Cost increase in construction costs (on average 2.5 to 5% increase)




”2050 ready mean homes built to have minimal energy use, net carbon emissions, highly insulated, low water demand & renewable energy systems.”
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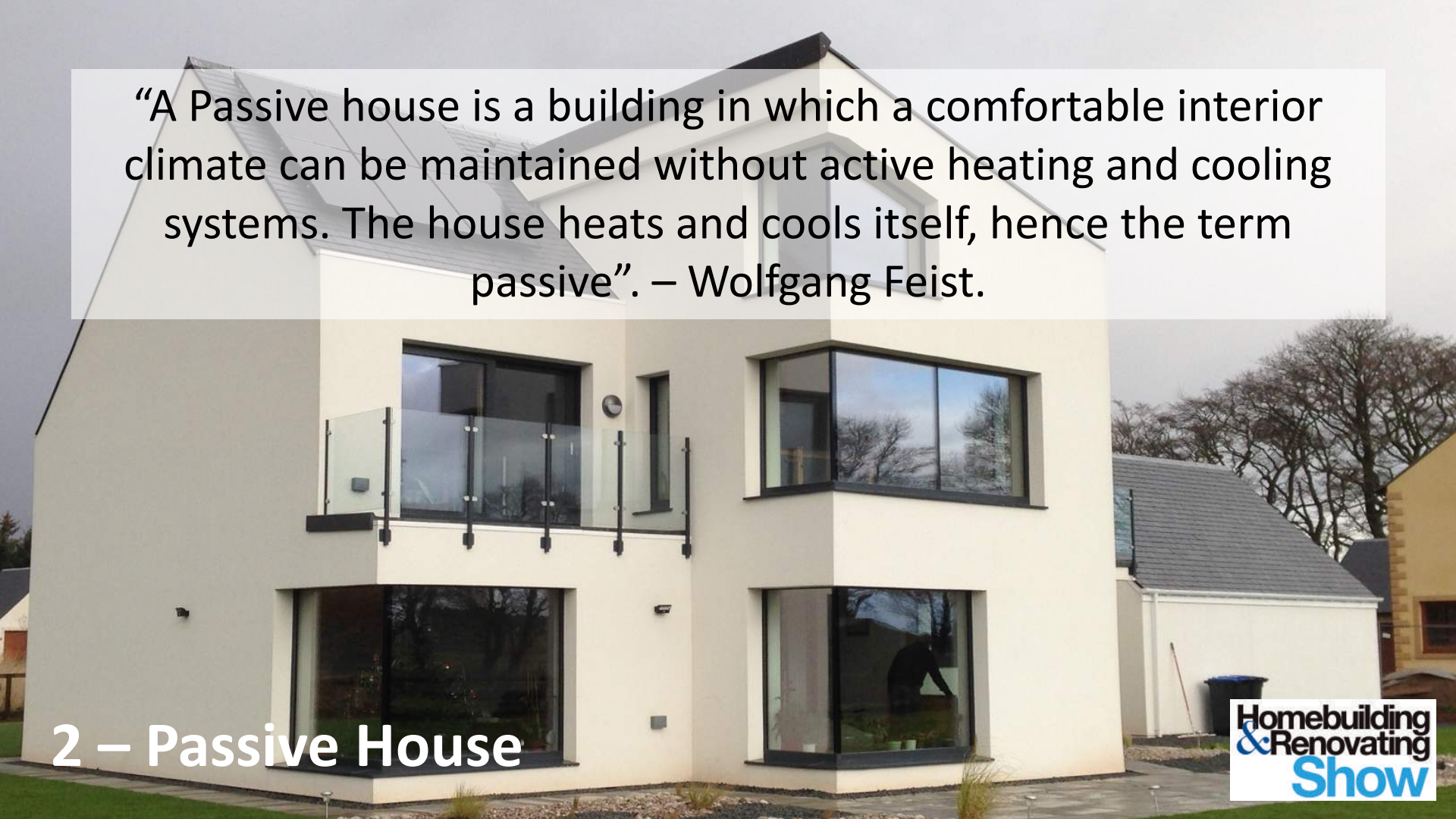

"A Passive house is a building in which a comfortable interior climate can be maintained without active heating and cooling systems. The house heats and cools itself, hence the term passive". – Wolfgang Feist.

2 – Passive House

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The background to Passivhaus Design -

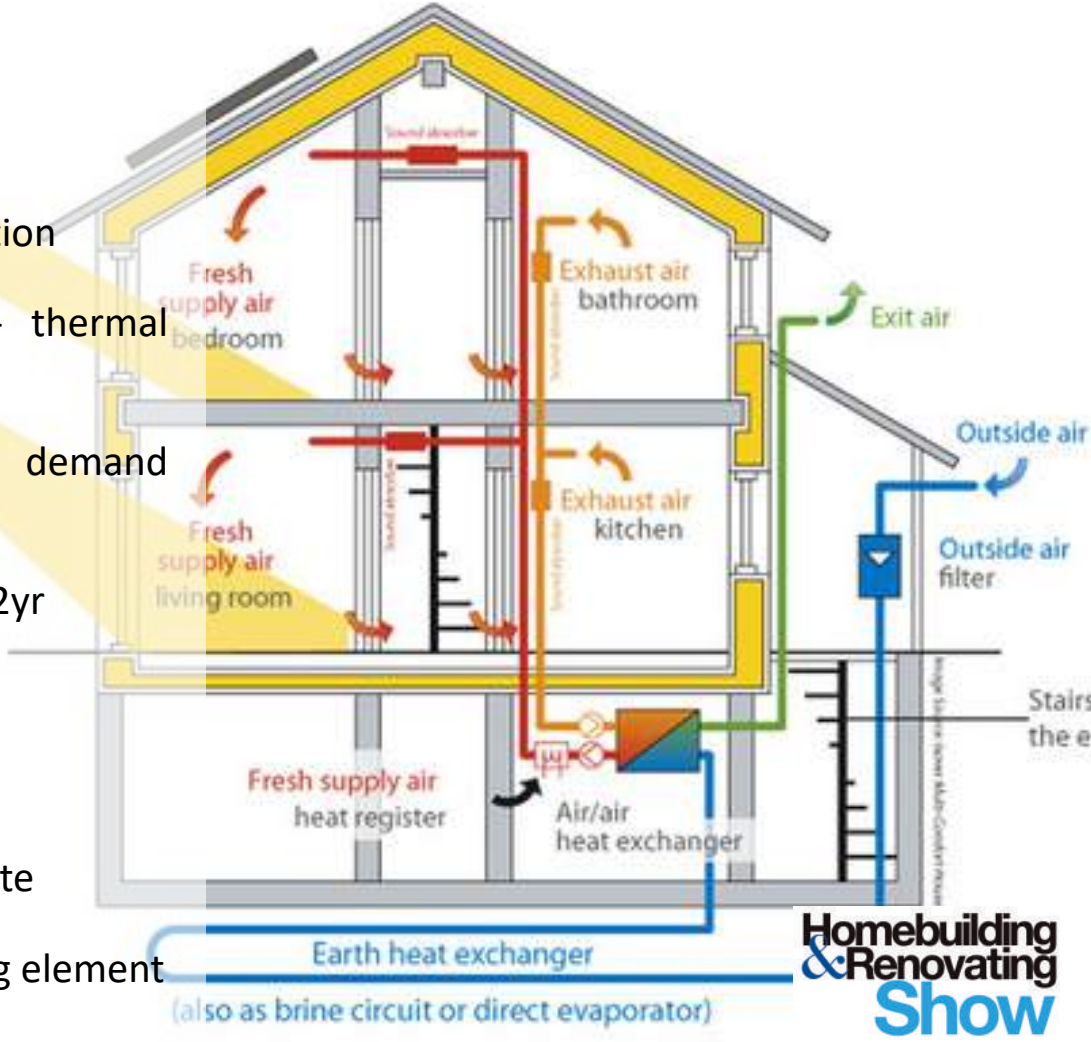
1. The Passivhaus standard was developed in Germany in the early 1990s by Professors Bo Adamson of Sweden and Wolfgang Feist of Germany and the first dwellings to be completed to the Passivhaus Standard were constructed in Darmstadt in 1991.

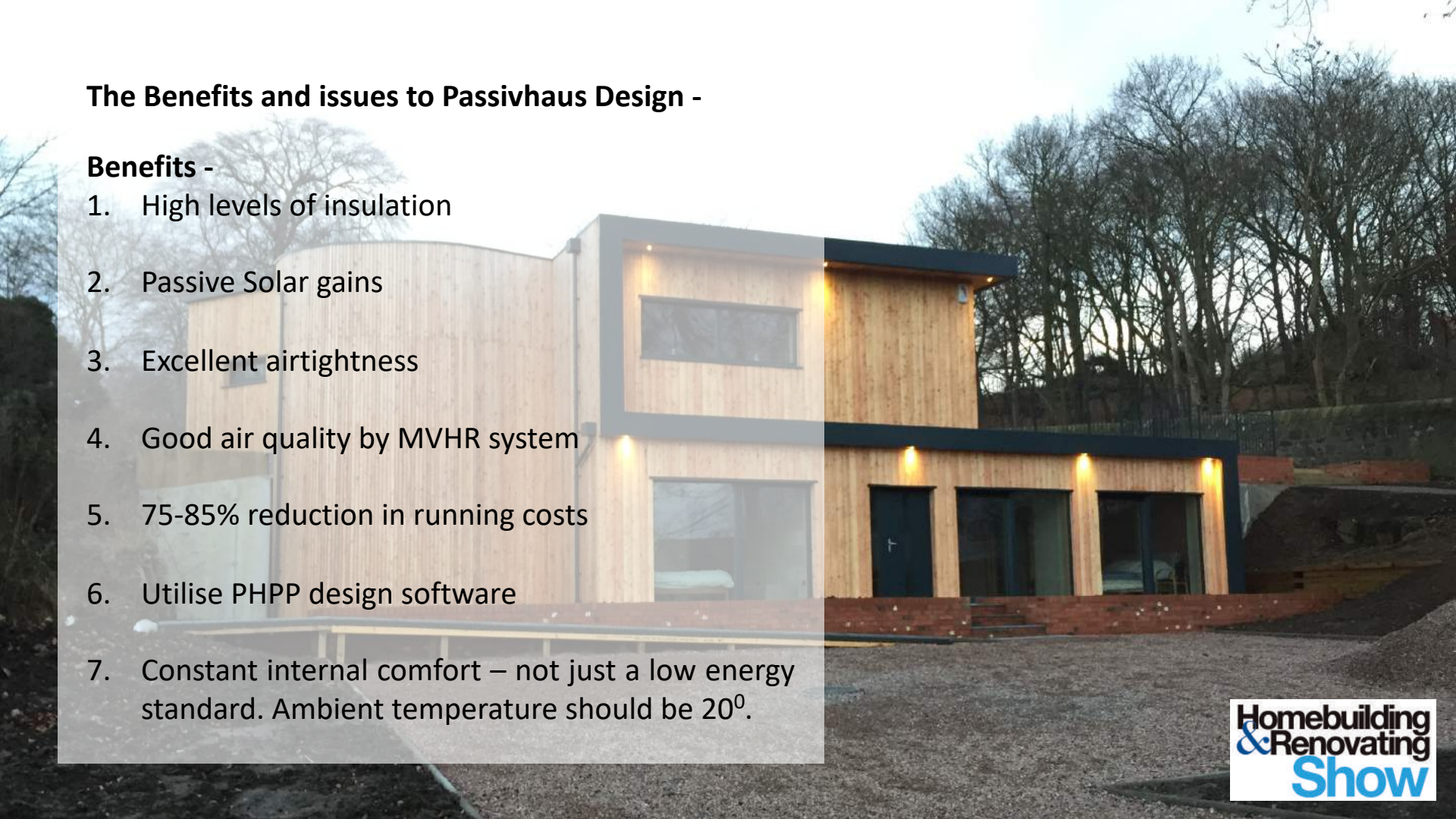
2. Passivhaus is the fastest growing energy performance standard in the world with 60,000 buildings realised to date.

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

Passivhaus 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 Passivhaus 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.

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The Benefits and issues to Passivhaus 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!***

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“Passive House is more than just a construction concept or heating strategy. It is a tested route to create a comfortable home.”
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”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

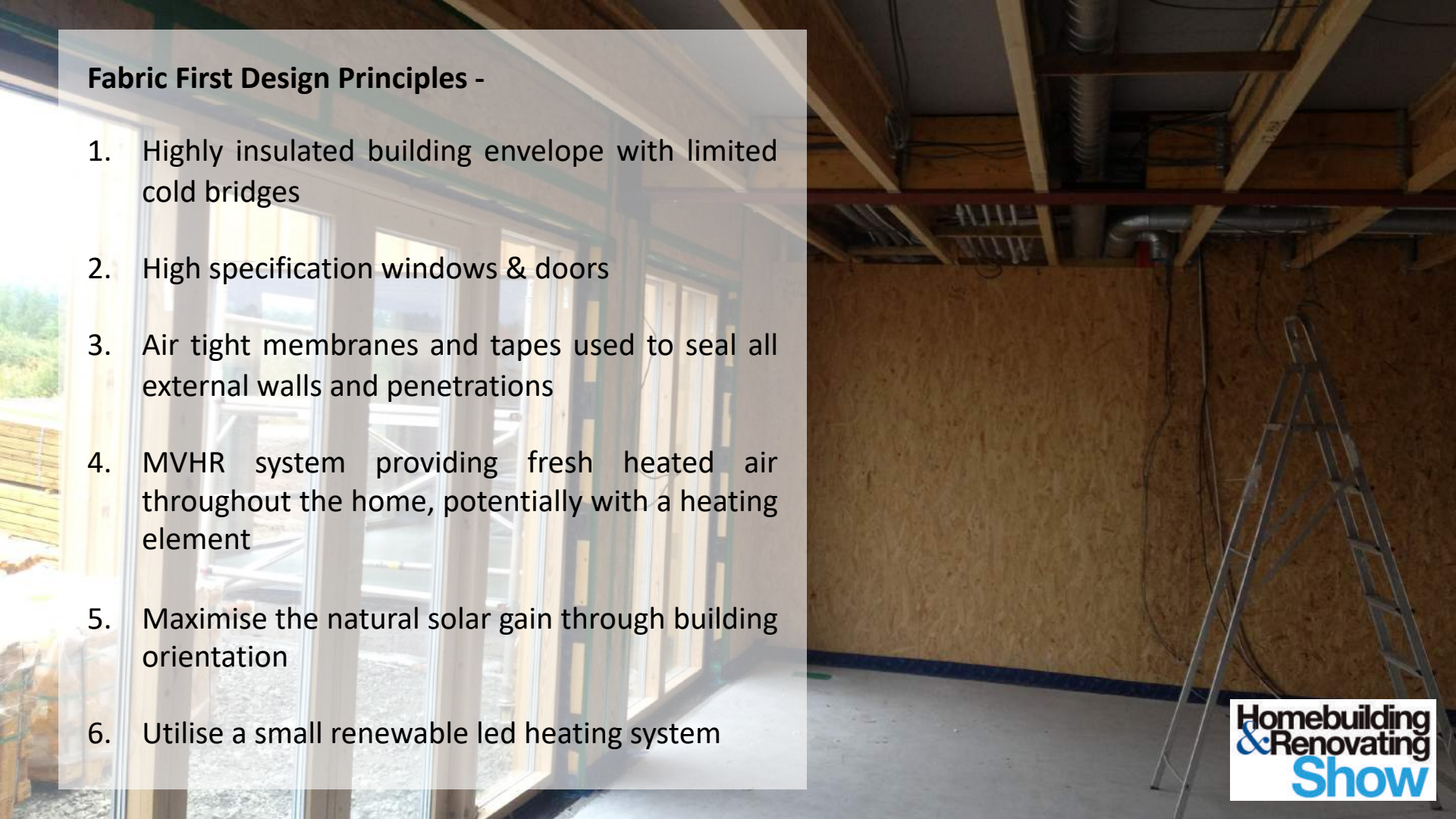
2. High specification windows & doors

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




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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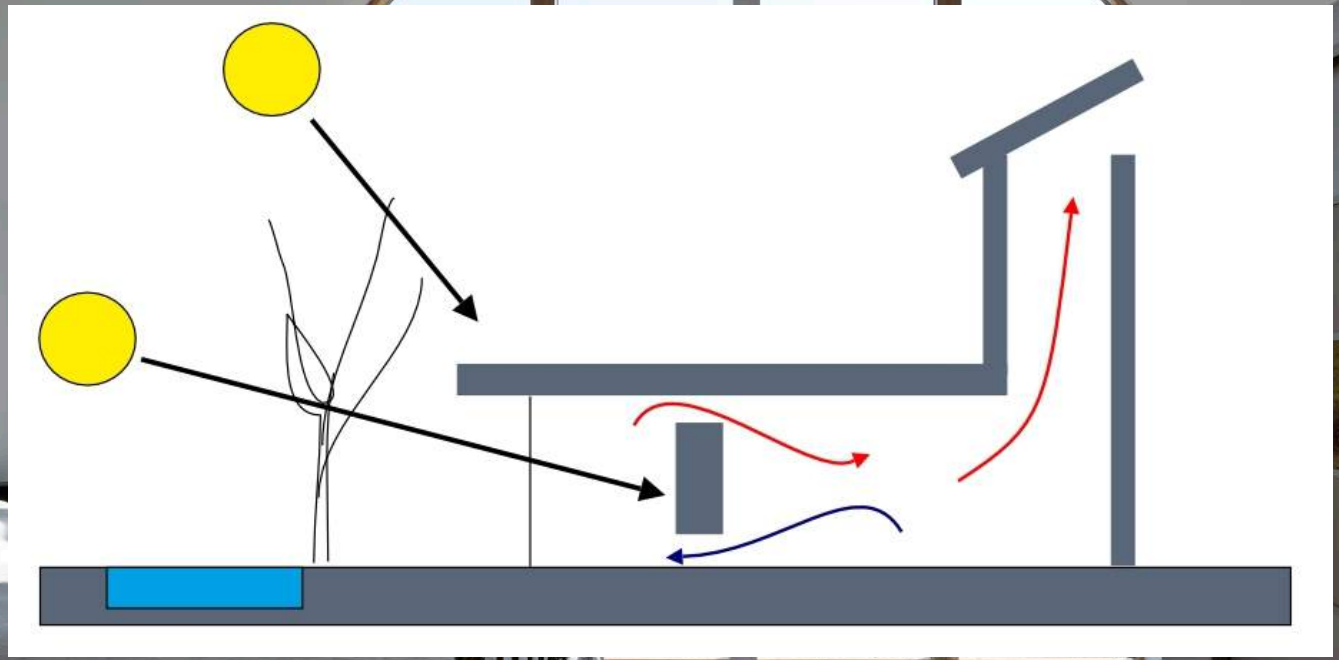
1. Solar Gain -

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



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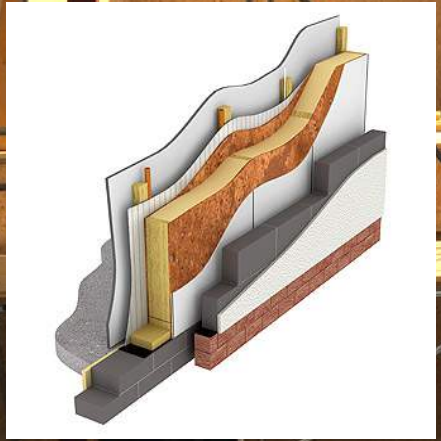
2. Construction Types -

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

Timber Frame



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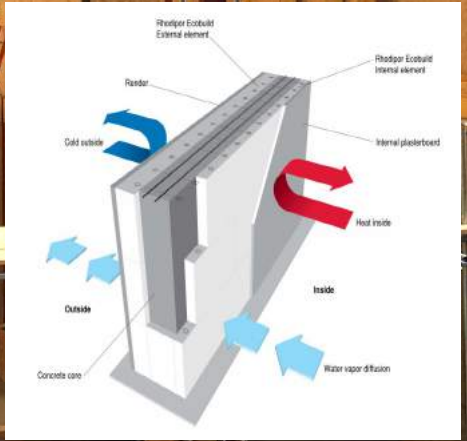

All can achieve a U-value of 0.10 to 0.15 W/m2k

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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

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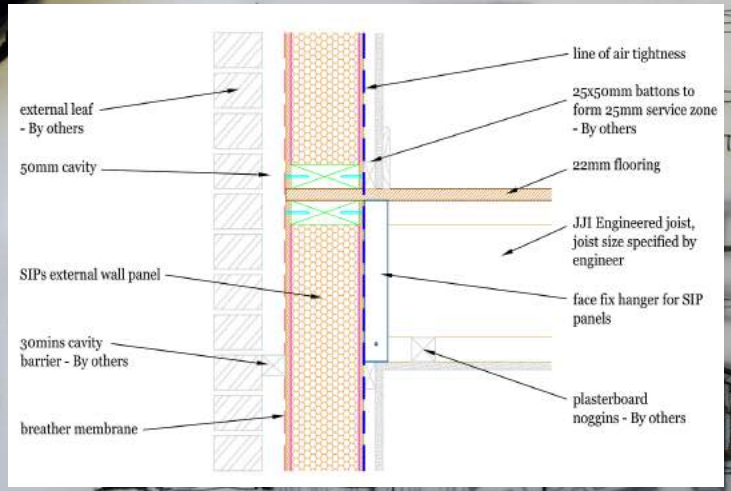
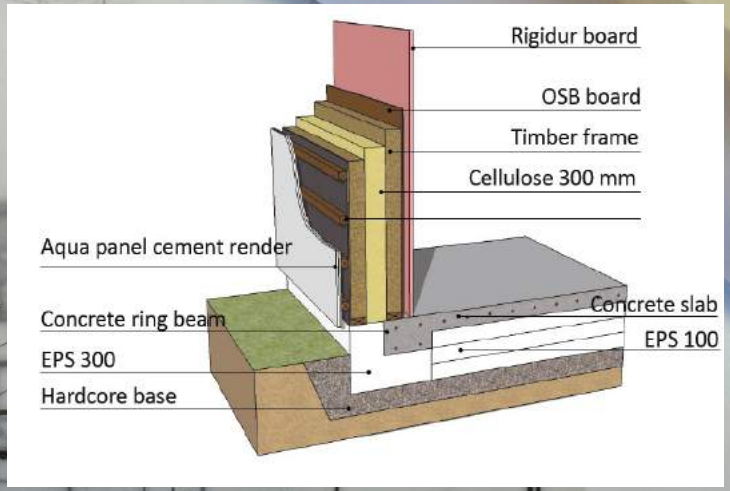
4. Limit Cold Bridging -

1. Architect to detail all parts of the buildings 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





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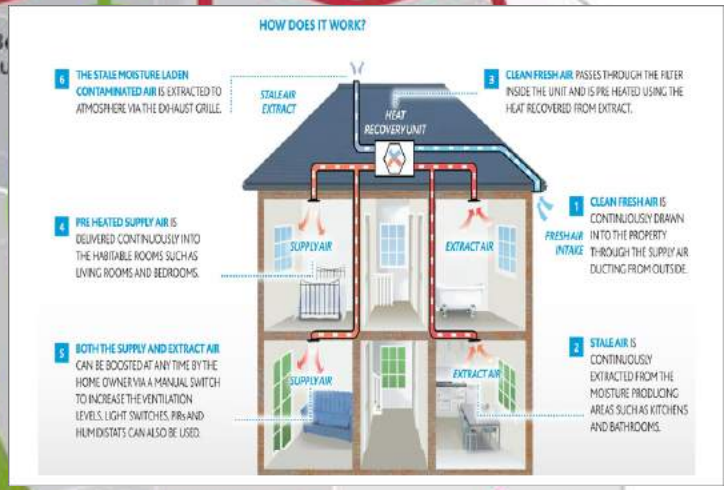
5. Ventilation Strategy -

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



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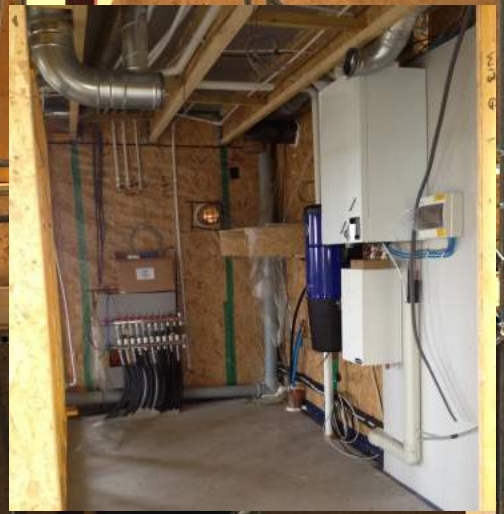
6. Heating Strategy -

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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IN SUMMARY

1. Review & research all options, principles and construction methods for low energy homes
2. Decide how energy efficient you want your home to be; Zero / Passive or Fabric First
3. Decide on the best Construction method for your build
4. Detail out all of the poor traditional construction details, ie limit areas of cold bridging
5. Strive for Passiv Haus standard Airtightness results
6. **Remember none of this matters if your designers/builders don't carry out these principles!**

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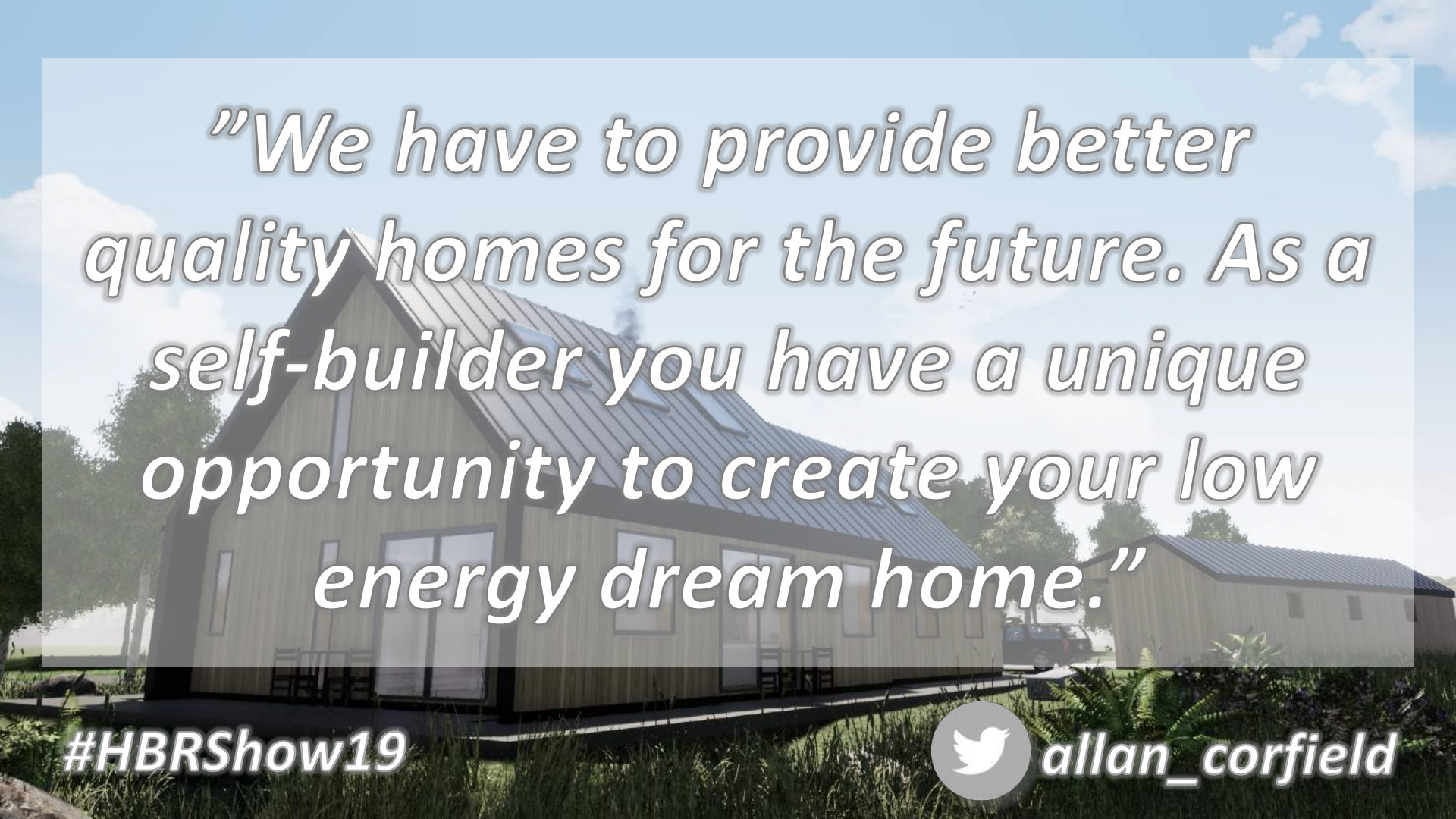
”We have to provide better quality homes for the future. As a self-builder you have a unique opportunity to create your low energy dream home.”
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