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HEALTHY BUILDINGS
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Preventing Overheating

STEICO
engineered by nature

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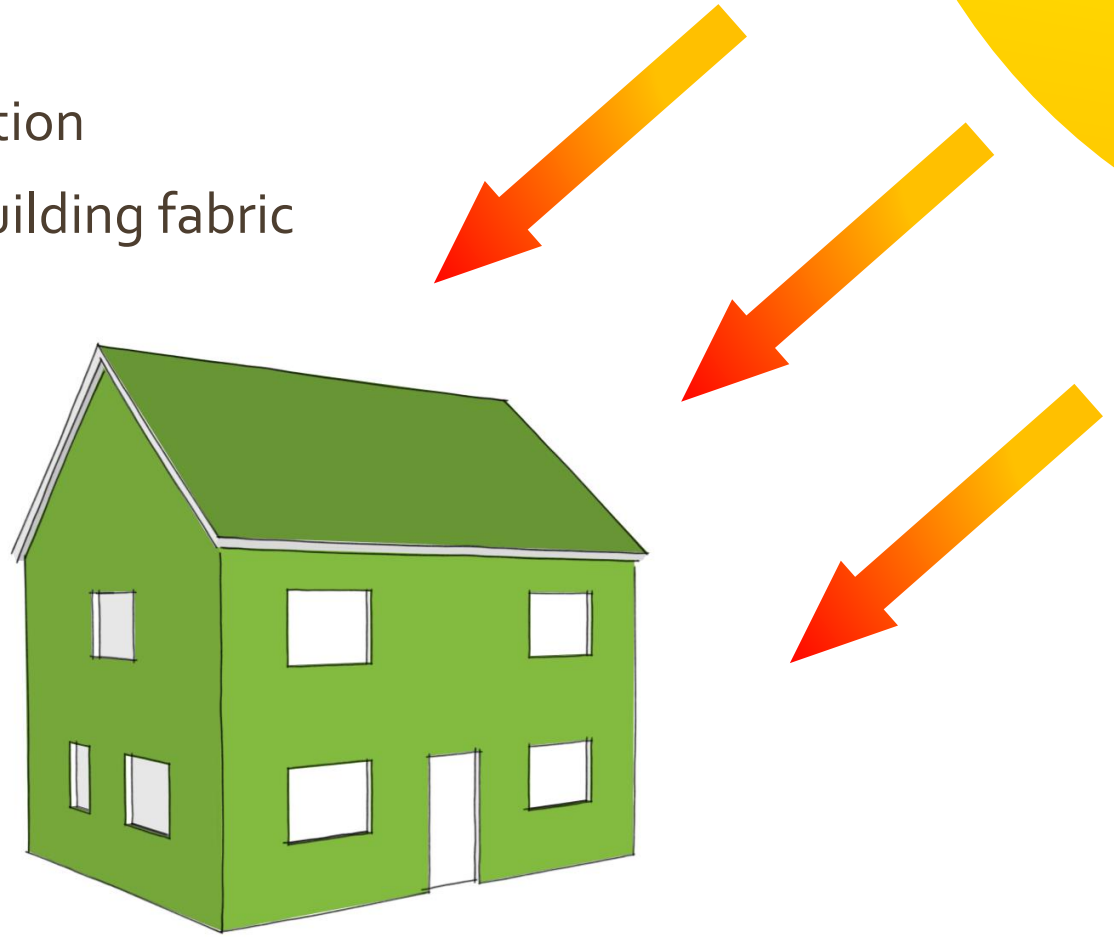
Preventing Overheating

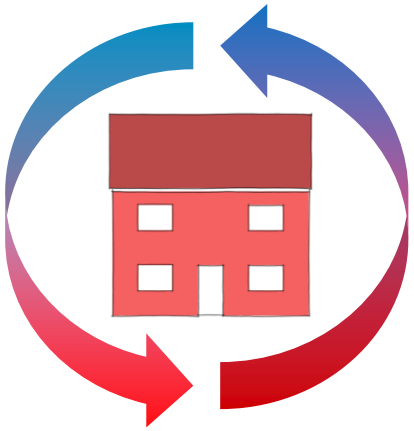
- Is it really an issue?
- Causes, risks and mitigation
- The critical role of the building fabric



Is it really an issue?

- What's changed? Why are we talking about overheating now?

  - We have changed the way we build.....

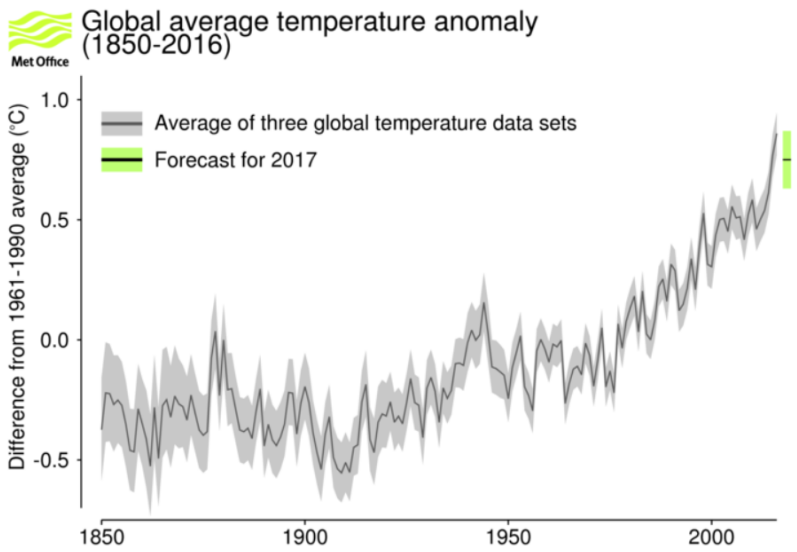


- Traditional building practices
- Poorly insulated
- Unplanned ventilation
- Inefficient glazing

- More lightweight structures hence less thermal mass
- Highly insulated
- Increased Airtightness
- Double / Triple glazing

And meanwhile.....

- Global temperatures are still rising
- 2015 and 2016 have been the 2 warmest years on record since 1850



Global annual average near-surface temperature anomalies (temperature difference from the 1961-1990 average in °C) from 1850-2015. The data is an average of HadCRUT.4.5.0.0, NASA GISTEMP and NOAAGlobalTemp. The 2016 value is an average for January to October.

The grey line and shading shows the 95% uncertainty range. The forecast value for 2017 and its uncertainty range are shown in green and black.

and dare I mention……

- Brexit
  - Environmental Regulations?
  - Future housing policy?
- The Trump effect
  - Climate change denial?
  - Withdrawal from the Paris Climate agreement?
  - Reinvigorate the US coal industry?

Things are definitely warming up !!

Causes , Risks and Mitigation?

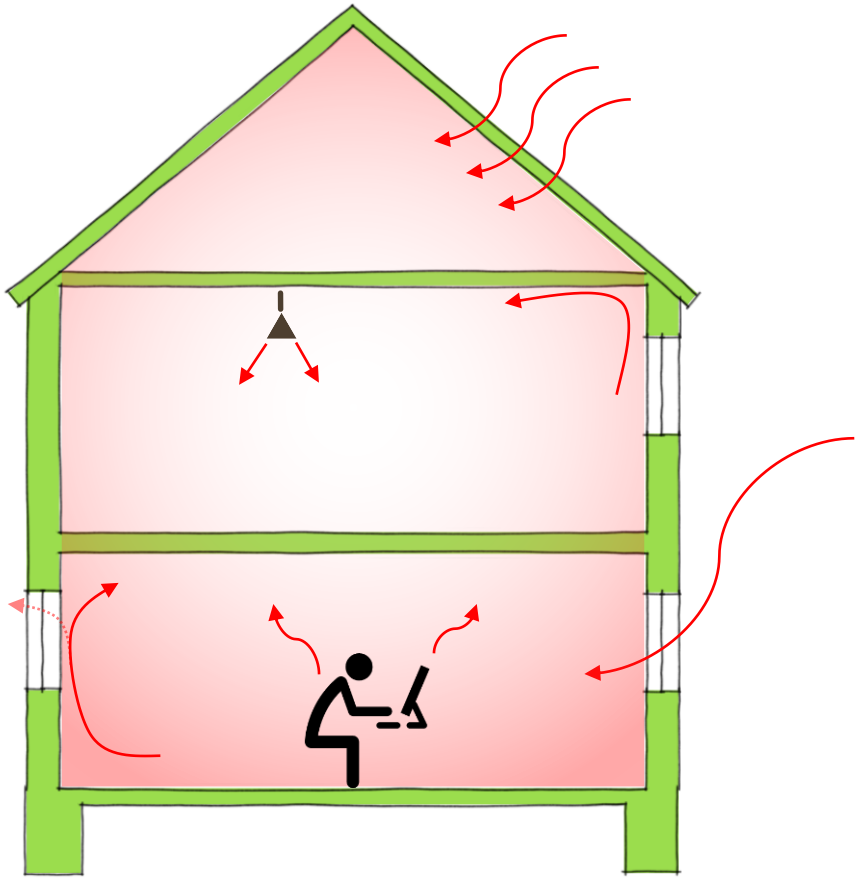
- How do we combat overheating?

  - We need to understand the causes
  - *Critically evaluate existing construction methods*

  - We need to appreciate the risks
  - *Understanding the risk allows us to make an informed judgement*

  - And we need to understand how to mitigate the problem
  - *Taking a holistic approach to construction*

Causes



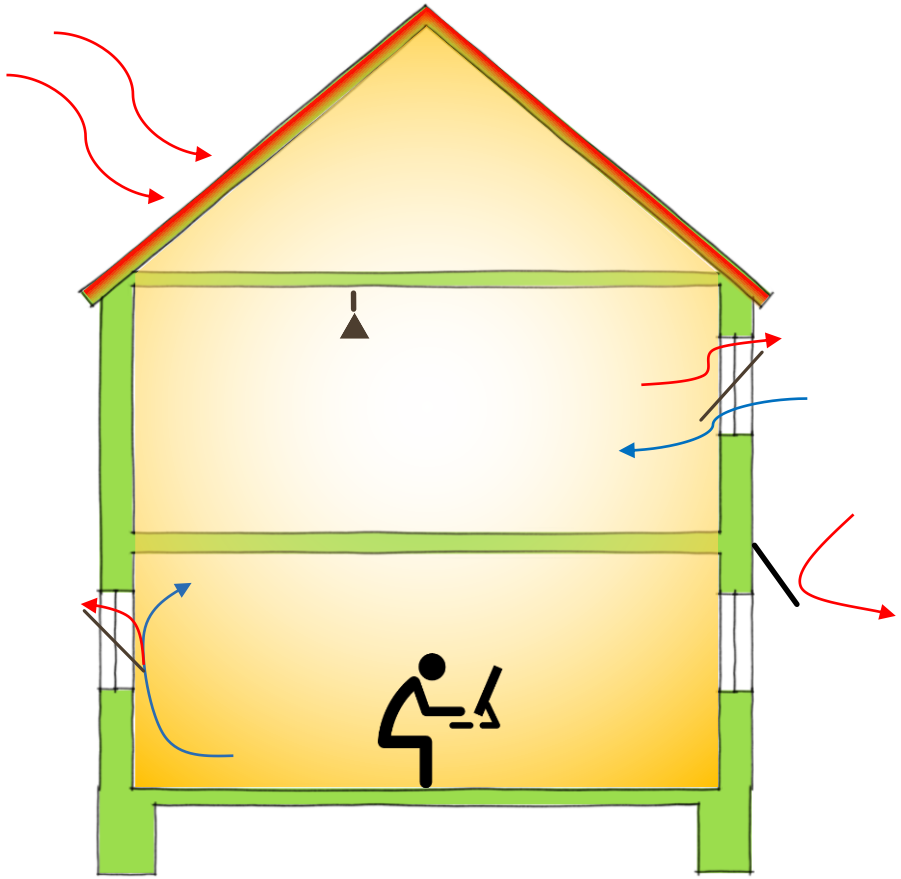
- Solar gain
- Internal gains
- Poor air circulation
- Inadequate ventilation
- Heat gain through fabric

Increased internal temperatures affect the comfort level of occupants and can increase the risk or respiratory and cardiovascular disease.

Risks

- Until recently it was assumed that there was no real risk from overheating associated with houses in the UK.
- Evidence from investigations into heat waves in other countries suggest air pollutants increase risks of respiratory conditions
- Internal temperature rises increase cardiovascular strain and can lead to heat exhaustion, heatstroke and hospitalization
- Susceptible age groups include the elderly and very young.
- Where overheating does occur it can have serious impacts on the health of occupiers. 2003 heatwave in Europe resulted in over 20,000 heat related deaths.

Mitigation



- Site orientation
- Effective shading
- Appropriate ventilation strategy
- Heat buffering by the building fabric

The combination of all these strategies can ensure that the internal temperatures and air quality are within healthy limits for the homeowner.

The critical role of the building fabric

- Wall and Roof structure can cover between 80 – 90% of the overall building fabric
- These areas are considered for thermal performance but not for their ability to restrict the ingress of Summer heat.
- The ability to buffer external heat is called 'Phase Shift' or ' Heat decrement delay'
- It is measured in hours with 12 hours being the optimum level
- The critical technical values required to achieve Summer Heat protection are the right combination of:

- **Low Thermal Conductivity**
- **High Density**
- **High Specific Heat Capacity**

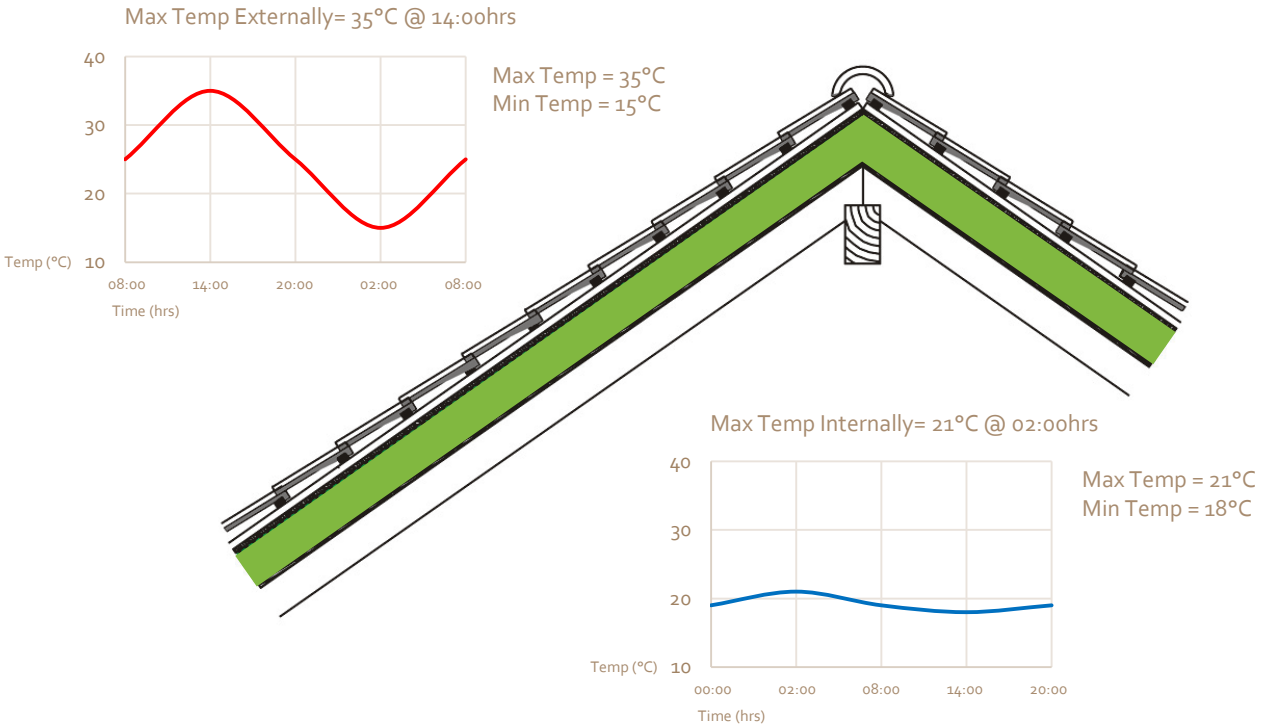
Comparative performance

- The correct choice of insulation is vital to the effectiveness of a particular construction
- The correct balance of High Density, Low Thermal Conductivity and High Specific Heat Capacity results in an insulation product with a Low Thermal Diffusivity.
- Low Thermal Diffusivity results in high Phase Shift values….

Material	Density [kg/m^3]	Thermal Conductivity [W/(m*K)]	Specific Heat Capacity J/(kg*K)]	Thermal Diffusivity a cm^2/h
Spruce, Pine, Fir	600	0.130	2500	3
STEICO*universal* sarking and sheathing board	270	0.051	2100	3
STEICO*protect H* external thermal insulation	265	0.048	2100	3
STEICO*special dry* renovation boards	140	0.041	2100	3
STEICO*therm* rigid insulation	160	0.038	2100	4
STEICO*top* insulation for attic floors	140	0.041	2100	15
STEICO*flex* flexible insulation from wood	50	0.038	2100	15
Brickwork	1800	0.800	1000	16
Reinforced concrete	2200	1.400	1050	22
Polystyrene	40	0.040	1380	26
Polyurethane foam	30	0.030	1380	26
Glaswool	30	0.035	800	52
Steel	7800	58	600	446
Aluminium	2700	200	921	2895

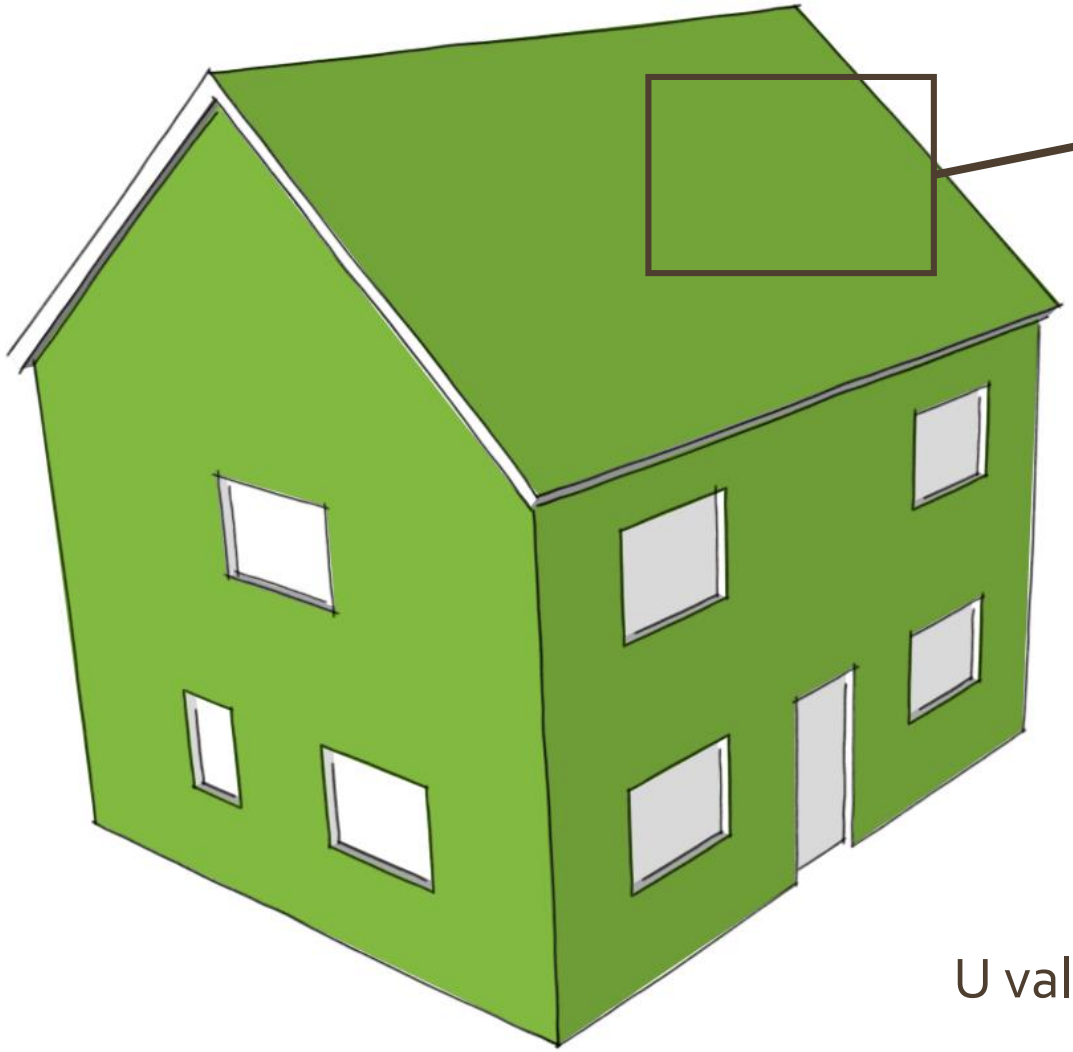
Phase Shift explained

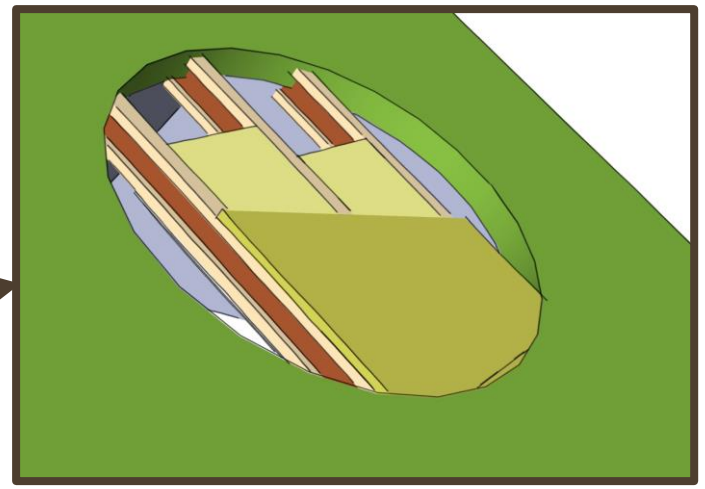
- Phase Shift is defined as the time span between the highest external temperature and the highest internal temperature
- In this example the highest temperature is at 14:00 and the highest internal temperature at 02:00. This equates to a 12hr Phase Shift
- With this level of performance a portion of the heat stored in the insulation components is returned to the external air
- Internal temperature will never reach that of the external



How does this work in practice.....

Comparative performance



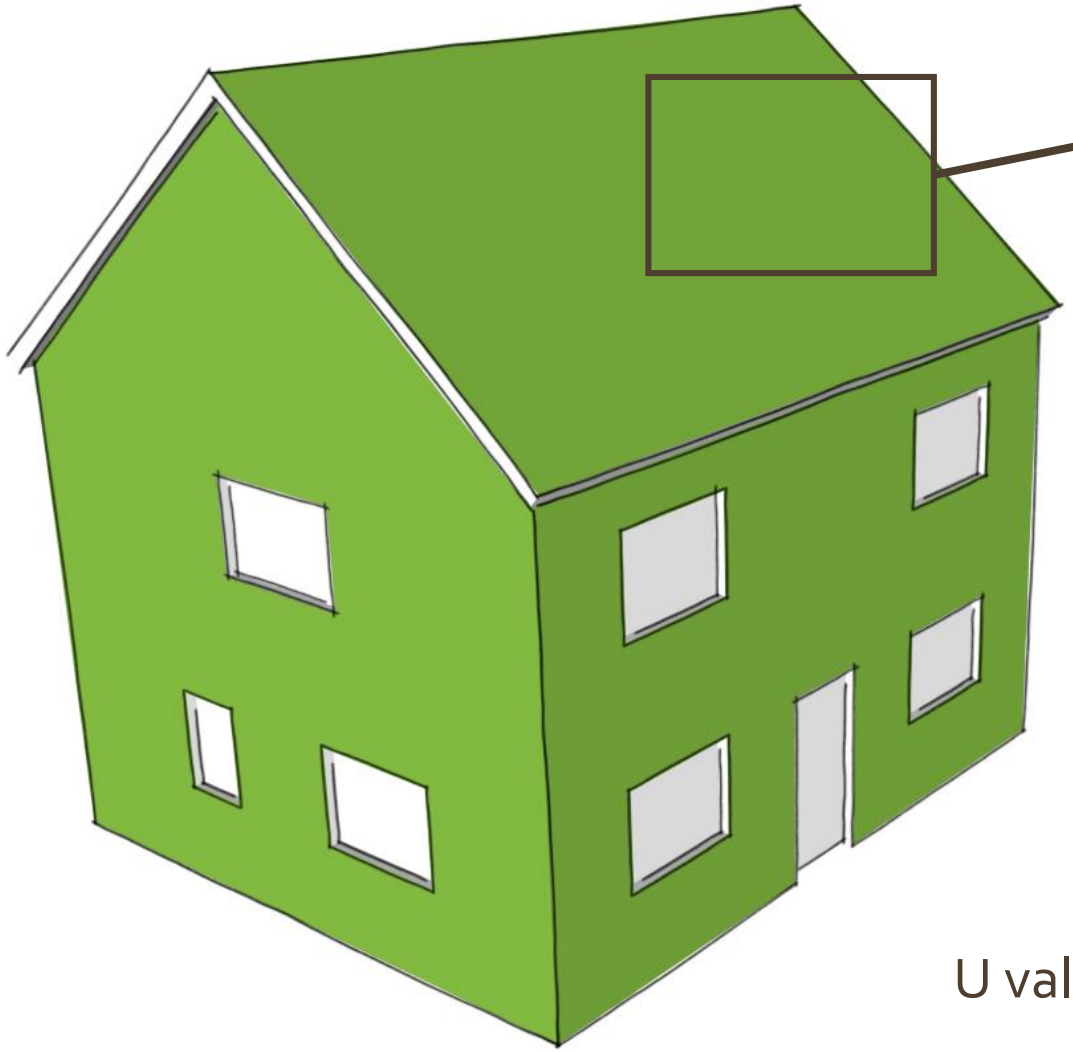


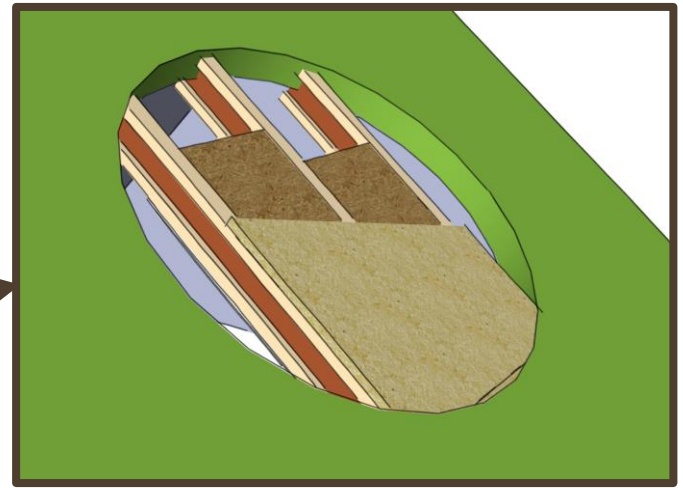
Roof build up:

- 12.5mm Plasterboard
- Vapour control layer
- 240mm STEICOjoist with Glasswool insulation
- 40mm Mineralwool
- External roof finish

U value: 0.15 W/m²K. Phase Shift: 7.1 hours

Comparative performance





Roof build up:

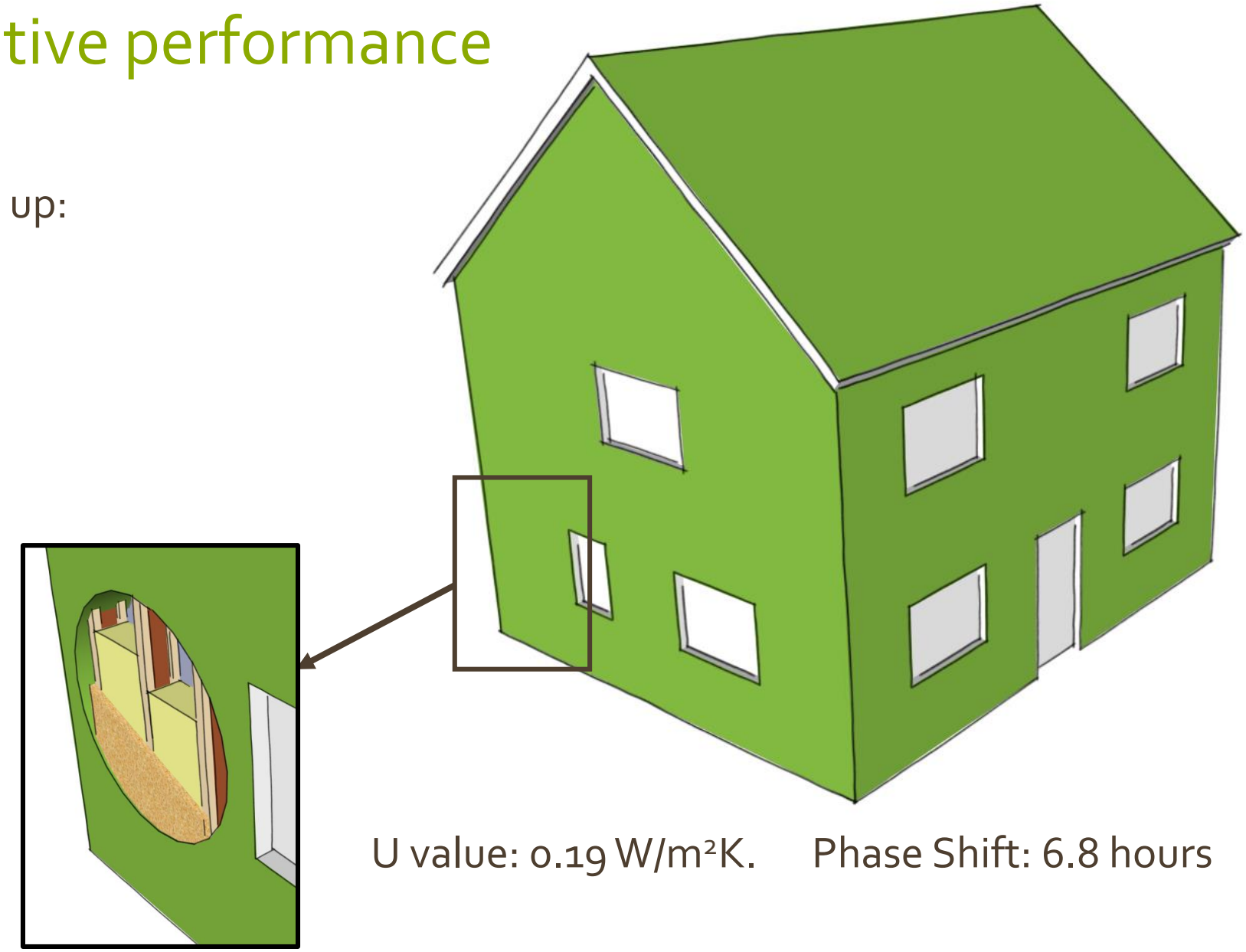
- 12.5mm Plasterboard
- Vapour control layer
- 240mm STEICO*joist* with STEICO*flex* insulation
- 40mm STEICO*universal dry*
- External roof finish

U value: 0.15 W/m²K. Phase Shift: 13 hours

Comparative performance

Traditional Wall build up:

- 12.5mm Plasterboard
- Vapour control layer
- 140mm PIR
- 11mm OSB
- Breather membrane
- Cavity / Brickwork

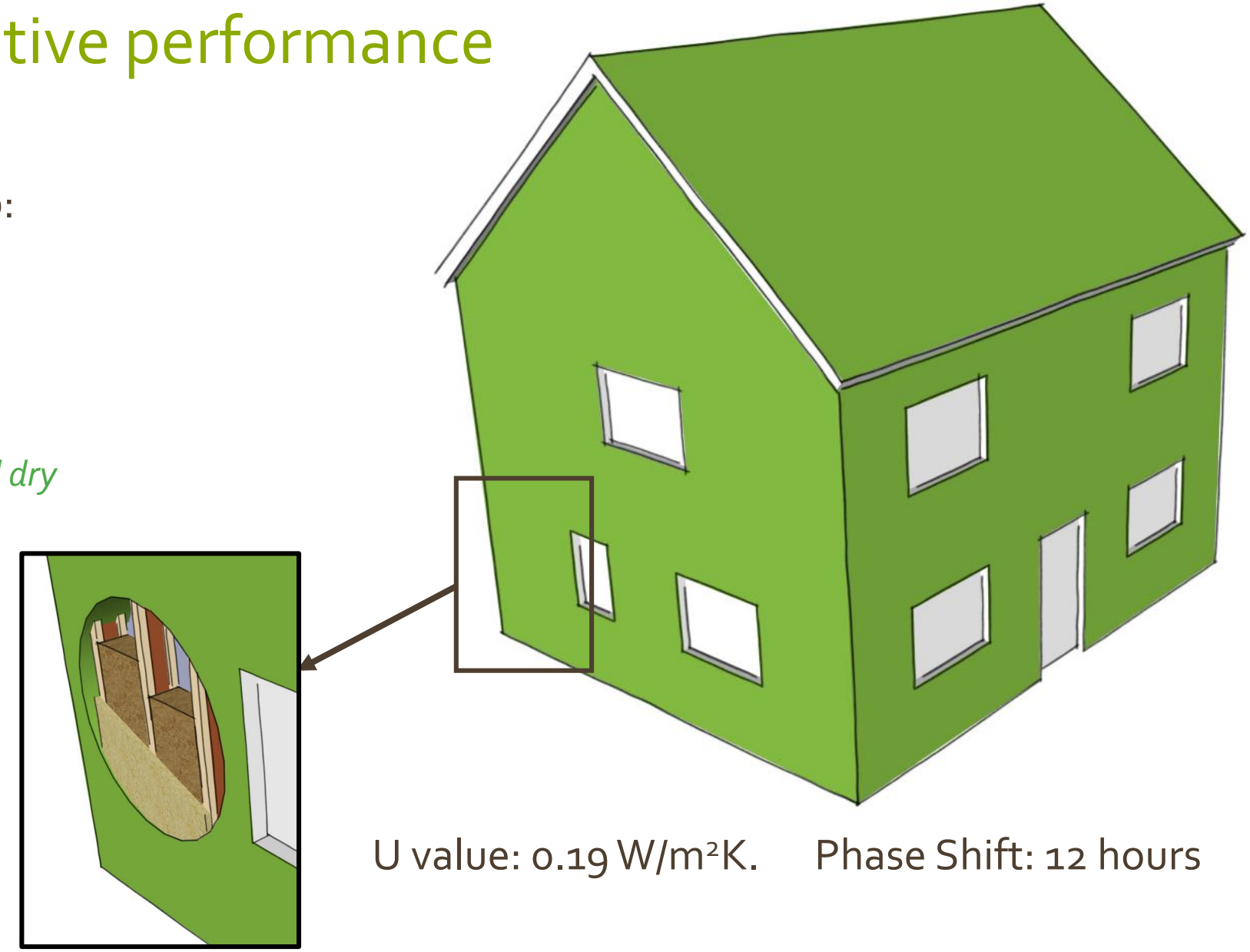


U value: 0.19 W/m²K. Phase Shift: 6.8 hours

Comparative performance

Reverse Wall build up:

- 12.5mm Plasterboard
- 15mm OSB
- 140mm STEICO*flex*
- 60mm STEICO*universal dry*
- Cavity / Brickwork



U value: 0.19 W/m²K. Phase Shift: 12 hours

Summary

- There is a growing body of evidence that overheating buildings can have negative health impacts on occupiers particularly those in vulnerable age groups
- A combination of strategies is required in order to reduce the risks of overheating homes
- Utilising the building fabric can have a significant impact on internal climate and reduces the requirement for the homeowner to actively combat overheating issues

Useful resources…

- ZERO CARBON HUB
  - http://www.zerocarbonhub.org/current-projects/tackling-overheating-buildings
- BRE
  - https://www.bre.co.uk/filelibrary/Briefing%20papers/116885-Overheating-Guidance-v3.pdf
- Department of Energy and Climate Change
  - https://www.cibse.org/getmedia/4a1e86ee-ea51-44ba-95fb-54f3165282cf/DECC-Overheating-guidance-document-19Jun2015.pdf.aspx
- NHBC Foundation
  - https://www.nhbcfoundation.org/publication/understanding-overheating-where-to-start/

Further information available at http://asbp.org.uk/

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Thank you for your time

Any questions?