HOMES UK
THE FUTURE OF LIVING
27-28 November 2019, ExCeL, London

BIRMINGHAM CITY University

Improving the energy performance of existing buildings and providing healthy indoor environments

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Indoor Air Quality

Although we are constantly made aware of the dangers of outdoor pollution, indoor air quality (IAQ) is a subject which is less frequently talked about.

We spend up to 90% of our time indoors.

Increased thermal insulation and air tightness are causing unintended consequences (low thermal comfort and IAQ, as well as overheating).

Inadequate ventilation coupled with poor quality building materials, such as PVC and paints, are causing negative impacts on occupant health.

A better indoor environmental quality can enhance the wellbeing of building occupants and help decrease the occurrence of sick building syndrome and building related illness.

Indoor Air Quality

There is a growing body of evidence demonstrating the impact air pollution has on many aspects of our health, across our lifetime.

Air pollution causes and exacerbates many chronic conditions, increasing the likelihood of strokes and heart attacks in susceptible individuals. Air pollution also adversely effects the development of the foetus. There is compelling evidence that air pollution is associated with new onset asthma in children and adults as well as contributing to diabetes, neurodegenerative diseases and is a risk factor for lung cancer.

Annually an estimated 40,000 deaths are linked to air pollution in the UK.

'Every breath we take: the lifelong impact of air pollution'
Royal College of Physicians (RCP) and Royal College of Paediatrics and Child Health's (RCPCH)

Department for Environment Food & Rural Affairs

CLEAN AIR STRATEGY 2019

Ministry of Housing, Communities & Local Government

Research into overheating in new homes

Phase 1 report

Good Homes Alliance

OVERHEATING IN NEW HOMES

Tool and guidance for identifying and mitigating early stage overheating risks in new homes

July 2019

Kindly sponsored by:

Berkeley Group · Window & Cladding · mpa · cpa construction products association · NHBC Foundation · VELUX

Ministry of Housing, Communities & Local Government

The Future Homes Standard

2019 Consultation on changes to Part L (conservation of fuel and power) and Part F (ventilation) of the Building Regulations for new dwellings

appg all party parliamentary group for healthy homes and buildings

Building our Future
Laying the Foundations for Healthy Homes and Buildings

WHITE PAPER

OCTOBER 2018

The Future Homes Standard

The UK has set in law a target to bring all its greenhouse gas emissions to net zero by 2050.

The Clean Growth Grand Challenge mission is to halve energy use in all new builds by 2030.

Homes – both new and existing – account for 20% of emissions. New homes being built now and in the next 5-10 years will still exist in 2050 and therefore we must ensure that the energy efficiency standards we set for them put us on track to meet the 2050 target.

As part of the journey to 2050 Future Homes Standard will be introduced in 2025. The standard is under consultation until the 10th of January 2020.

Under this standard, an average home built to it will have 75-80% less carbon emissions than one built to current energy efficiency requirements (Approved Document L 2013). This is expected to be achieved through very high fabric standards and a low carbon heating system.

Healthy Homes and Buildings

healthyhomesbuildings.org.uk

The health, comfort and wellbeing of residents should be at the heart of good building and infrastructure planning.

'We must ensure that the homes and buildings we work and live in positively contribute to our physical and mental health instead of diminishing it.'

Building design and the renovation of the current housing stock should be holistic; considering elements such as energy efficiency, indoor air quality, ventilation, lighting and acoustics, etc.

Jim Shannon MP - Chairman of the All-Party Parliamentary Group for Healthy Homes and Buildings

Indoor Environmental Quality
Emphasis on Energy Conservation
and Higher Expectations

Poor Air Quality

Overheating

Low comfort

Unnecessary Air Conditioning

Medical Conditions

Distress
Incapacity
Death

Public Health Problem

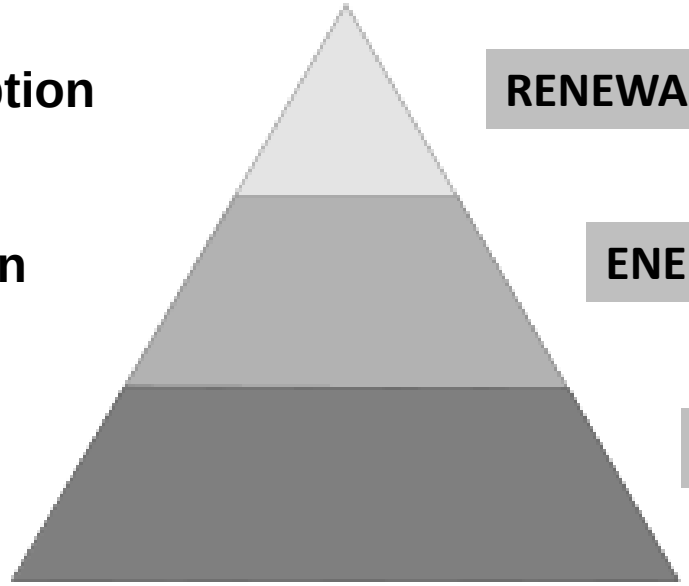
Cost to society

The cheapest energy is the one that is not consumed

OFFSET energy consumption

SAVE energy consumption

AVOID energy demand



RENEWABLE ENERGY

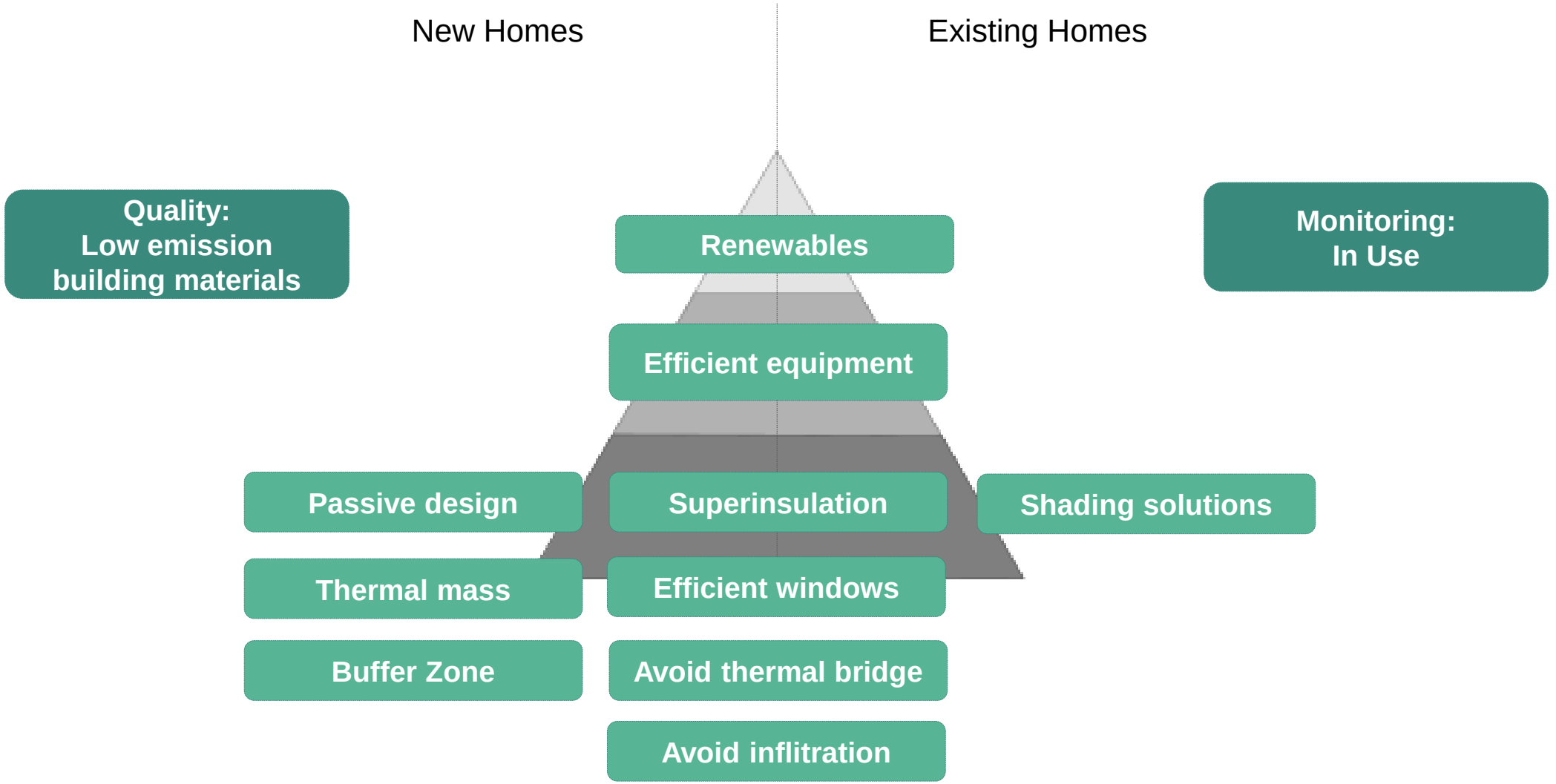
ENERGY EFFICIENT EQUIPMENT

EFFICIENT BUILDING DESIGN

HOLISTIC APPROACH

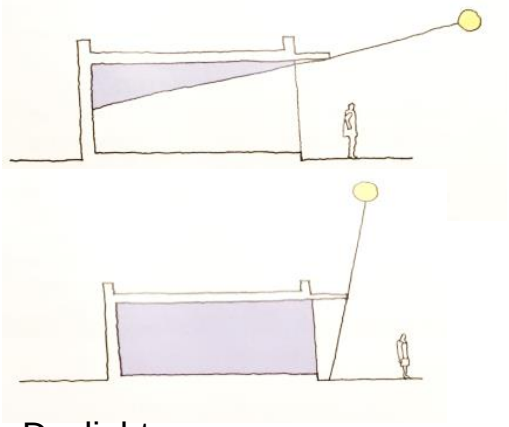
Form + function + technology

Steps to improve the energy performance and provide healthy indoor environments

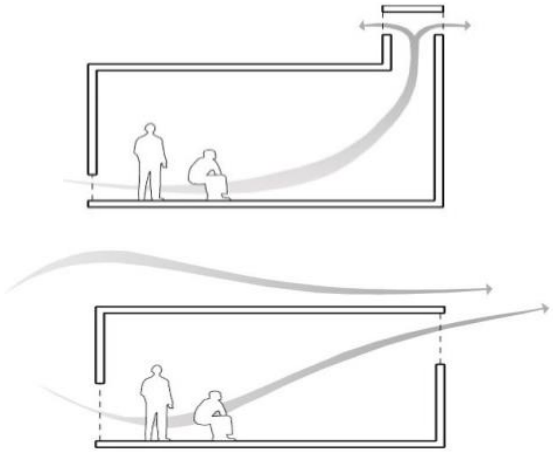


Passive design

Harness the power of the low winter sun and prevent overheating in summer.



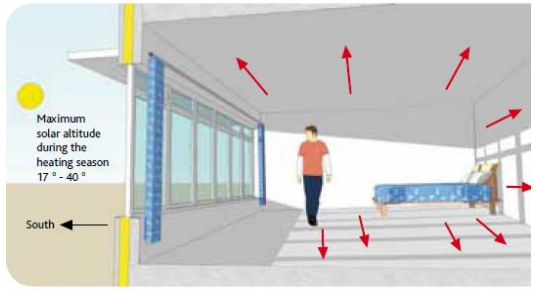
Daylight
Natural ventilation

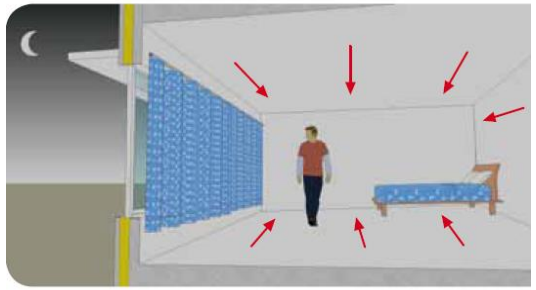


Thermal mass

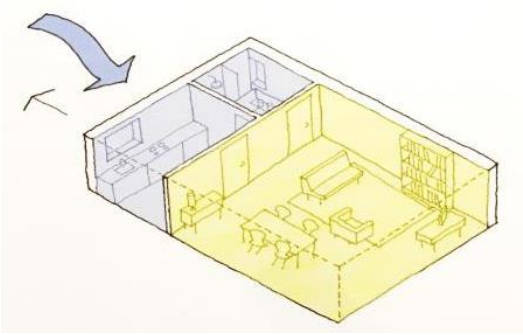
Ability of a material to absorb and store heat energy.

Heavyweight materials (brick, stone and concrete) have a high storage capacity. They absorb heat during the day, and release it at night.





Buffer Zone

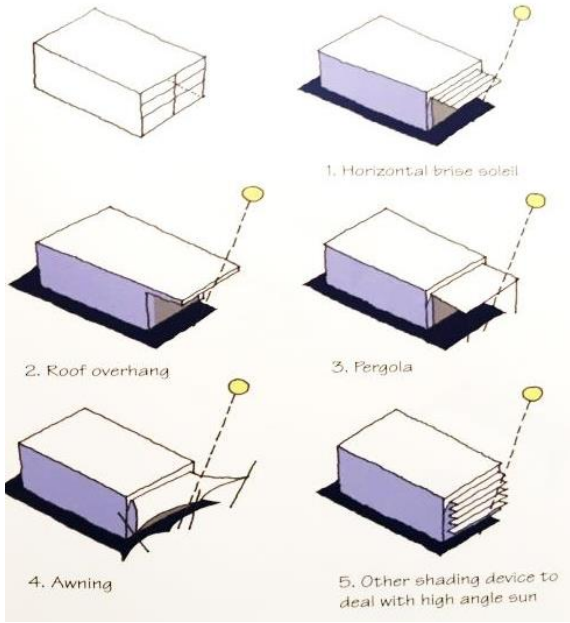


Cold rooms to North
Warm rooms to South

North:
Rooms used occasionally or that generate their own heat

South:
Living rooms

Shading solutions



Superinsulation

Limiting fabric parameters (Part L)

Wall: 0.3 W/(m²K)
Roof: 0.2 W/(m²K)
Floor: 0.25 W/(m²K)

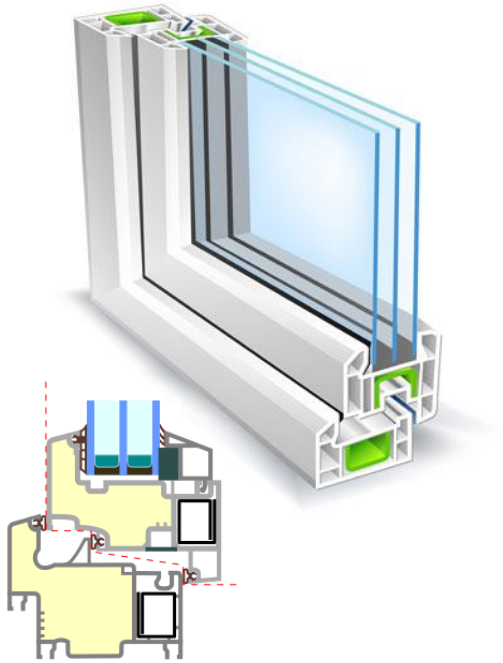
Passivhaus: 0.15 W/(m²K)

Efficient windows

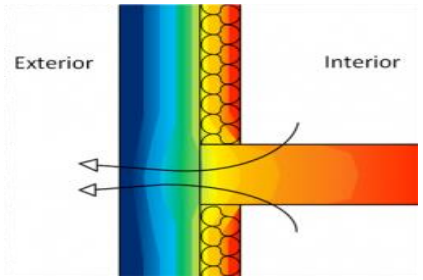
Limiting fabric parameters (Part L)

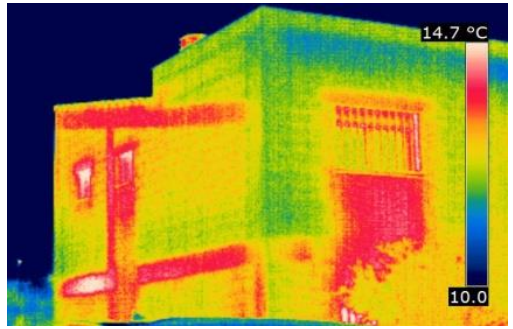
Windows: 2.00 W/(m²K)

Passivhaus: 0.80 W/(m²K)



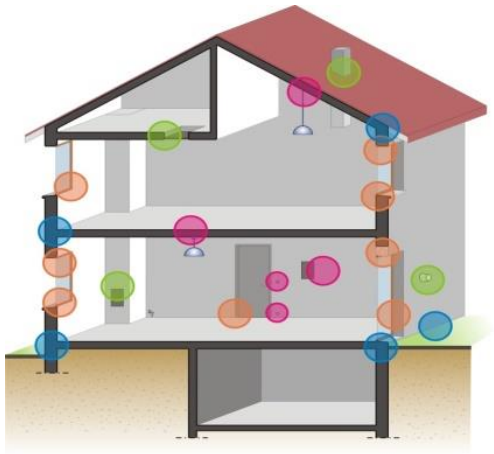
Avoid thermal bridge



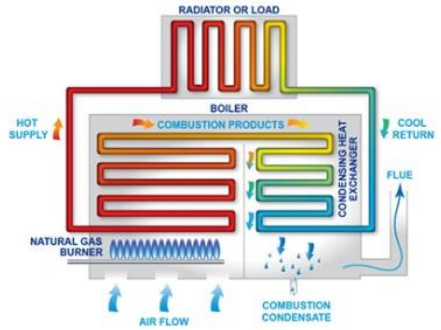


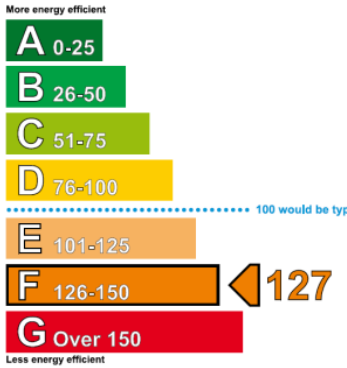
Avoid inflitration

Uncontrolled ventilation

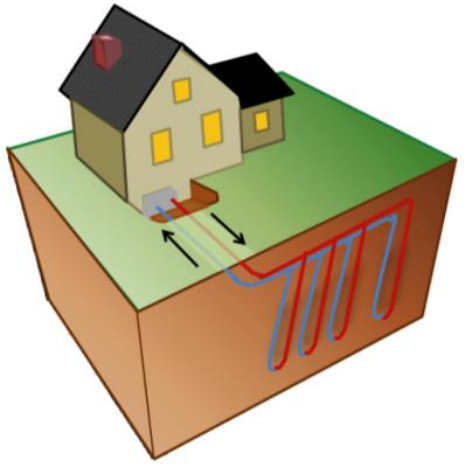


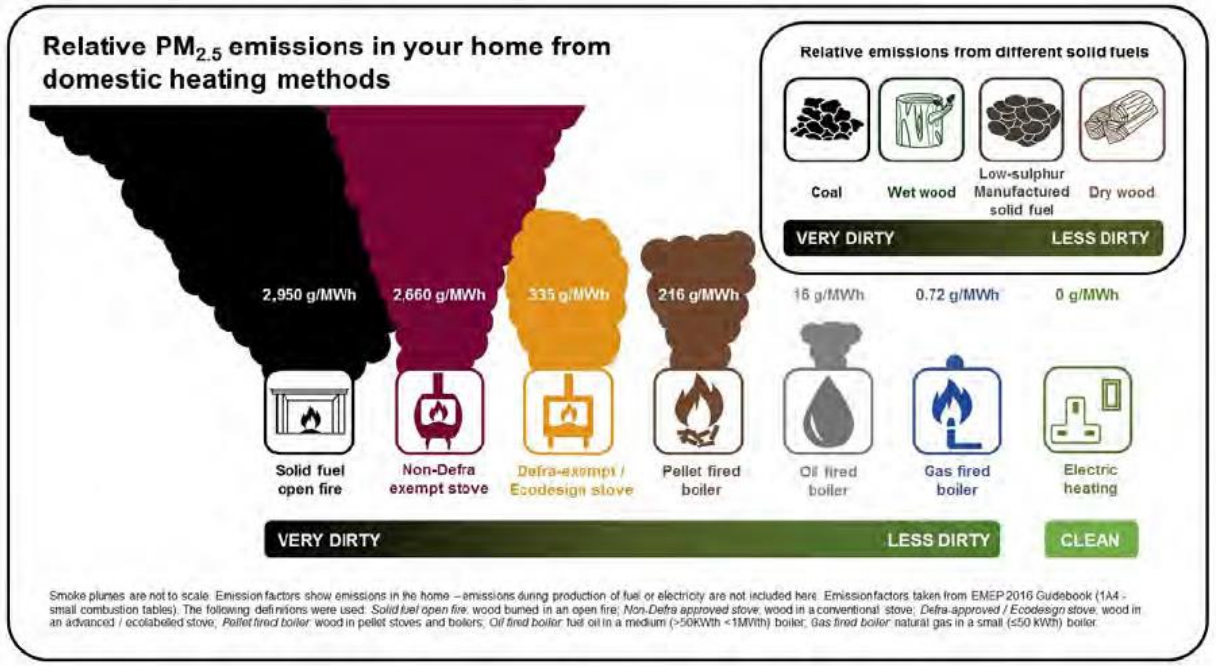
Efficient equipment





Renewables

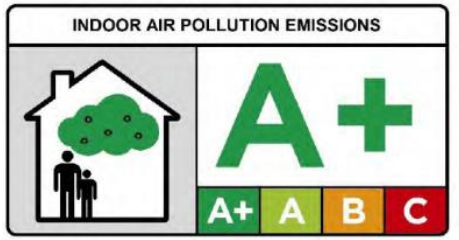


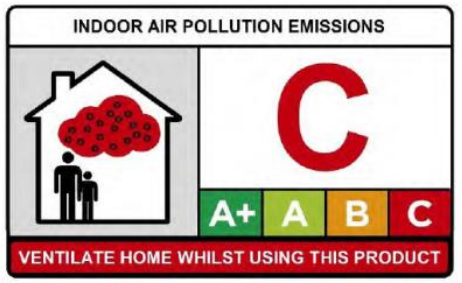


Low emission building materials

Emissions from building materials, cooking fumes and cleaning products exposes people to VOCs.

Domestic burning (Clean Air Strategy 2019)
"Air quality benefits can be realised through a new efficient appliance as compared to an old stove or open fire".

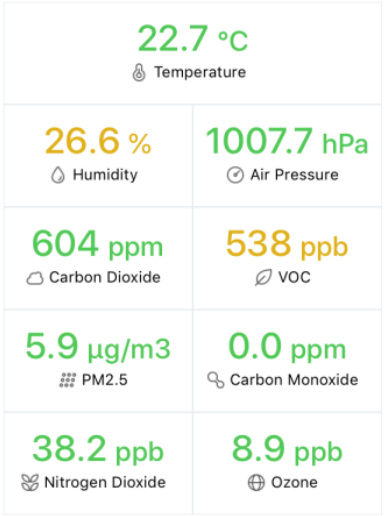


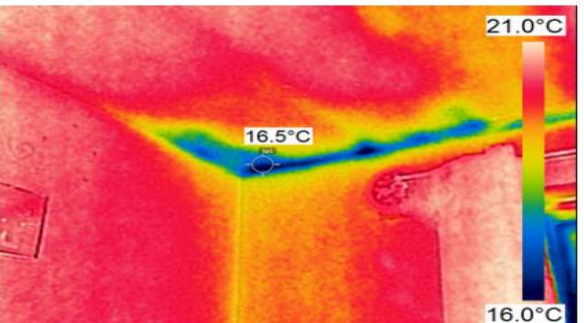


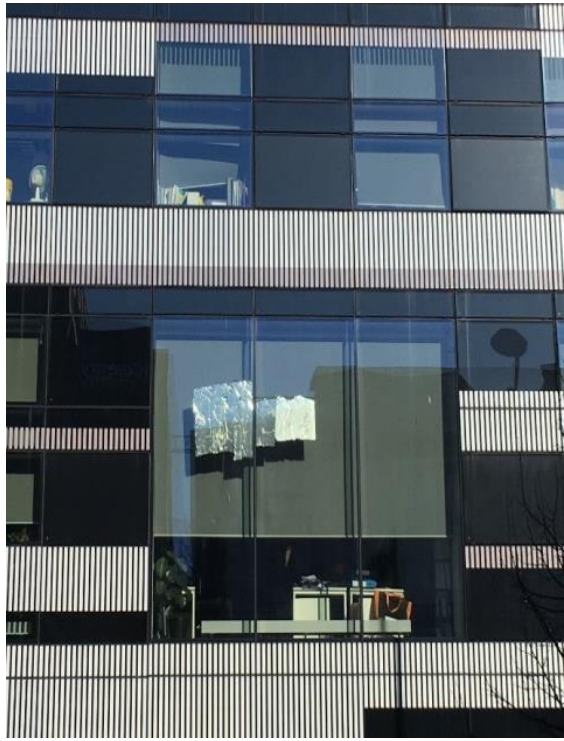
Monitoring

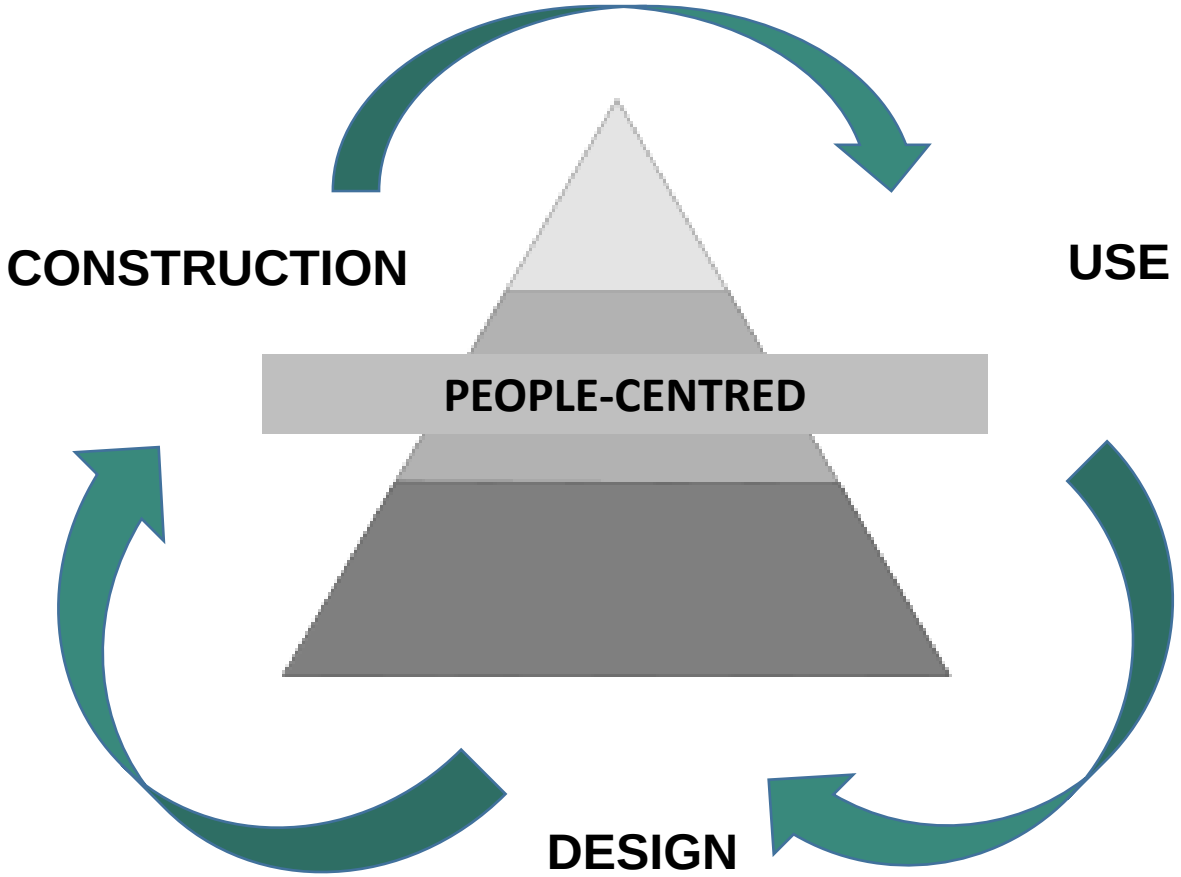
Environmental and pollutant parameters:

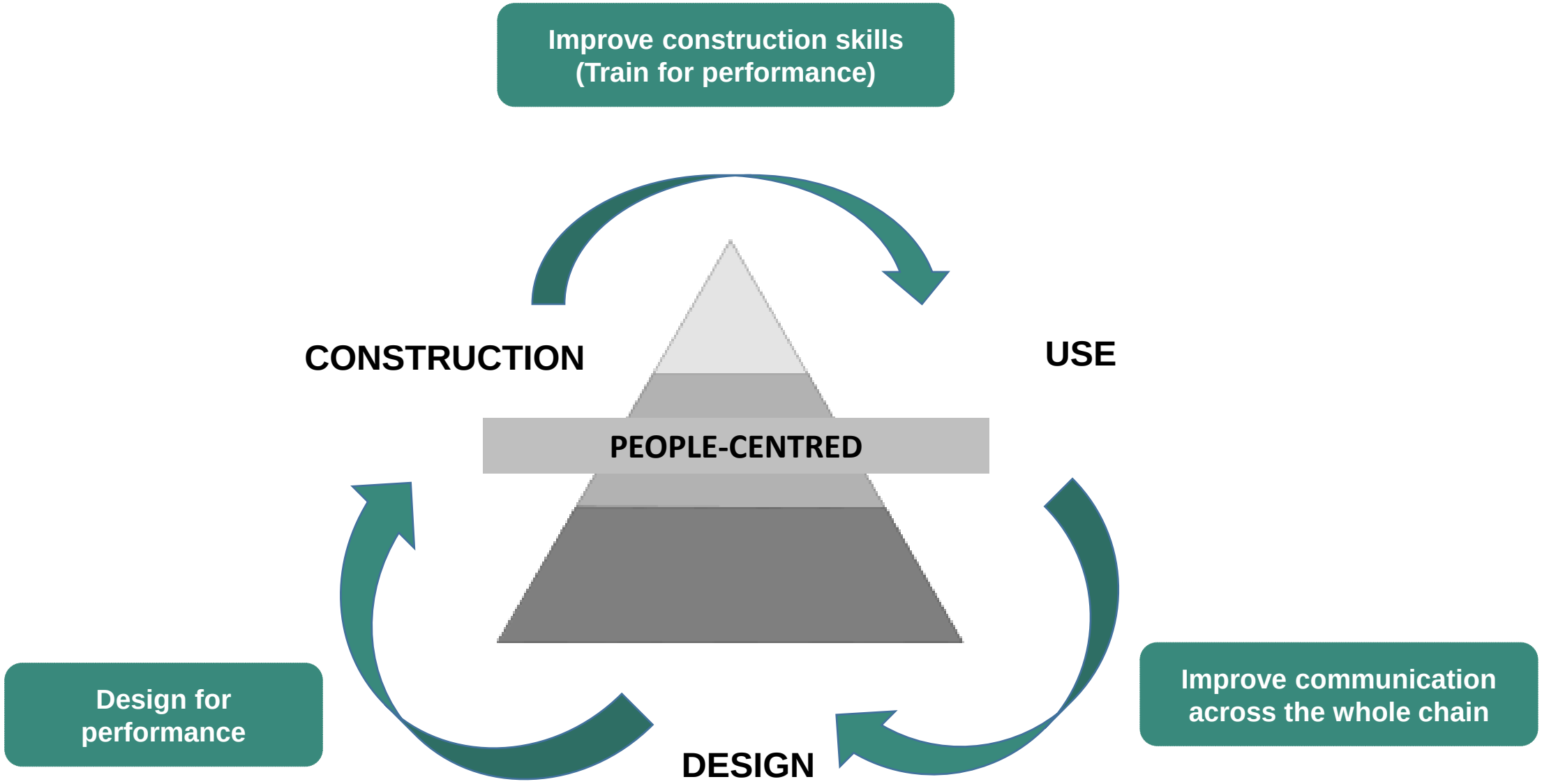
- Temperature
- Humidity
- Carbon Dioxide CO2
- Carbon Monoxide CO
- Ozone O3
- Nitrogen Dioxide NO2
- Air Pressure mBar
- Particulate Matter PM2.5
- Volatile Organic Compounds (VOCs)




21.0°C
16.5°C
16.0°C




CONSTRUCTION
USE
PEOPLE-CENTRED
DESIGN


Improve construction skills
(Train for performance)
CONSTRUCTION
USE
PEOPLE-CENTRED
Design for
performance
DESIGN
Improve communication
across the whole chain

BIRMINGHAM CITY University

Indoor air quality improvement and overheating prevention in new build residential developments in the UK

The aim of the project is to propose cost effective scalable construction solutions and strategies that take account of human behaviours with the potential to improve the indoor environmental quality (IEQ) and reduce overheating in new homes. The research will seek to analyse the factors that affect users comfort and wellbeing including indoor pollution and solar gain; and the barriers to potential remedies. The research will involve working with major home builder partners to conduct trials to monitor and record indoor air quality in unoccupied and occupied dwellings across the UK, gathering user's feedback on thermal comfort and wellbeing and evaluating the data obtained to propose new methods than can cost effectively improve the indoor air quality and comfort in new developments.

Cost Effective Scalable Construction Solutions

- 1 PhD funded internally
- 1 PhD funded by cross industry alliance
- Already have 4 house builders on board as funders plus housing association
- Importance of cross industry solutions

- **Need one more and some smaller ones**
- Please contact myself: monica.mateogarcia@bcu.ac.uk

Solution focus

Complex
Trans-disciplinary
Multi-perspective
Dynamic

Problem Space

Materials
Form, room adjacency
Fenestration
Orientation, location
Services and Facilities

Build quality
External context
Regulations

Solution Space

Currently single issues

NEED to
Manage the Complexity
And system of production and use

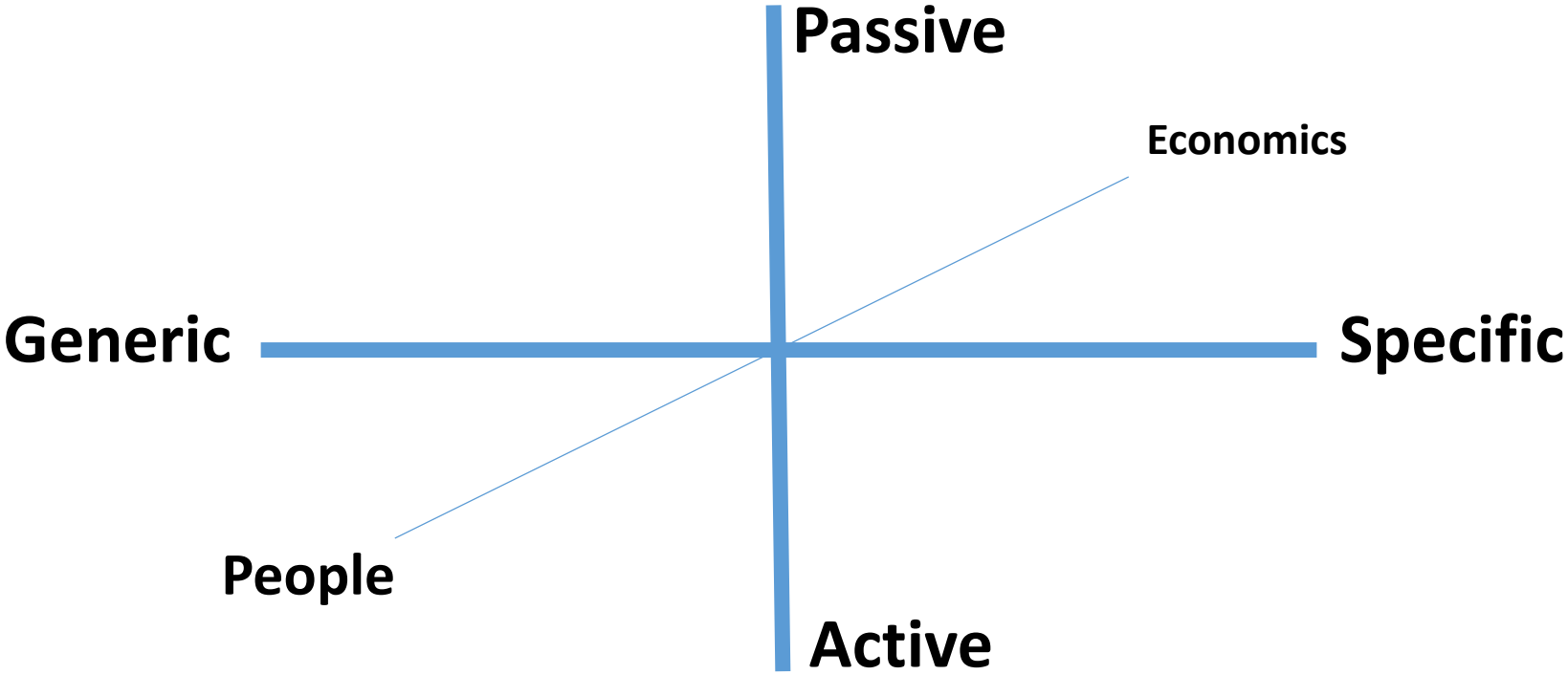
Opportunities for adaptation

A primary conclusion is that the goal of shifting into a lower carbon society has created a new context for comfort, from its conventional emphasis as automated, uniform and predictable, to a broader notion that takes into consideration dynamic, integrated, and participatory aspects.

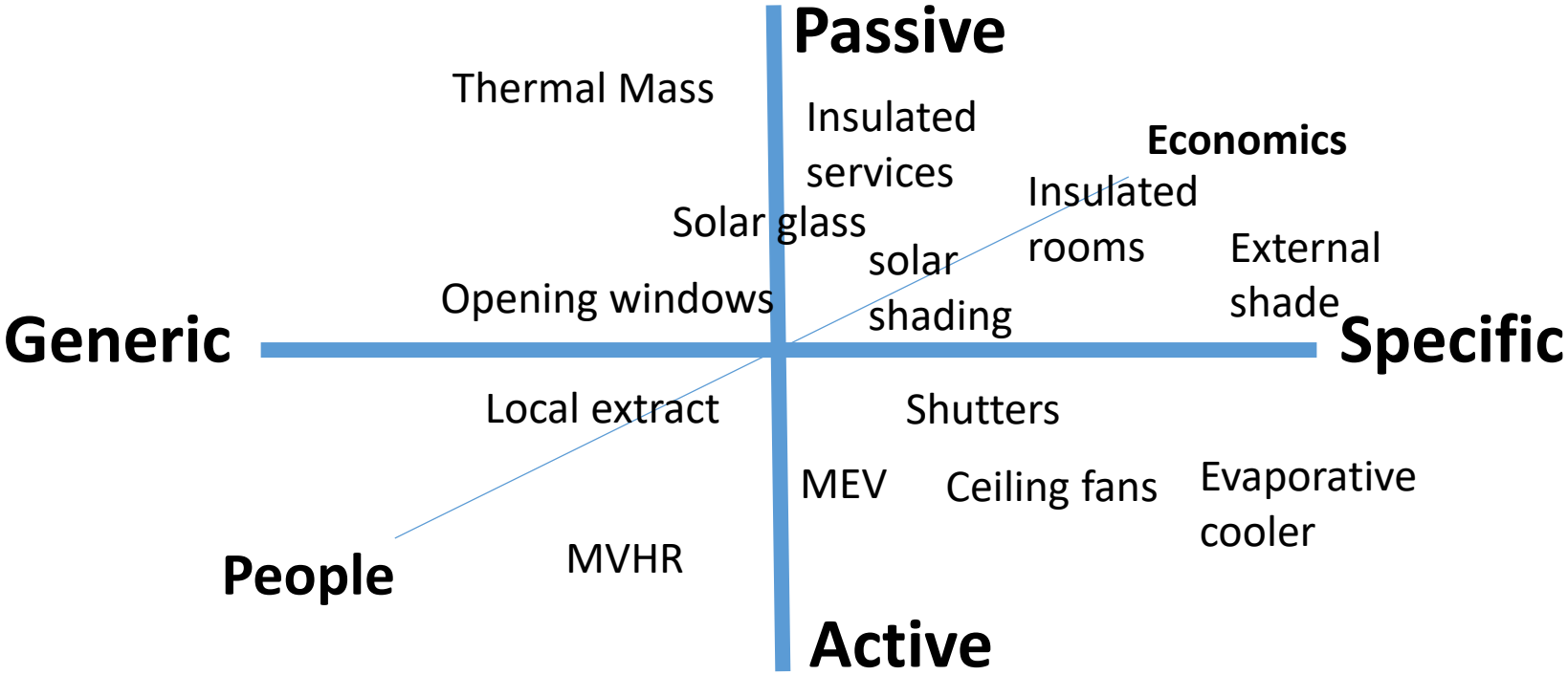
Raymond J. Cole , John Robinson , Zosia Brown & Meg O'shea (2008)
Re-contextualizing the notion of comfort, Building Research & Information, 36:4, 323-336

Reconceiving comfort?
Or go for air conditioning

Solution spaces



Solution spaces



How do the parts of the solution space work together with the occupants to fulfil their needs

Conclusion

- Overheating and poor Indoor Air Quality surfacing as big issues
    - Unintentional consequences of energy saving
- Act now to mitigate risk; climate change
- Issues Complex and not understood
- People see new houses as healthy homes
- BCU project on Solutions

MANY THANKS FOR YOUR ATTENTION

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