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CIBSE Energy Performance Group
Building Energy Solutions
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THE PASSIVHAUS CONCEPT

We assume you know all this!
THE MOTION

This house believes that implementing the Passivhaus standard is the most suitable way of delivering low carbon buildings in UK volume housing.
VOTE
50/50
FOR

Nick Grant
Elemental Solutions
Passivhaus Trust
Passivhaus;
the best way we know to deliver low carbon buildings

Nick Grant
"The building process for the first Passivhaus prototype started in 1990. At the time we knew about other similar buildings — buildings made by William Schurcliff and Harold Orr — and we relied on these ideas"

Dr. Wolfgang Feist: —
“I read that the construction industry had experimented with adding insulation to new buildings and that energy consumption had failed to reduce. This offended me – it was counter to the basic laws of physics. . . . . So I made it my mission to find out what (they were doing wrong) and to establish what was needed to do it right.”

Professor Wolfgang Feist Founder Passivhaus Institut, Germany
Natural progression

• 1970s Solar v Superinsulation debate

• 1980s low e glass, blower doors and commercial HRV.

• 1990s, Passivhaus refinements, PHPP, understanding of net IHGs, better windows.

• 2000s, Passivhaus proven but people still repeating 1970s mistakes, why??
Why?
Simple metrics

• Annual heating requirement $\leq 15$ KWh/m$^2$.a

(or Heating load $\leq 10$ W/m$^2$)

• Total primary energy consumption $\leq 120$ KWh/m$^2$/a

• Airtightness better than 0.6 ach

• Strict comfort criteria: summer overheating, radiant asymmetry, stratification, drafts, noise etc.
Code & BREEAM seem like a good idea:

- Check lists good – tick box design bad
- Zero Carbon UK good – ZC buildings, 1970s bad idea
- % improvement sounds good – but statistical anomalies
- Storm drainage good – SUR 1, irrational madness
- Water calculator sounds good – fundamentally flawed
- Green Materials nice – Green Book flawed
- Flood risk assessment good – for buildings on hills mad.
Calculated vs. measured water use for 'known' sanitaryware specifications

Figure 3: Calculated Vs measured water use for dwellings with 'known' sanitaryware specifications

This contains confidential and commercially sensitive information, which shall not be disclosed to third parties.
Lowest lifecycle energy use

RIGHT, WE'VE STIRRED THE METHANE DIGESTER TANK, DESCALED THE SOLAR COLLECTORS, SERVICED THE WIND GENERATOR, RENEWED THE BATTERIES, MILKED THE COW, FED THE PIG, COLLECTED THE EGGS, CLEANED OUT THE FISH POND, DUG THE VEGETABLES, WEEDED THE PLANTS... I'M OFF TO WORK THEN!
PHPP Energy balance

- Losses:
  - Ventilation
  - Infiltration
  - Thermal Bridges
  - Doors
  - Wall
  - Floor
  - Roof
  - Windows

- Gains:
  - Heating, 15
  - Internal
  - Solar
SAP energy balance suggests zero heating.

Over estimates gains 6-12 W/m² c.f 2.1 W/m².

Under estimates losses.

Slide courtesy of Warm/AECB Carbonlite Passivhaus Training.
A pragmatic solution: simplified models, precise data
"All models are wrong, some are useful"

George Box via Malcolm Bell.

BIBO - garbage in garbage out . . .
Proof of the pudding
Life is to short for:

• Reinventing the wheel and making it square
• Models that are more complex than buildings
• Wasting time and money on eco-bling
• Perpetual pilot projects with piss poor performance.
CONSULTING

If you’re not a part of the solution, there’s good money to be made in prolonging the problem.
AGAINST

Henrietta Lynch
University College London
This house believes that implementing the Passivhaus standard is the most suitable way of delivering low carbon buildings in UK volume housing

Passivhaus – Why not?
‘Passivhaus is an Austrian product that requires mechanical ventilation systems in houses, and they cause sick building syndrome - why not just open the windows’

‘the British are too pragmatically intelligent to be conned by a marketing ply like that - there are some good aspects of it but you have to pay the mech vent penalty to join the club – bonkers’

‘The principle lesson perhaps being that, whilst it is all too easy for me to carp on about what is wrong with the Passivhaus standard, or why it is not quite the dog’s bollocks (try translating that!), they have built loads of them.’
'Passivhaus is an Austrian product that requires mechanical ventilation systems in houses, and they cause sick building syndrome - why not just open the windows'

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‘The principle lesson perhaps is that it is too easy to carp on about what is wrong with the Passivhaus standard - it is not quite the dog’s bollocks (try translating that!), they have built loads of them.’
• The construction industry doesn’t know what a Passivhaus is?

• What it means to build one

• Architects, Engineers and Contractors not trained to design Passivhaus

• We lack supply chain component

• Site skills

• QA

• R+D

• Existing muddled legislation – Part L ++

• Procurement and planning prohibitive

• Large house-builders don’t want to build them! – too much change!!
c. £1m CSH 6
Lots of renewables but lower fabric spec

Japan – Key Architects

c. £150,000 Passivhaus
First Passivhaus in Japan
Political Will *(who’s he?)*

But what about the infrastructure?

Where is the plan + the incentives?

\[
\text{£££} = \text{CO}_2
\]
Passivhaus ja-ein...😊
This house believes that implementing the Passivhaus standard is the most suitable way of delivering low carbon buildings in UK volume housing.
PASSIVHAUS SUITS . . . OCCUPANTS

• lowest possible heating costs

£130/yr gas bill
PASSIVHAUS SUITS . . . OCCUPANTS

- lowest possible heating costs

Austrian Passivhaus office . . . has no heating system!
• lowest possible heating costs
• focussed on thermal comfort

“A Passivhaus is a building for which thermal comfort can be achieved solely by post-heating or post-cooling of the fresh air volume required to achieve sufficient indoor air quality conditions . . . . . ”
Radiant surface temperatures

• consistently warm surfaces (less than 4° variance)

• means external walls and window surfaces should never be colder than 16-17 °C!

Air temperature stratification

• even room temperatures (less than 2° variance between head and ankles)

• requires warm floors and no downdraughts!
Air speed and turbulence

- draught-free rooms (air movement less than 0.08 m/s)
- means air tight construction (hence 0.6 n50)!

Moisture control

- relative humidity maintained between 30 - 60%

Research suggests up to 2°C higher temperatures are required for comfort for majority if these conditions are not met . . .
PASSIVHAUS SUITS . . . OCCUPANTS

- lowest possible fuel costs
- focused on thermal comfort
- lower noise pollution
- avoidance of summer overheating
- highest indoor air quality
  - $30m^3/\text{hr/person}$ balanced ventilation
  - filtered fresh air
WHY HEAT RECOVERY VENTILATION?

Exhaled 3742 times, boiled 1 litre of water, watered flowers, sneezed 3 times, washed 2 pairs of socks, cried for 1.6 minutes from peeling onions... hmm... by my calculation the window should be opened by 2.5cm for 4.3 minutes to give the right cross flow ventilation.

Mythbuster: You can open the windows in a Passivhaus!
WHY HEAT RECOVERY VENTILATION?

£130/yr gas bill

'natural ventilation' . . . the healthy option?
PASSIVHAUS SUITS . . . DESIGNERS

• clear and simple targets to achieve
• PHPP allows science back into architecture
• myriad architectural possibilities within responsible design constraints
• Passivhaus can be a stepping stone – design to AECB Silver first?
PHPP IS NOT A SPREADSHEET . . .

. . . it’s a design tool

• Designer inputs . . .
  - treated floor areas
  - assembly U-values
  - window dims & specifications
  - thermal envelope dims
  - ventilation designs
  - shading parameters
  - uses regional climate data
WHAT IS A PASSIVHAUS DESIGN?

Not a kit of parts . . .
WHAT IS A PASSIVHAUS DESIGN?

Nor this . . .
But this is . . .
And so are these . . .
And all of these . . .
Passivhaus provides Quality Assurance . . .

- internationally recognised building standard (consumer protected)
- thermal conductivities & components are to EN standards
- tested and commissioned to PHI requirements
- evidence-based certification (photographs and contractual records)
- independently verified by an approved Certifier
PASSIVHAUS AND QUALITY
CfSH AND QUALITY?
Energy & Climate Change secretary, Chris Huhne

“Passivhaus is a fundamental re-imagining of our relationship with the outdoors . . . I would like to see every new home in the UK reach the Passivhaus standard.”
AGAINST

Richard Partington
Richard Partington Architects
passivhaus
15 kWh / sq m / year
<table>
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Bioregional: One Brighton
Feilden Clegg Bradley
VOTE
70/30 FOR
You’re all members now!