Reducing Energy Use in Housing: Insulation and Retrofit Problems in Wales and the UK
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Why is it important to understand insulation materials?
How do you choose insulation materials – what criteria?
Aesthetics, Cost, Construction, Environment???
• There is general agreement that existing and new build houses should achieve higher standards of energy efficiency.

• **Is all insulation the same?** There has been an assumption that all insulation materials are much the same and that, providing that thermal performance figures are satisfactory, any material can be used in any form of construction.

• **Insulation the elephant in the room.** Recent reports on climate action, zero energy and retrofitting amazingly barely mention insulation

• **Performance Gap.** Evidence shows, however, that inappropriate insulation and installation measures can lead to many unintended consequences and a gap between predicted and actual performance.

• **Retrofit disasters?** Far from reducing fuel poverty and carbon emissions, mould and damp can occur, aggravating health problems, which has been confirmed by academic research.

• **Fire Risks.** Flammable insulation materials are still widely used

• **Health Problems.** Sealing up increasingly airtight buildings with non-breathable, flammable and even hazardous synthetic materials can cause damage to building fabric and occupant health. The importance of indoor air quality and ventilation is often overlooked

• **Negative environmental impacts of insulation?** Furthermore the embodied energy and pollution involved in the production of many commonly produced insulation materials can be bad for the environment

• **Our book on insulation materials** tries to help people understand the differences between different kinds of insulation and indicates natural environmentally friendly alternatives
Insulation is central to keeping houses warm and to reducing CO2 emissions. But how much thought is given to which insulation to use? Insulation is often ignored in climate and energy policies.
Here are ten recent reports on housing, energy zero carbon and retrofit. In over 600 pages insulation is only mentioned 50 times and then only in a very vague and general way.

- **The Green Construction Board**
  - Insulation only 8 refs.

- **Net Zero Litmus Test**
  - 2019, 48 pages.
  - Only mentions insulation 3 times.

- **Zero Carbon Manchester**
  - 2017, 26 pages.
  - Insulation mentioned only once.

- **Zero Carbon Hub. 2014**
  - 44 pages.
  - Insulation only mentioned twice.

- **Energy Efficiency Infrastructure Group**
  - 2017, 88 pages.
  - Only mentions insulation and then only in passing 9 times.

- **Retrofit Detox**
  - 2019, 32 pages.
  - Insulation only mentioned 10 times but only in passing.

- **Green New Deal. 2018**
  - Only 6 references to insulation.

- **Retrofitting the Built Environment**
  - Only 5 pages refer to insulation materials.

- **Scoping Up Retrofit 2050**
  - 2019, 22 pages.
  - Insulation only mentioned 10 times but only in passing.

- **Affordable Warmth. Clean Growth**
  - 2014, 3 pages.
  - Only mentions insulation twice.

- **The Buildings Mission 2030**
  - 2018.
  - Only 6 references to insulation.

- **Playing Our Full Part**
  - With 8 insulation refs but mostly repetition.
This is the worst (2019) UK GBC ..insulation not mentioned at all

House of Commons
Business, Energy and Industrial Strategy Committee

Energy efficiency: building towards net zero
Twenty-First Report of Session 2017–19

Report, together with formal minutes relating to the report

Ordered by the House of Commons to be printed 9 July 2019

Each Home Counts

HC 1738
Published on 12 July 2019
by authority of the House of Commons
How can you discuss retrofit and decarbonisation without discussing how to insulate homes safely and effectively?
Insulation and retrofit problems

49. Over the years, householders have experienced energy saving interventions, such as damp proofing and solid wall insulation, which have not delivered the benefits that were promised. This has eroded householders' confidence in such activities. Mark Harris from the Homebuilders' Federation gave the Committee an example of the historical problems:

“I was working at Bridgend council delivering Arbed schemes, and we were merrily cladding buildings and filling cavities full of insulation. Five years later, we've got companies setting up now to take cladding off and to take insulation out because we've realised that, actually, either it wasn't the right thing to do or the skill set that delivered it wasn't properly skilled and it was done in a rush.”

Standards of installation

80. If the housing stock is to be decarbonised, almost every home will need some energy efficiency improvements. Yet scams and poor standards of workmanship have blighted confidence in energy efficiency installations. Issues such as damp from poor installations, hard sell approaches, and scams related to the Green Deal have “exacerbated” the problem. If there is limited trust in energy efficiency schemes, there will be limited progress in housing decarbonisation and fuel poverty alleviation.
RETROFIT PROBLEMS

Green Deal nightmares: 'British Gas botched our insulation – then offered £50 Nando’s meal'

Non-existent cashback and dodgy works have left these householders out of pocket. We share their stories below

Heidi and Jonathan Mcnally-Henry say Green Deal works carried out on their home have left it barely habitable

The great cavity wall calamity: 1.5 million homes are blighted by damp after cowboy builders cash in on a Government insulation drive

- Millions of homeowners persuaded to sign up to scheme with promise of cheaper bills by call-centre staff and salesman trying to meet targets
- The Government scheme was meant to make homes energy efficient
- But experts claim homes were not suitable for cavity wall insulation
- Victims left with houses riddled with damp and mould from botched fittings

By BEN ELLERY FOR THE MAIL ON SUNDAY

BBC Radio 4 – Cavity Wall Insulation

BBC Radio 4 have reported the issues many people are suffering from caused by Cavity Wall Insulation. The report illustrates what can go wrong when Cavity wall insulation is installed incorrectly.

Listen to the recording below.
One of the best documented disasters Fishwick in Preston

FISHWICK Community Energy Savings Programme (CESP)

Disastrous Preston retrofit scheme remains unresolved
Deterioration Since October 2015

Another picture of Porch Interior – showing water ingress. Taken Mar. 2016

Now on to the exterior – below taken 14th Feb. 2016, note poor finish to silicone and messy fit to the topcoat which is spread over UPVC trim. Hardly done with great care.

Carmarthenshire
Mould and damp: Retrofit disasters case studies. Many are in Wales.
Colin King BRE. Has done a lot of excellent work to draw attention to unintended consequences of retrofit. I have borrowed these from one of his presentations.
Poor installation of insulation is common in building construction leading to massive performance gaps. Actual performance has been shown to be as much as 70% less than predicted SAP.
Here are examples of how plastic foam insulation can shrink though often this can be unseen.
FIRE AND FLAMMABILITY

We’re two years on from Grenfell, so why do these fires keep happening?

Luke Barratt

It’s not just unsuitable cladding: a host of other safety issues are not being addressed by authorities and building owners

Residents ‘safe’ after Cardiff high-rise flats fire

Cardiff flats fire safety funding offer ‘insulting’

The catalogue of failures that make this huge Cardiff apartment complex a ‘major concern’ fire risk

Bolton Cube student block fire: Everything we know so far
**Worcester Park fire: 'It's gone' - fire rips through block of flats**

A four-storey residential block has been destroyed after a fire ripped through the building in the early hours of Monday.

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**FIRE WARNING** Persimmon and Bellway new-build homes 'are fire risk', BBC Watchdog investigation finds

House builders are required to make sure the homes they sell meet fire safety standards.

By Alice Graham, Digital Consumer Reporter
1 May 2019 1:00am Updated 1 May 2019 1:37

HUNDREDS of new homes constructed by Persimmon and Bellway Homes have been built with "potentially dangerous fire safety issues", an investigation by BBC Watchdog Live has found.

The Persimmon properties were sold with missing or incorrectly installed fire barriers, designed to prevent the spread of fire, according to a new episode airing on BBC One tonight.

'New-build homes not fire safe', BBC investigation finds

Houses developed by Persimmon Homes and Bellway Homes have potentially dangerous fire safety issues, BBC Watchdog Live has found.
Bad indoor air quality can be another consequence of airtight insulated houses.

**Health Effects of Modern Airtight Construction**

HEMAC Multidisciplinary Network

**Ventilation and Indoor Air Quality in New Homes**

**New build homes face emerging ventilation crisis**

Despite increasing standards of insulation and airtightness, housing developers face few requirements to provide better ventilation and indoor air quality for new home buyers — beyond knocking extra holes in walls. But as reports of condensation and mould affecting new housing developments continue to surface in both the UK and Ireland, and research indicates many new homes may have poor indoor air quality, are developers finally waking up to the need for properly engineered ventilation systems?
Ian Mawditt has shown that pollutants from plastic foam *external insulation* exceeded safe limits inside his house when the MVHR system is turned off.

While it is frequently claimed that improved energy efficiency leads to better health, the evidence of this is questionable whereas studies have shown increased health problems.
Many insulation materials are made from hazardous chemicals.

Chapter 1: Introduction
Chapter 2: Volatile Organic Compound Emissions
Chapter 3: Emissions from materials – Why do we need to use hazardous chemicals?
Chapter 4: Cancer, Carcinogens and Building Materials
Chapter 5: Other Hazards and Radiation
Chapter 6: Hazardous Materials to be avoided and why
Chapter 7: Mould, Damp, Fuel Poverty and Breathability
Chapter 8: Ventilation and a critique of Passiv Haus
Chapter 9: Dealing with problems in existing buildings
Chapter 10: Healthy Building Theories
Chapter 11: How to building Healthier Buildings
Chapter 12: Policy Issues for Healthy Buildings – Appendix A: Carcinogenic Chemicals
Appendix B: Useful Organisations
Hazardous emissions from PUR and PIR insulations: Isocyanates, polyols, flame retardants, blowing agents and catalysts, by products

Carcinogens and products causing respiratory problems

Research demonstrates that in isolation each group could impact human health, with some carrying higher risks compared to others [13,14]. During the production, and lifecycle, of PU products various organic compounds can be released from the foams into the indoor environment. Scarce data is available covering these emissions and to address the knowledge gap, a compilation of small studies was published by ASTM to provide further insight [15], followed by the ASTM D8142-17 standard for measuring SPF chemical emissions. This collection of reports provides data in relation to SPF emissions and their implications on indoor environmental quality (IEQ). Polyurethane products are found abundantly in modern indoor environments [8], however their cumulative volatile and semi-volatile organic (VOCs, SVOCs) long-term emissions and implications on human health are still largely unknown...
"Isocyanates are highly reactive chemicals
That can cause skin, eye and lung irritation,
asthma and chemical sensitization"
US Environmental Protection Agency
Polystyrene insulation creates a massive waste problem.
Shortage of hazardous isocyanates
Has caused problems for the companies making foam insulation
Pre-mixed Polyols with contaminants, CFS etc?
CFC emissions have been tracked to China

Illegal CFC-11 production: response to China embassy letter
17th August, 2018

China has identified illegal use and production of CFC-11 in a series of actions undertaken in response to our report Blowing it, which recently revealed that companies making polyurethane foams in China continued to use the banned ozone depleting substance.

In a letter to the Guardian, which reported on our findings, a spokesperson from the Chinese embassy stated that an investigation of the 19 PU foam enterprises had been undertaken. Although no CFC use was found in 12 enterprises, CFC-11 was detected in one enterprise and six remain under further investigation. In addition, authorities uncovered two enterprises producing CFC-11 and CFC-12. According to the letter, “The seized CFCs and raw materials have been confiscated and sealed up, and the local police have filed charges against the enterprises and are hunting down the suspects in the cases.”
Types of thermal insulation materials
2.1. Mineral wool insulation
2.2. Glass wool insulation
2.3. Hemp fibre insulation
2.4. Hemp-lime insulation
2.5. Flax fibre insulation
2.6. Sheep wool insulation
2.7. Wood fibre insulation
2.8. Aerogel insulation
2.9. Polyisocyanurate (PIR) and polyurethane (PUR) insulation
2.10. Extended polystyrene (EPS) insulation
2.11. Extruded polystyrene (XPS) insulation
2.12. Polyethylene (PE) insulation
2.13. Phenolic insulation boards
2.14. Urea formaldehyde foam insulation (UFFI)
2.15. Spray foam insulation
2.16. Structural insulated panels (SIPs)
2.17. Insulating clay bricks
2.18. Cotton waste insulation
2.19. Cellulose insulation
2.20. Vacuum insulation panels (VIPs)
2.21. Injected fibres for cavities
2.22. Magic wallpaper and thermal paint
2.23. Clay boards
2.24. Injected expanded polystyrene
2.25. Expanded cork board insulation
2.26. Straw bale insulation
2.27. Cob, rammed earth and adobe
2.28. Aircrete – aerated concrete and autoclaved aerated concrete (AAC)
2.29. Mushroom insulation
Wood fibre.

2 houses we designed in North Wales.
Hempcrete has good insulation and thermal mass.
Thank you

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