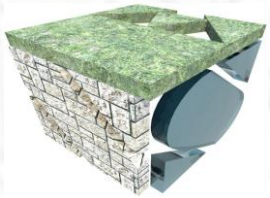
MODULE 3

HOUSE ENVELOPE 1 – ROOF, FLOORS – INCORPORATING GREEN ROOFS, WALLS, DETAILING, AND NEES BEST PRACTICES.

Training for Sustainable Building

Vocational Training Modules for the Natural Energy Efficiency and Sustainability (NEES) Project



University of ULSTER

Umeå University

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

GCU
Glasgow Caledonian University

ARCTIC TECHNOLOGY CENTRE

THE NEES PARTNERS

SOUTH KERRY DEVELOPMENT PARTNERSHIP LTD.

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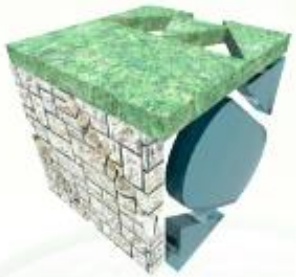

Where can I get more information on NEES?

If you wish to find out more about the NEES Project, please check our comprehensive Web Site, contact your NEES regional rerpesentative or the NEES Project Manager at the address below.

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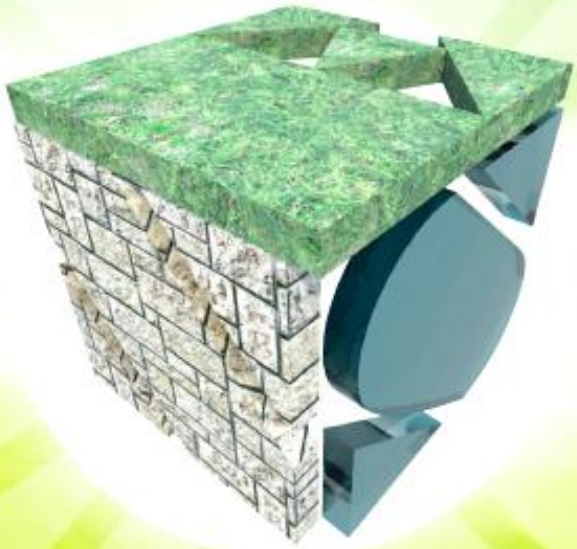


Natural - Energy Efficient - Sustainable

NEES PROJECT

NATURAL ENERGY EFFICIENT SUSTAINABLE

VOCATIONAL TRAINING MODULES

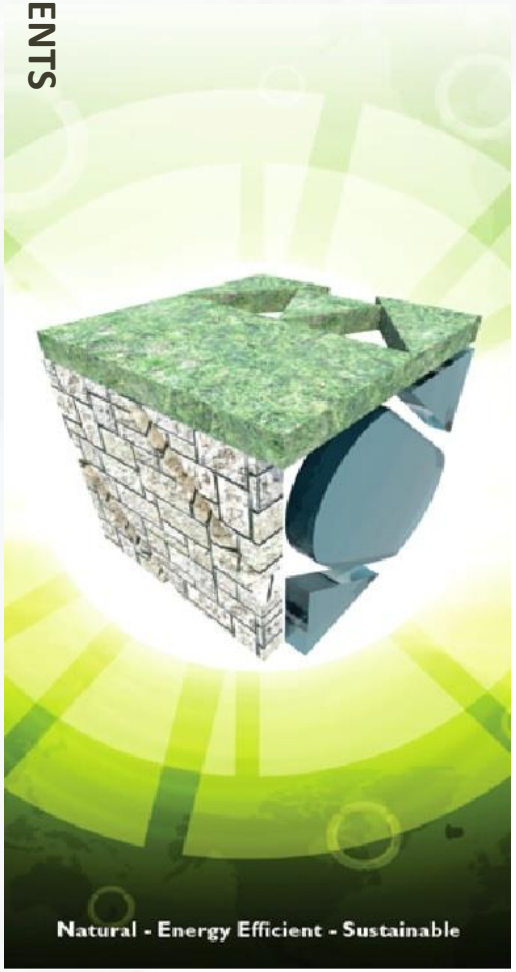
Module 3 House Envelope 1

3.1 **Green Roofs**

3.2 **Earth Construction**

3.3 **Retrofit Methods and Materials**

CONTENTS



NEES Training Module 3

- This training module focuses on forms of construction that have been used by NEES Best practice companies
- It does not attempt to give a comprehensive guide to ecological construction.
- The focus is on the use of
  - Green Roofs
  - Earth and Cob
  - Retrofit methods

3.1 Green Roofs

- There are many exaggerated myths about green roofs, for instance that they provide insulation and that they enhance biodiversity.

- However the main reasons for using them are:

1. Protecting roofing membranes and insulation from UV light
2. Possibly to help to keep a roof cooler
3. Replacing the ground from beneath the building on top
4. They look nice

- Try to use local plant and vegetation material
- Ensure that you have a good root barrier
- Ensure the roof is properly insulated with eco materials

ANÚ GREEN

Anú green

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Natural Energy Efficiency and Sustainability (NEES)

Best Practice in Products and Services

1. Product Description

Complete green roof system supplied with each green roof's unique characteristics as well as the aims of the client factoring in to the type of system specified

2. 'Natural' and/or 'recycled' content

Protection Fleece: 100% post consumer recyclables
Drainage: 50-100% recycled materials
Growing Medium: 60-100% recycled materials

3. Percentage of the product processed and / or manufactured in the NPP region

60-90% based on volume

4. Recyclability / biodegradability

All recyclable or biodegradable at end of life

5. Contribution to energy efficiency in buildings

Green roof systems can improve heating cooling by 30-90% depending on the type of building and type of green roof

6. Lifespan

30+ years (up to 80 or more)

7. Costs – Product and maintenance

Entirely dependent on the size of the green roof and type

8. Examples of usage

Photographs of materials, manufacturing process and/or usage.

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The above information was supplied by the producers/service provider and has been verified by the NEES Project.

Anu Green

Green roof systems

NEES Best Practice

ttp://www.anugreendesigns.com

http://www.optigreen.co.uk

Grass roof using sods dug up from the building footprint, this can be possible with many projects otherwise imported materials should be as local as possible

Sedum (stonecrop) is from the northern hemisphere and can thrive in rock gardens but Sedum does not always thrive on roofs. They flower but can often look brown and dreary in the winter.

Many green roof systems are imported from Germany, use synthetic insulation and plastic roof membranes and sedum that may not be appropriate for your area

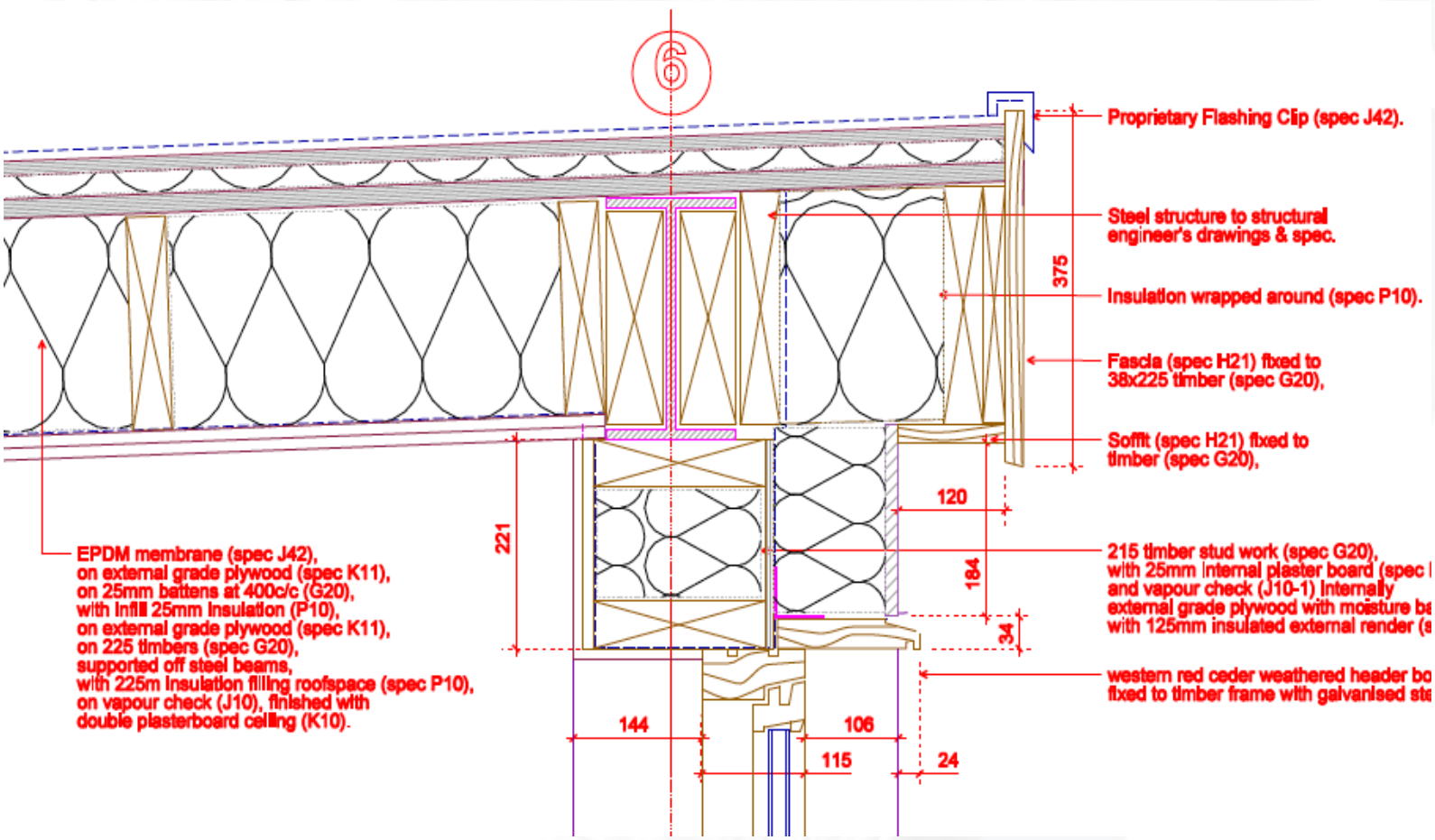
Sedum roof, inappropriate use on a north facing, overshadowed

Many green roof systems are imported from Germany, use synthetic insulation and plastic roof membranes and sedum that may not be appropriate for your area

This green roof detail is not recommended.

Roof not vented so there is a risk of interstitial condensation.

Important to get the detailing of flat and green roofs right



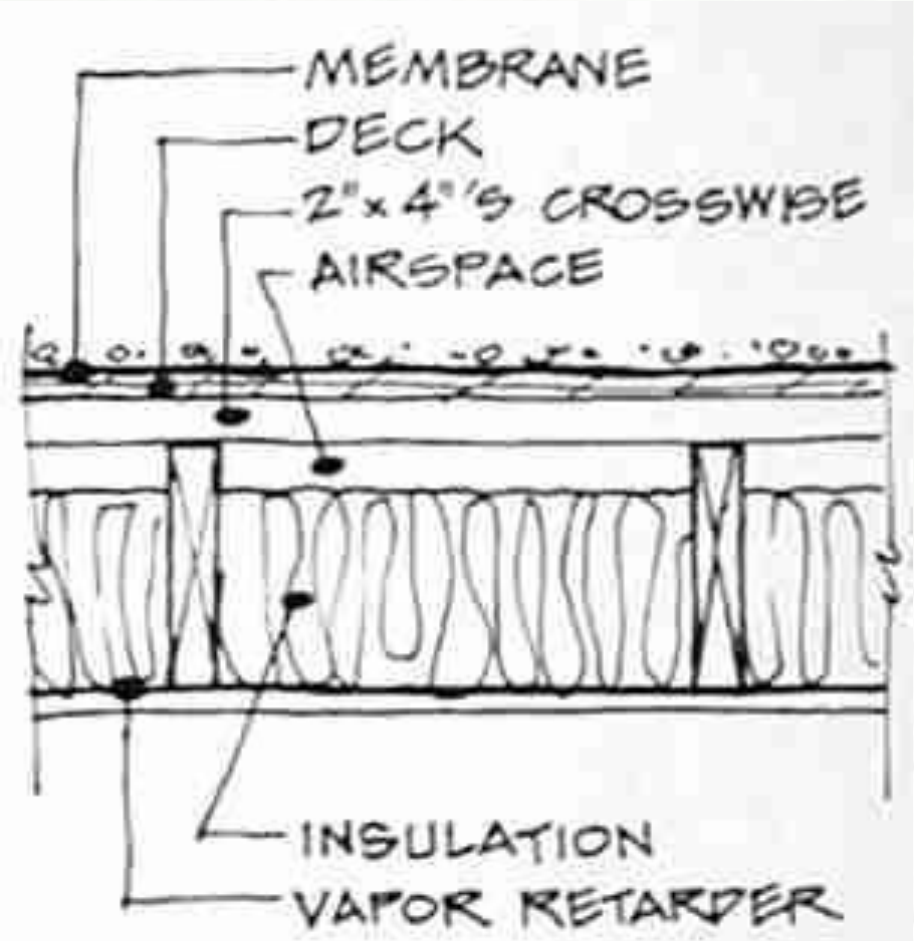


Figure 2. Flat woodframe roofs need a good air/vapor barrier and good ventilation. A ventilation plenum can be formed by laying 2x4's across the joists.

BETTER FLAT ROOF DETAIL

Important to use a vented roof detail with counter battens.

It is not enough to use vapour barriers and waterproof membrane

This sketch would require a more substantial deck to support the green materials

3.2 Earth Construction

Mud and Wood

NEES Best Practice
Cob and Strawbale training

http://www.mudandwood.com/

Natural Energy Efficiency and Sustainability (NEES)

Best Practice in Products and Services

1. Service Description

Consultancy, Training, Architectural and Building Services for Natural Building Projects (specialising in building with cob (earth), salvaged wood and other salvaged materials)

2. 'Natural' and/or 'recycled' content

Mud and Wood promotes the use of earth building and timber-frame/straw-bale construction. Both are 100% natural. We also promote the use of salvaged materials in building projects, from structural timber to slates to internal fixtures and fittings. All of these are 100% reclaimed, but not necessarily 100% natural.

3. Percentage of the product processed and / or manufactured in the NPP region

Besides natural insulations and lime, 100% of our materials are sourced locally in Ireland. Mud and Wood would be happy to use NPP natural insulations and lime if we could get access to them in Ireland.

4. Recyclability / biodegradability

Cob, timber and straw bales are 100% recyclable and 100% biodegradable.

5. Contribution to energy efficiency in buildings

More scientific research is required on cob to prove the abundance of anecdotal evidence that cob buildings are warm and dry. Cob has great thermal storage properties and excellent humidity buffering properties too. Straw bales in timber-frame are a cheap and natural way to super-insulate a building. Both building methods have very low or zero carbon emissions associated with them, when looking at the embodied energy of the materials themselves.

6. Lifespan

When detailed correctly, cob buildings will last for centuries. Timber frame homes are classified as permanent construction.

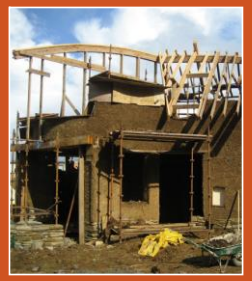
7. Costs – Product and maintenance

We teach skills to dramatically reduce the cost of building a house. The materials can be free or a fraction of their original cost, although building this way can be labour intensive and requires an amount of forward planning. Maintenance is very low-tech. External limewashing is usually required every 3-5 years, but can be extended with the application of potassium silicate.

8. Examples of work

See photos attached.

MUD AND WOOD



Mud and Wood

Natural building training, advice and help for self-builders and community projects. Repair services for earth buildings also available.

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Natural-Energy Efficient-Sustainable

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Mud and Wood

NEES Best Practice
Cob and Strawbale training

4-Day Cob Garden Structures Course I
Learn to build cob shelters, sculptures & walls for your garden

€ 295 / € 270 unwaged/student - T & Cs apply

02 - 05 May 2014 (inclusive)

NEW Dublin Weekend Cob Oven Course
Build a pizza oven from humble and lowly mud at the **Heritage Walled Garden, Donnybrook.**

€ 145 / € 130 unwaged/student - T & Cs apply

24 - 25 May 2014

9-Day Intensive Mud and Wood Course
How to build a cob-and-timber-frame house

€ 770 (includes **Mud and Wood** Handbook)
€ 715 unwaged/student - T & Cs apply

05 - 13 July 2014 (inclusive)

http://www.mudandwood.com/

Cob and strawbale house in Sligo

This house is built with mud walls on the sunny side and strawbale walls for better insulation on the north and overshadowed side

An earth building made from mud and straw using adobe bricks and cob

Cob house in Oxfordshire

Cob house in Oxfordshire

Cob houses can be beautiful but it is hard to meet modern insulation and energy standards

This outstanding cob house being built by Kevin McCabe in Devon is being built to almost passiv haus standards but relies on significant amounts of petrochemical based insulation such as PIR to achieve this

Cob house at The Hollies

http://thehollies.ie/

The Hollies

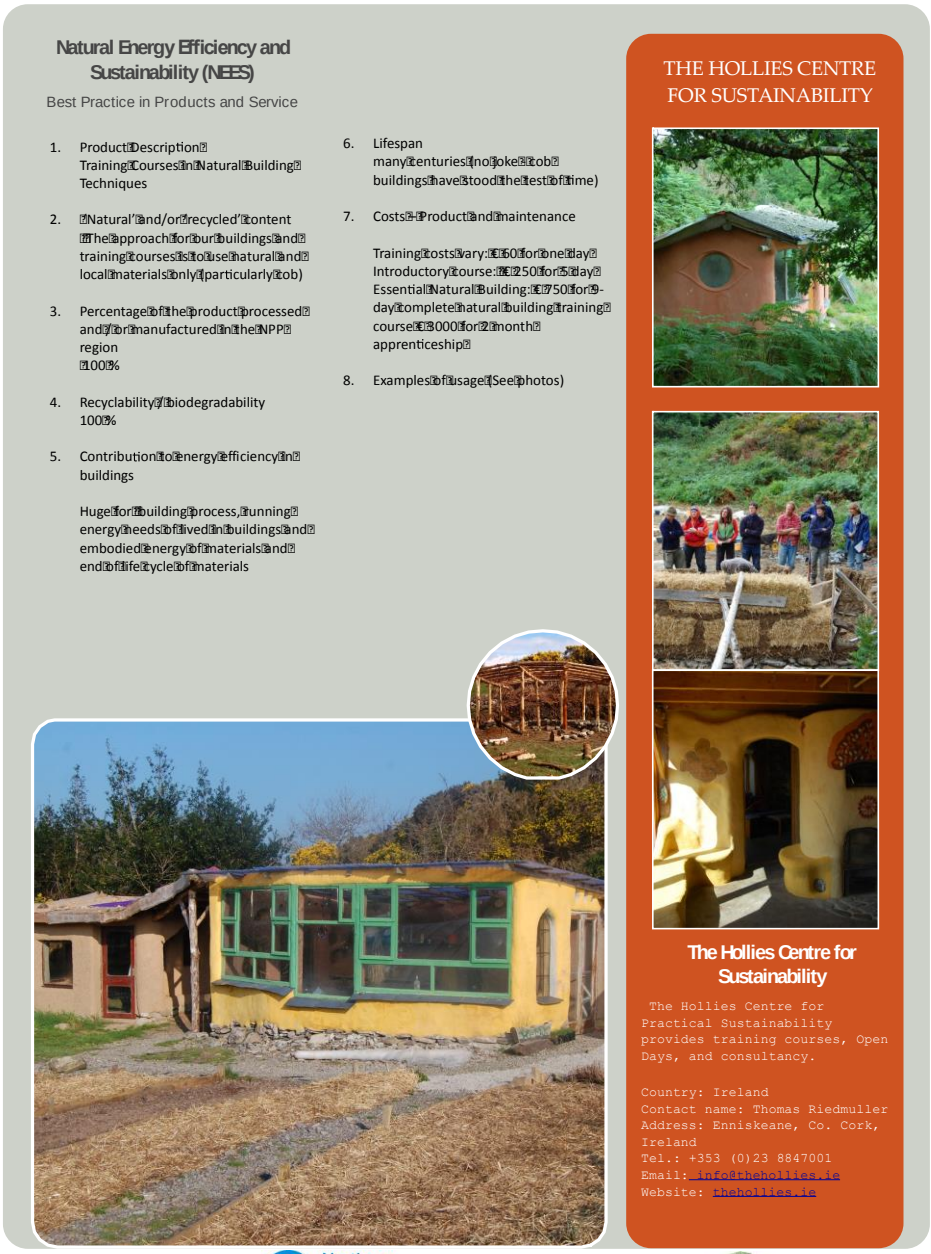
NEES best practice

Cob construction and eco building Training

The Hollies

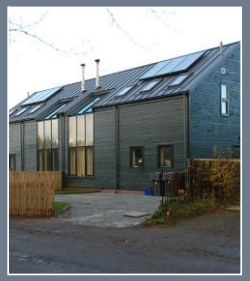
NEES best practice

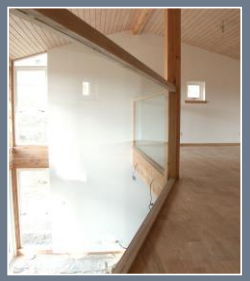
Cob construction and eco building Training



Most strawbale buildings in the UK involved hybrid construction with bales Packed into timber frames unlike this load bearing SB structure

LOCATE ARCHITECTS





Locate Architects

Locate Architects is an innovative young practice specialising in contemporary ecological design, tailored to circumstance and budget.

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Tel.: 086 351 1836
Email: chris@locatearchitects.co.uk
Website: www.locatearchitects.co.uk

Natural Energy Efficiency and Sustainability (NEES)

Best Practice in Products and Services

1. Product Description
Local (Scottish) Timber

2. 'Natural' and/or 'recycled' content
100% natural – no chemical additives
0% recycled normally, but reclaimed timber can, and has be used
(various % 'recycled' timber is normally used in various sheathing boards etc. as part of timber frame construction)

3. Percentage of the product processed and / or manufactured in the NPP region
100% where supported by Client

4. Recyclability / biodegradability
Re-usability is more relevant than recyclability, we also specify re-used timber, but this is more down to Client taste with finishes, floors etc.
Biodegradability is 100%, but main issue is that we use the timber without preservatives / insecticides etc. so it can be safely composted

5. Contribution to energy efficiency in buildings
Certainly better thermally than using metal or concrete for frame, but otherwise no major contribution to operational energy use (which is achieved using thermal insulation and airtightness, passive solar design etc). Very large contribution to carbon sequestration however which is part of an overall energy efficient design and another reason why we routinely use timber in preference to other materials.

6. Lifespan
Indefinite, assuming it is designed and specified properly.

7. Costs – Product and maintenance
Varies hugely due to large number of variables involved

8. Examples of usage
See pictures

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Locate Architects

NEEs Best Practice

Timber and strawbale construction

www.locatearchitects.co.uk/

Locate Architects

www.locatearchitects.co.uk/

Ecological Architecture

Nees Best Practice www.ecological-architecture.co.uk

ecological architecture



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The Big Shed Morenish Mews Holmlea Gardens Rynachulig Straw Bale House Hemcrete House The Manse
South Byre Cottages Kilgregan Competition Careston Hall Brechin The Cart Shed Studio Other Work

Hemcrete House



The desire for the house to sit harmoniously in its location led to the choice of Hemcrete as a construction material. Echoing the thick walls of its neighbour, a straw bale house, the ground floor is also raised above the ground to take full advantage of the views south to Loch Tay.

The house contains a double height sitting area with a mezzanine leading to attic bedrooms above. The kitchen and dining area is located beneath the mezzanine, which allows easy access to the external timber deck for 'al fresco' eating. The entrance hall which gives access to the main living area, further bedrooms and a family bathroom, is also a double height with a rooflight, leading to an impression of space.

Hemcrete offered the benefit of a very high standard of wall insulation which could be installed as a single layer, with high levels of air-tightness. It also absorbs carbon dioxode from the atmosphere during the drying process. The high standard of insulation was continued throughout the 'envelope' of the house with wood fibre batts in the roof and ground floor. The house is so well insulated and air tight that it can be heated by a single wood burning stove.

The Lime Technology website gives more information on Hemcrete.

Ecological Architecture have designed strawbale and hempcrete buildings

ecological architecture



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The Big Shed Morenish Mews Holmlea Gardens Rynachulig Straw Bale House Hemcrete House The Manse
South Byre Cottages Kilgregan Competition Careston Hall Brechin The Cart Shed Studio Other Work

Straw Bale House



A client led self-build project using straw bales as the external wall material and insulation, with an internal Douglas Fir timber frame. External and internal lime render, wood-burning stove and solar hot water. Please take a look at their blog for a week by week account of Willie and Wendy's build. This project won the 2012 Murray Armor Self Builder of the Year award. The National Self Build Association (NaSBA) gives the annual award for Britain's most determined self builder. Willy and Wendy's home stood out because it used mostly locally sourced, natural and recycled materials. For more information have a look here.

Its important to ensure that architects are fully qualified and registered

ecological architecture

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Mary Roslin Sue Manning

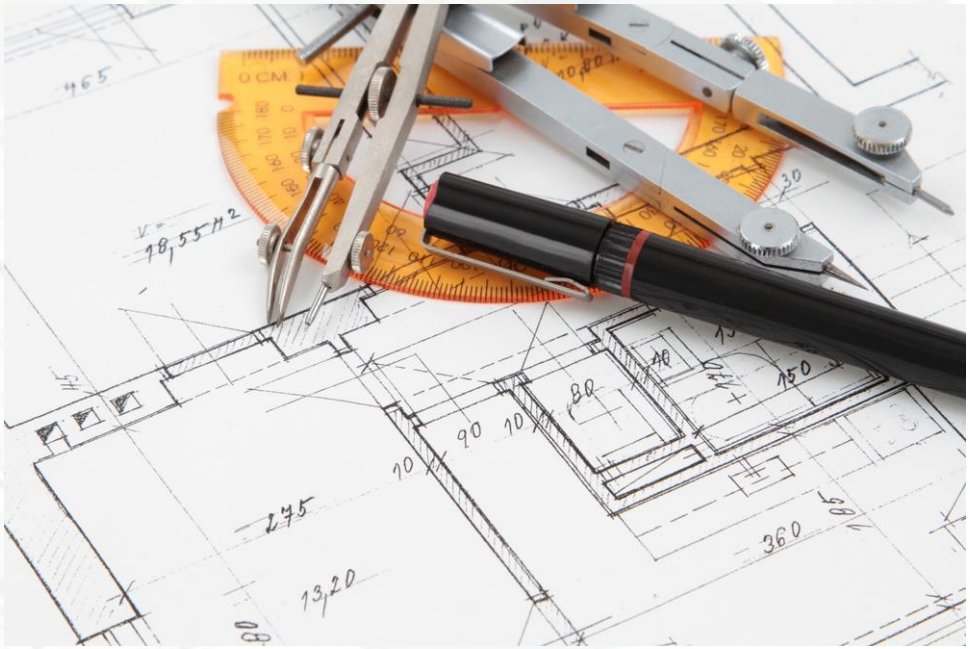
About Us

We have been researching, teaching and practicing ecological architecture since the mid 1980's, and currently work from offices in Inverclyde and Loch Tay in Highland Perthshire.

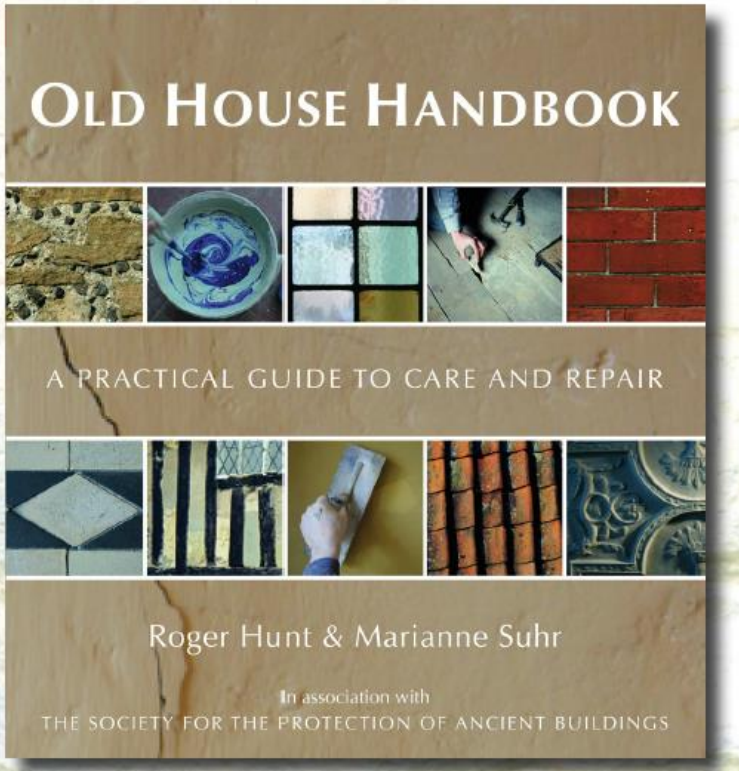
Practice Notes

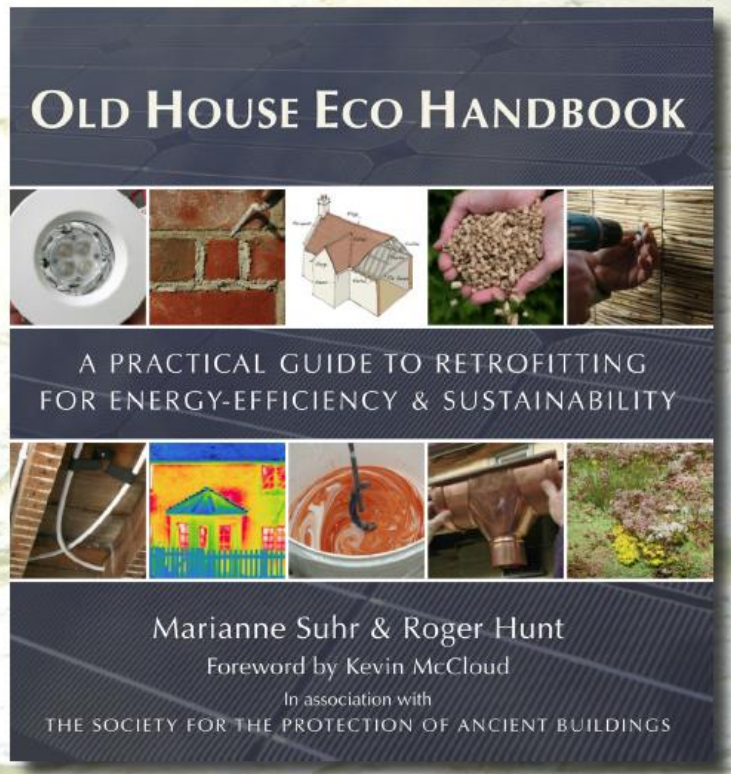
- ARB (Architects Registration Board) registered
- RIBA (Royal Institute of British Architects) associates
- RIAS (Royal Incorporation of Architects in Scotland) associates
- SEDA (Scottish Ecological Design Association) members and director
- A registered LLP, ea-ecological architecture LLP No SO302173 (Scotland)
- Professional Indemnity Insurance to £500,000 held and can be extended as required

3.3 Retrofit Methods and Materials



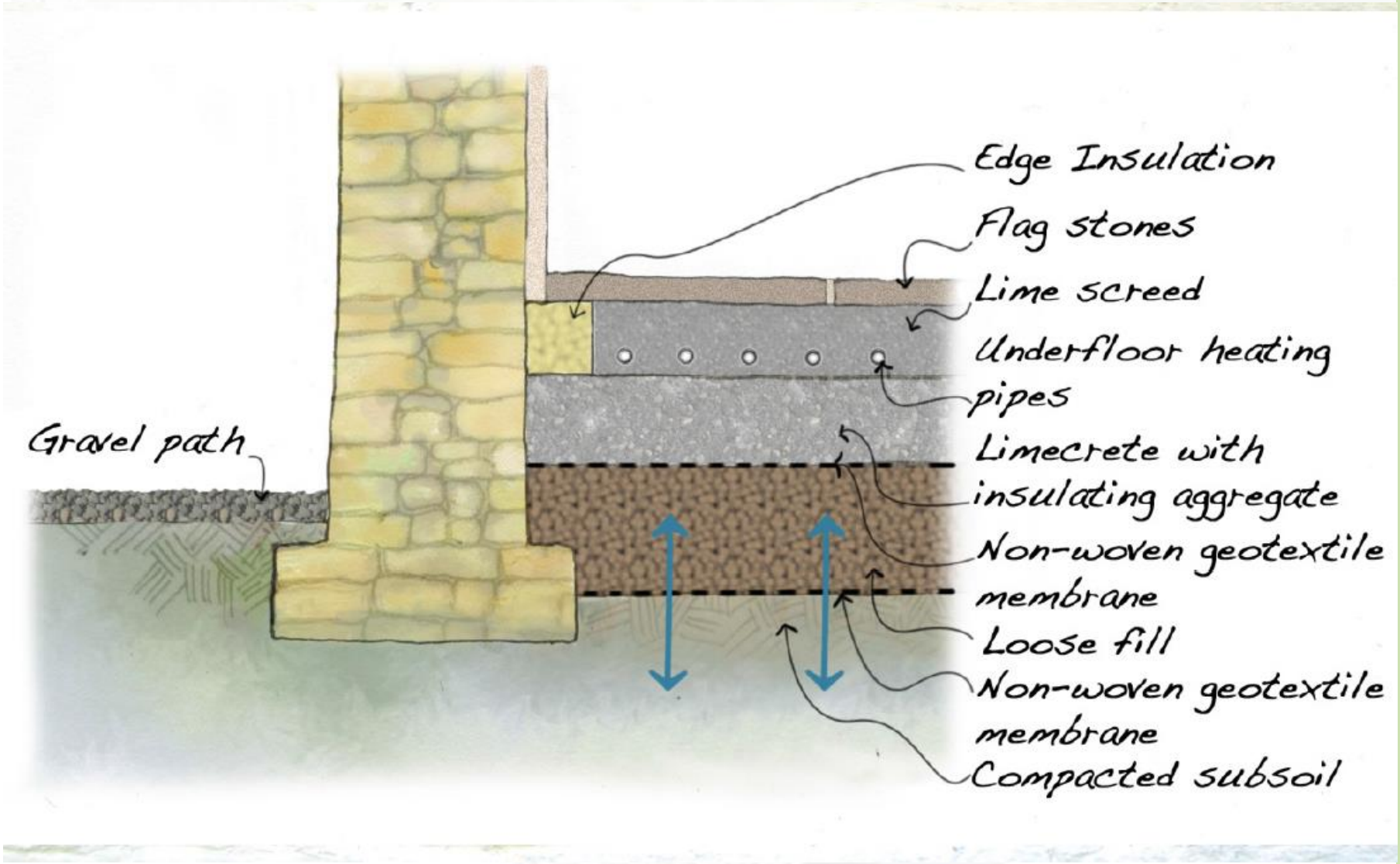
Retrofitting – these books by Hunt and Suhr provide a very helpful introduction to the subject and tend to favour natural and ecological materials





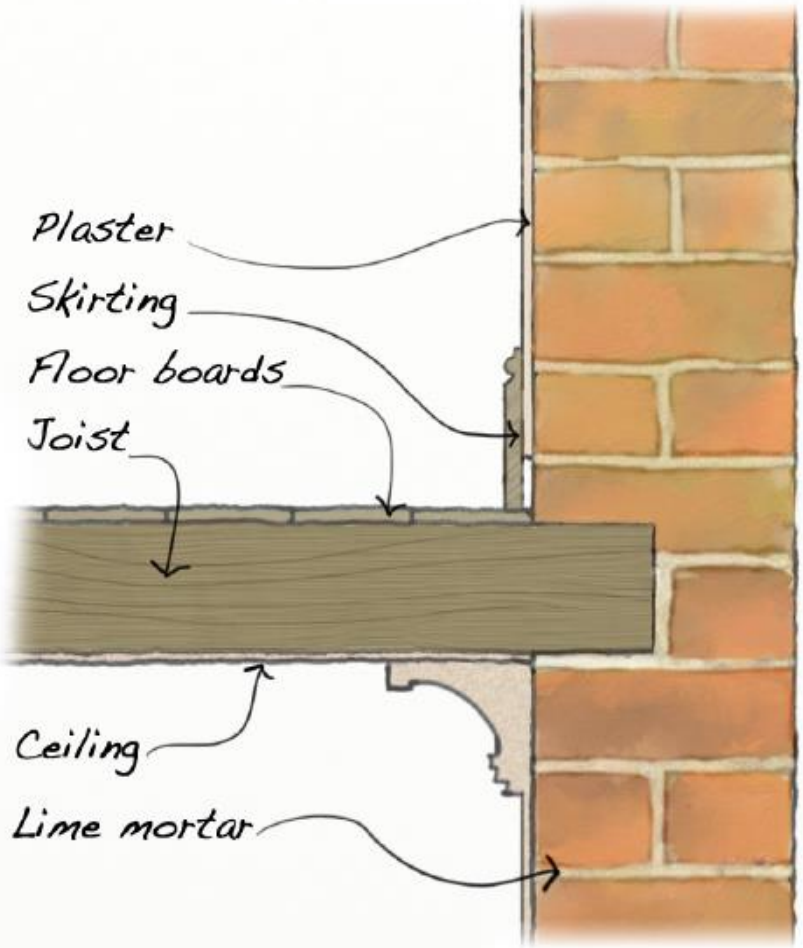
www.huntwriter.com

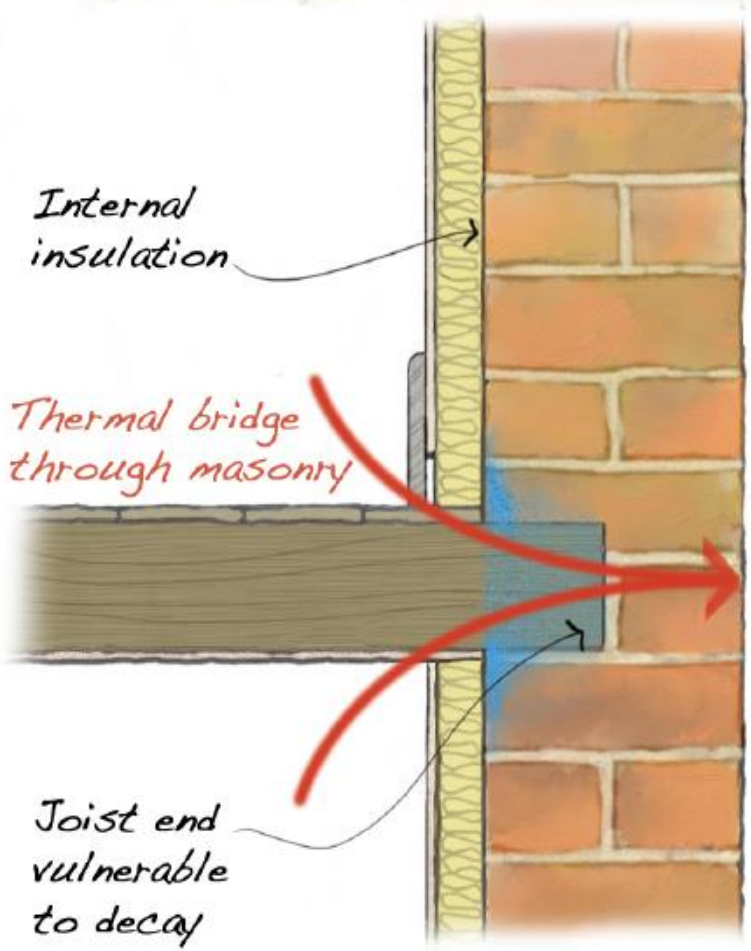
Using limecrete in floors: Its possible to minimise concrete in floor construction

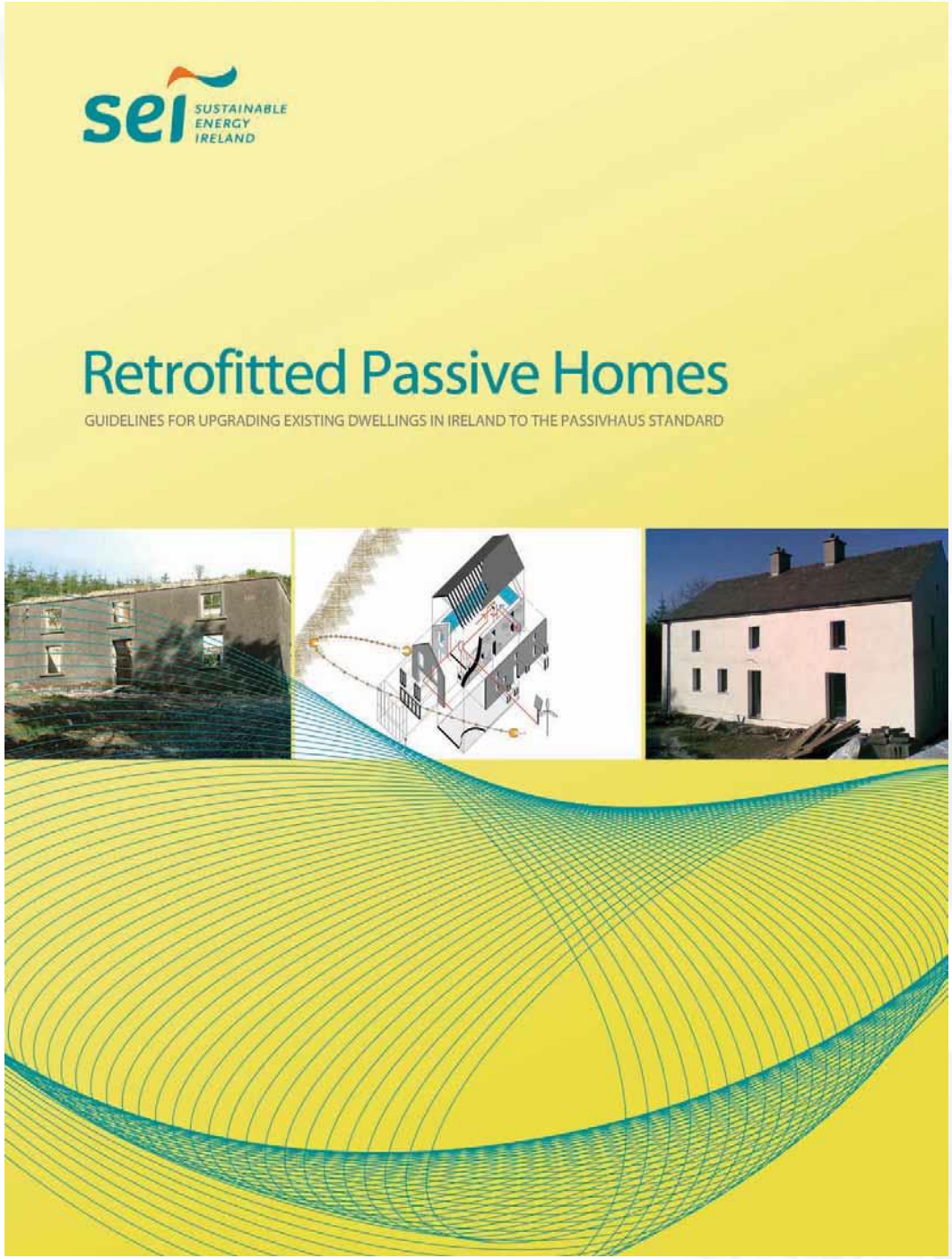


Insulating raised timber floors with natural insulations

This is an approach to insulating solid walls which is being widely adopted
BUT is unlikely to be successful where insulation is applied directly to solid walls
This can lead to problems with dampness and condensation



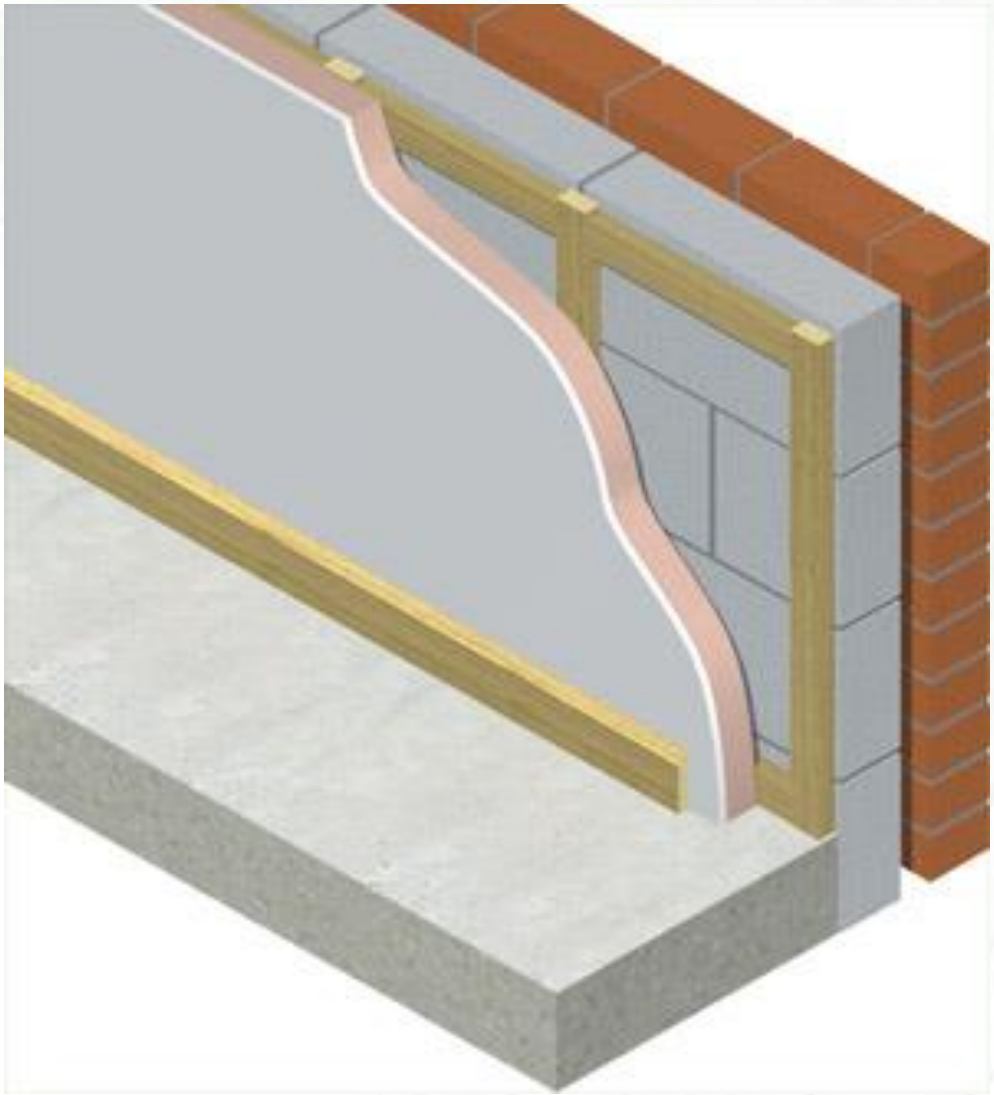




Extreme insulation and air tightness are being advocated for retrofitting

But this can lead to problems

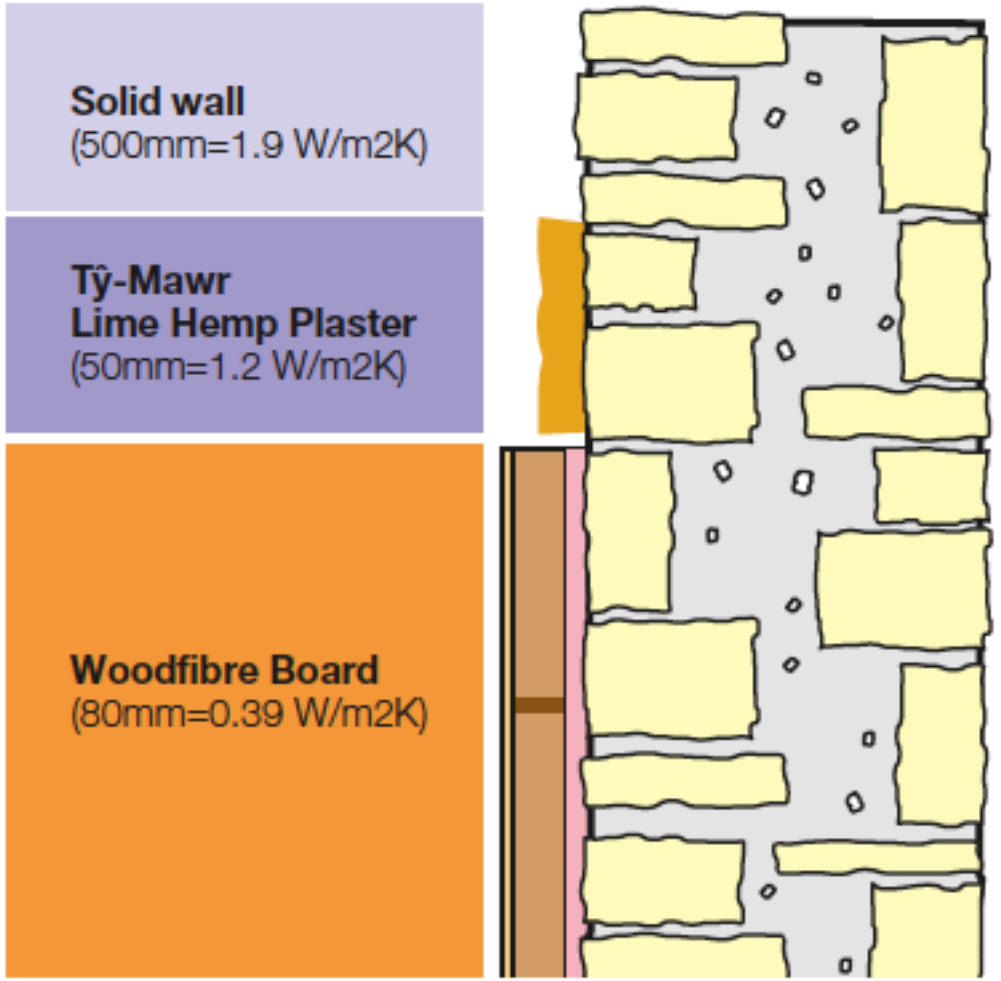
Taping up to achieve air tightness may also seal in damp



Fixing insulation on battens to existing walls puts the timber at risk, the gap should be ventilated

Breathable insulation boards can be fixed directly to masonry.
Their hygroscopic character can reduce moisture risks but careful condensation risk analysis is required before adopting this approach

Eco materials suppliers Ty Mawr in Wales suggesting “u” values for Insulation applied directly to walls. They may be underestimating The effective thermal performance of lime hemp plaster



http://www.lime.org.uk/

Internal insulation is commonly
Used but should be used with care

Existing Wall Internally Insulated

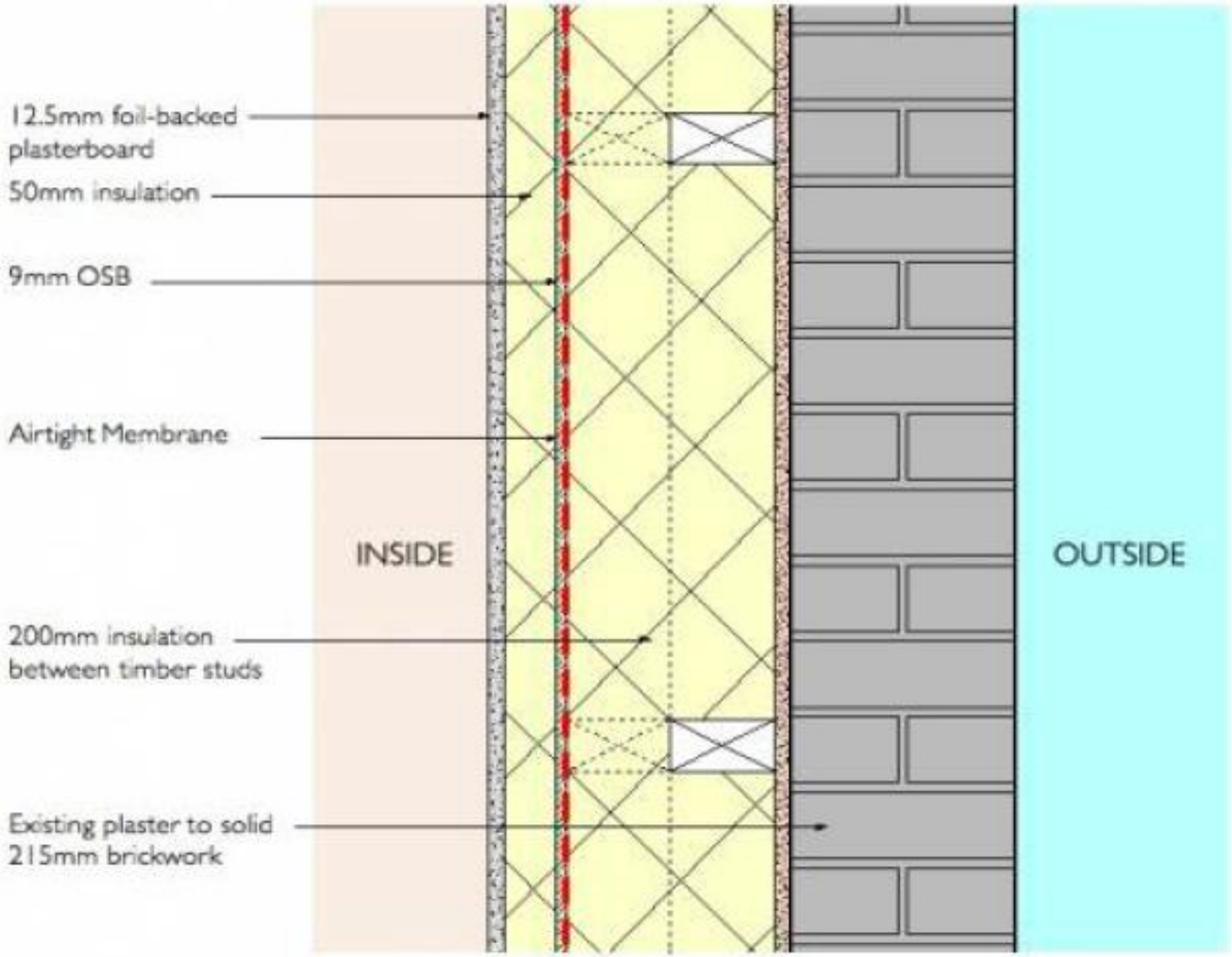
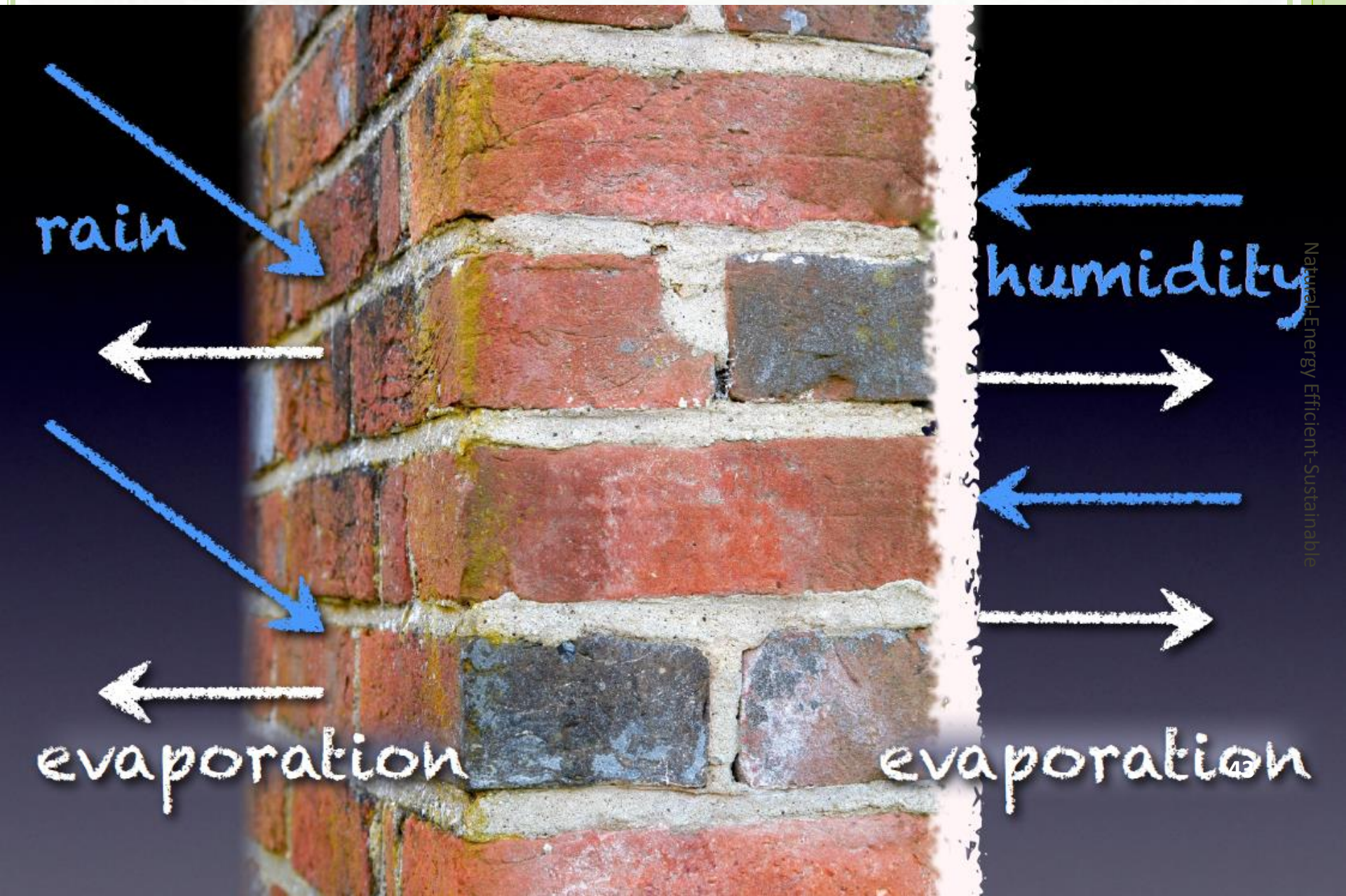
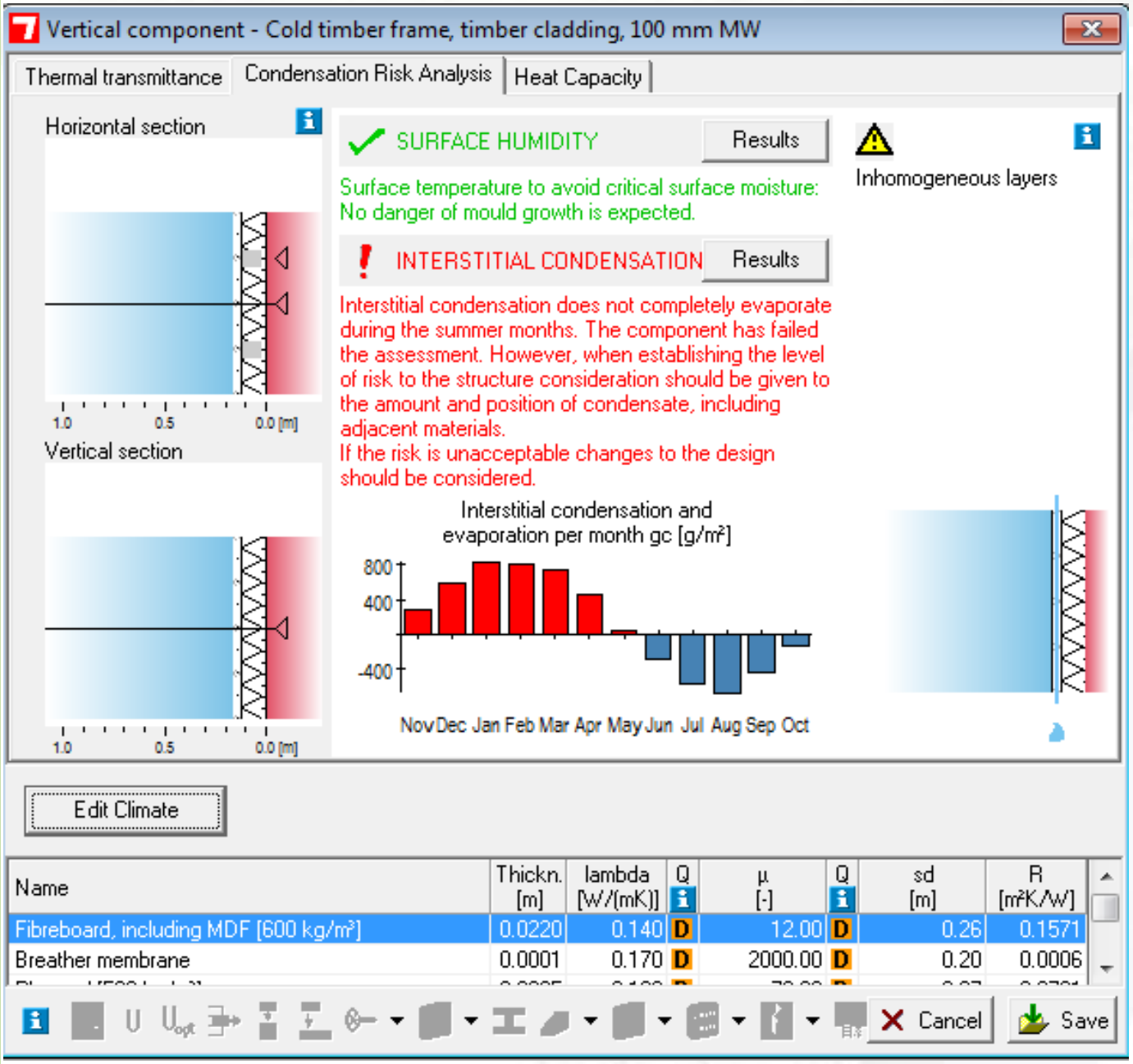


Image from Old house Eco house showing breathable masonry wall
Adding insulation will compromise breathability





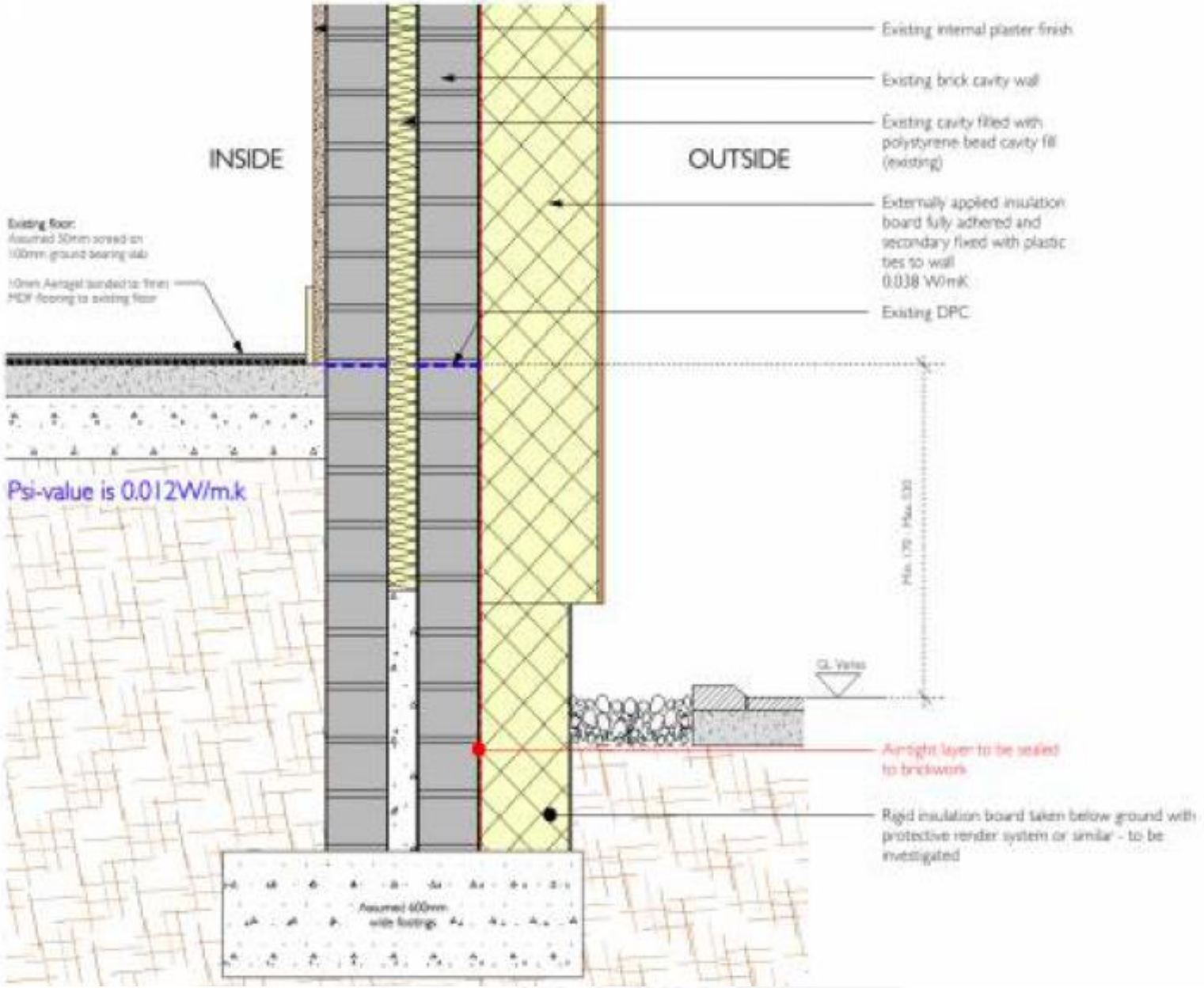
builddesk.co.uk

Mould growth is usually attributed to cold bridging, but it can have complex causes due to lack of adequate ventilation, air movement and poor insulation

Experimental external insulation used in North Wales using cement based breathable board

Experimental external insulation using sheep's wool insulation in Wales

External wood fibre insulation board detail Anne Thorne Architects/Technology Strategy Board



attic insulation & roof insulation | pavatex distributor

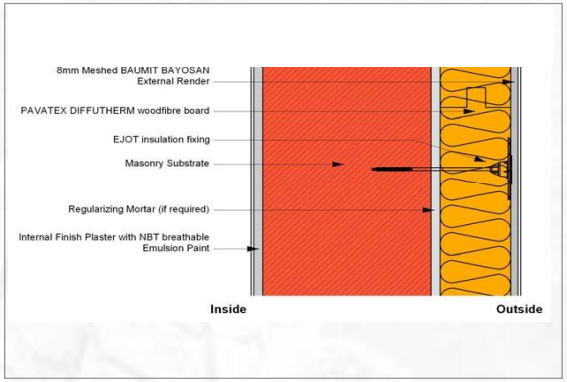
pavatex

Construct. Insulate. Relax.

Suppliers of Natureplus certified Pavatex wood fibre insulation

Masonry Solutions

System description:



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NBT Diffutherm systems are highly vapour open and hygroscopic making them very suitable for the thermal upgrading of existing solid wall buildings as well as brick-infilled traditional timber frames, all of which need to breathe. They can also be used with cavity constructions

NBT Diffutherm systems can be used with both new solid wall and cavity walls.

- Excellent thermal performance, with reduced thermal bridging and excellent ψ (psi) values
- Highly vapour open and hygroscopic system ensuring fully breathing and dry walling, with reduced risk of damp and interstitial moisture.
- Excellent acoustic performance, increasing flanking sound protection
- Increased overheating protection
- Simple, robust detailing with full systems parts
- Full design and site support from NBT
- Tried and tested system, fully certified

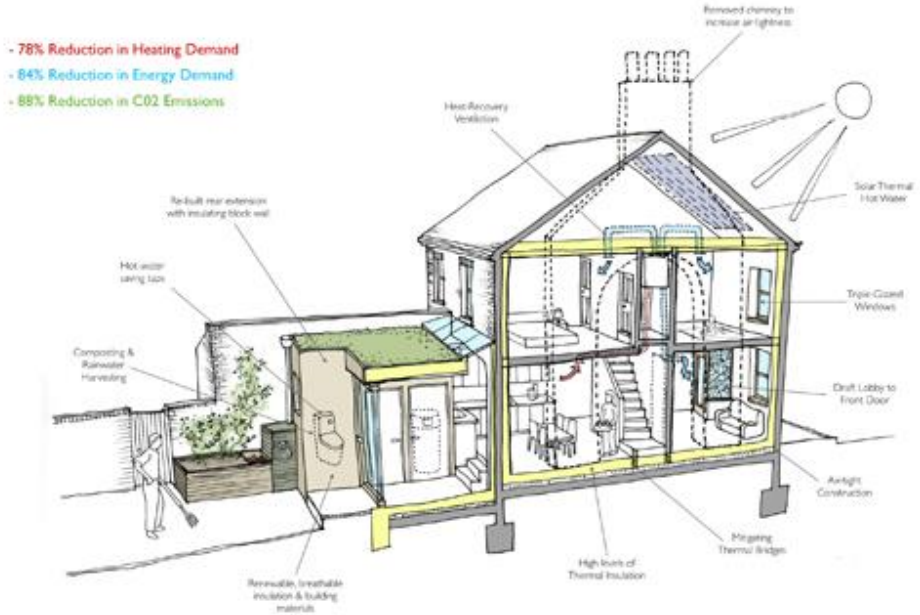
Woodfibre boards are non-toxic, contain over 95% waste wood from sustainable forests, and lock up 1.2 tonnes of CO_2 for every tonne of boards produced. They are BREEAM Green Guide, and WRAP assessed.

Suppliers of Natureplus certified Pavatex wood fibre insulation

England
http://www.natural-building.co.uk/

Ireland
http://www.acaraconcepts.com/wood-fibre-insulation/

Passivhaus retrofit St Lukes Stoke on Trent



For more details of passivhaus retrofit
St Lukes Stoke on Trent
Look at

http://annethornearchitects.co.uk/

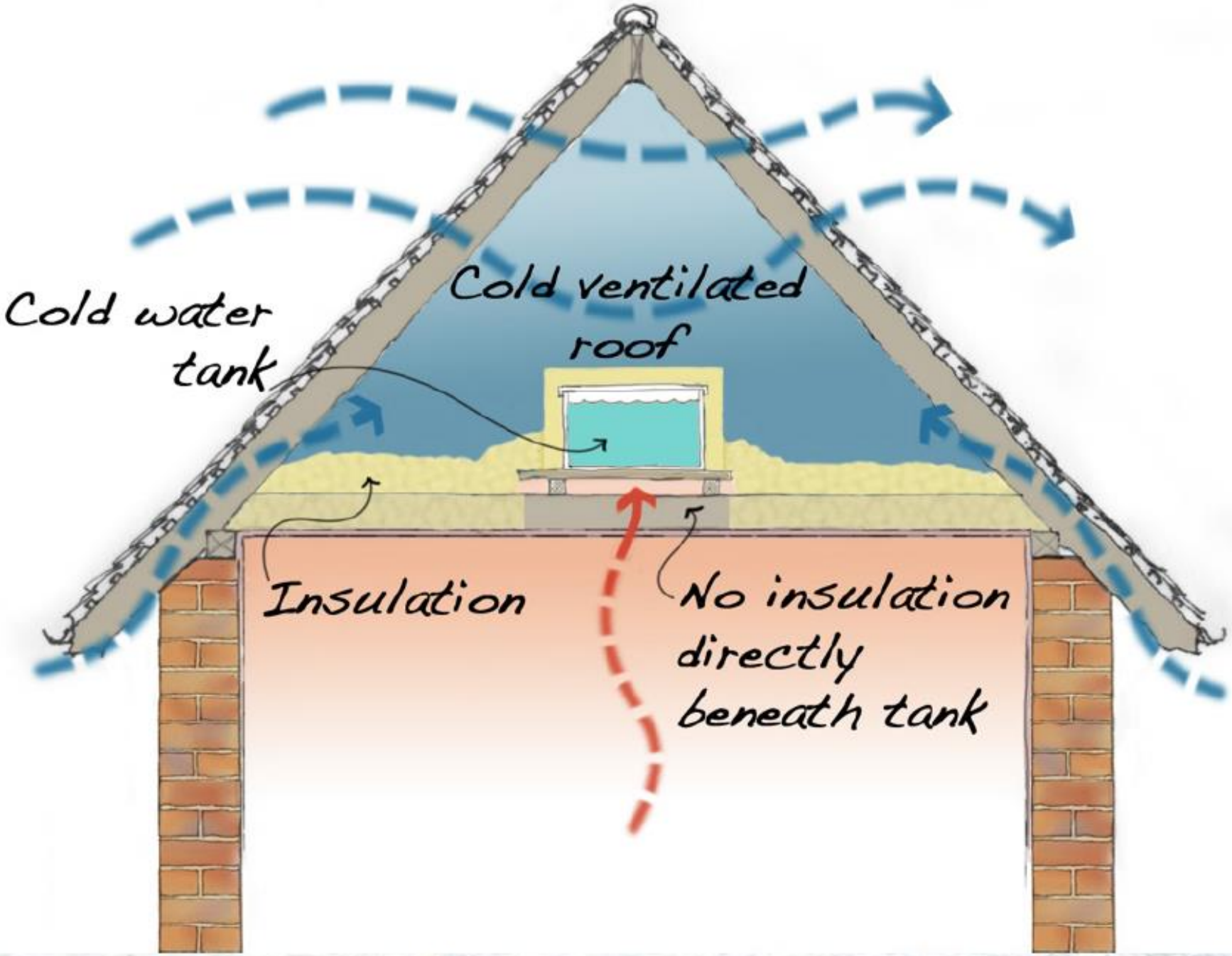
Natural-Energy Efficient-Sustainable

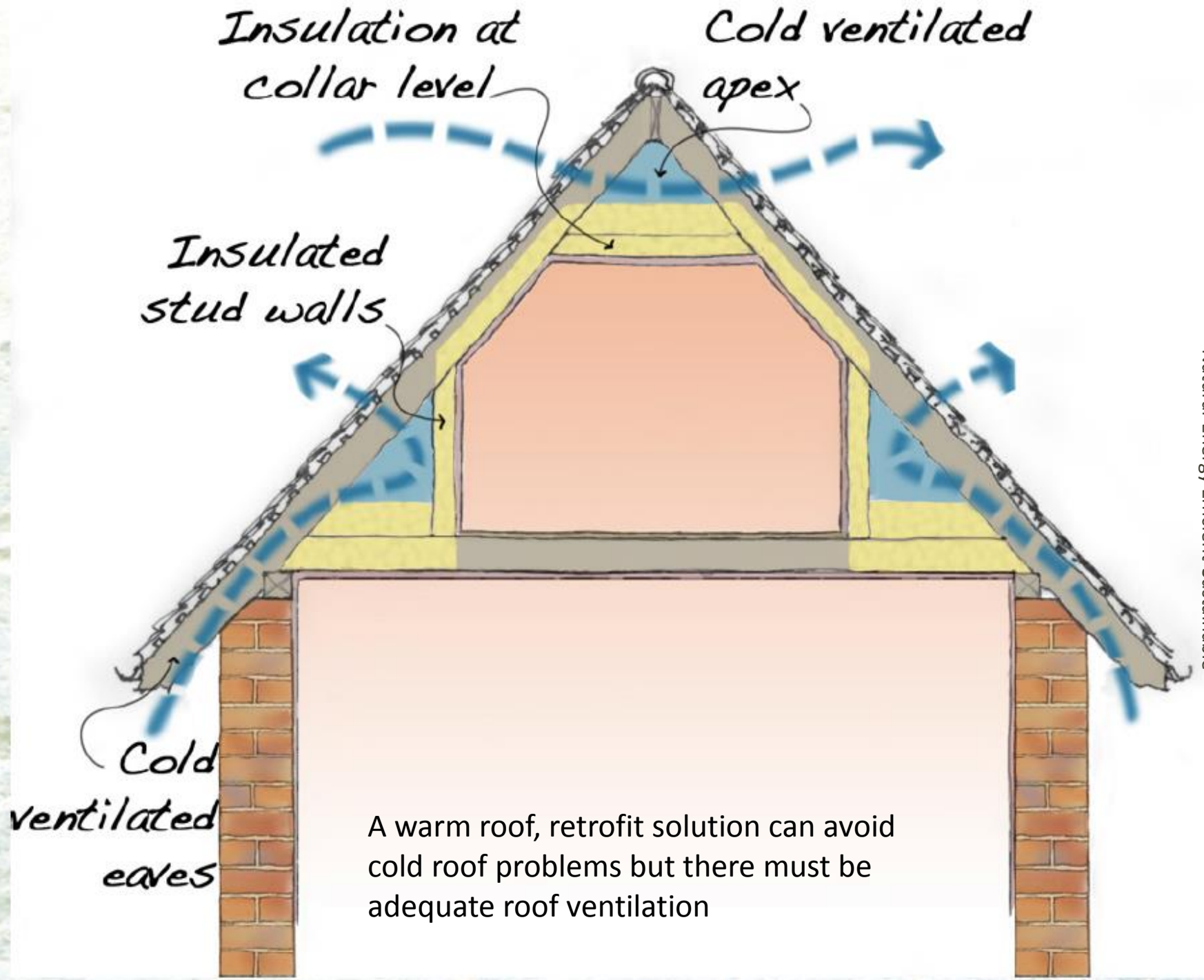
Synthetic insulation is difficult to install ensuring full air tightness
1 mm gap will result in up to 30% reduction in efficiency of insulation

Use of petrochemical external insulation
Will prevent old masonry walls from breathing

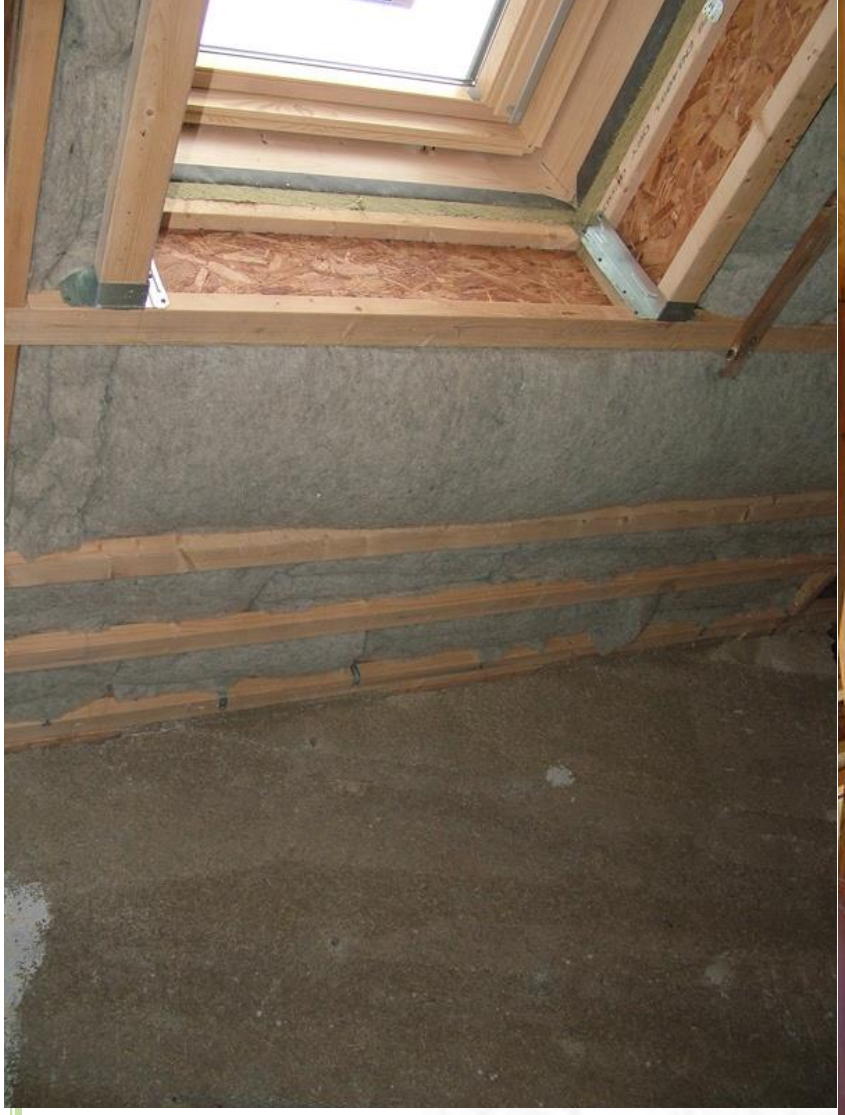
Highly insulated cold roof construction with waterproof “breather” membrane has led to condensation. Water droplets can be seen here dripping onto the synthetic fibre Insulation

Problems of this nature are likely to become more commonplace with super insulated retrofits where breathability is ignored





A warm roof, retrofit solution can avoid cold roof problems but there must be adequate roof ventilation



Warm roof detail with
350mm of sheep's wool

Examples of using hemp lime to insulate old and refurbished buildings

Green Light Trust Modece Architects
http://www.modece.com/community-temp-2.html

Medieval oak framed house in Oxfordshire Renovated with hemp lime cast into the walls

http://oldhouseconsultancy.co.uk/

Hemp lime plaster on old brick walls

Showing temporary shuttering for place hemp lime insulation against an existing masonry wall

Hemp Lime plaster onto old masonry walls in Ireland, shortly after the material is cast and is still wet

This dried out in about 2 weeks and could be plastered

Once the wall was finished and plastered it was painted with a breathable natural clay based paint

Hemp lime being applied
To old stone walls in Wales

Images Pat Borer http://www.patborer.co.uk/