# Retro Fit Assessor

# Objectives

- 4 Day online course comprising of online study and at least 6 hours or remote learning or CPD
- Understanding of the PAS2035 and TrustMark
- Risk Assessment
- Energy Efficiency Advice
- The benefits of deep retrofit
- Building Physics such as; u Values, condensation, thermal bridging, ventilation
- Occupancy Assessment
- Heritage Buildings
- Site constraints
- Structural defects
- Estimating energy use and cost
- Condition Report

# What is PAS 2035

- **PAS 2035** is the new specification which came into effect on June 30th 2019, and is the overarching document in the retrofit standards framework which specifies the requirement for a holistic approach to the end-to-end delivery of domestic retrofit work.
- It gives better clarification regarding the qualifications and responsibilities of individual retrofit roles and respective activities required prior to the commencement of the physical installation, ensuring standards are maintained and providing the consumer with a choice of high-quality, safe and trustworthy options when enhancing the energy efficiency of their homes.
- PAS 2035, which spun out of the Each Home Counts Review, has been developed as the route that all organisations must follow if they are to operate as a Trust Mark approved scheme and carry out domestic retrofit work.
- This new framework provides a 'whole building' approach to the retrofit process by looking at the home, environment, occupancy and the householders' improvement objectives when determining suitable measures to install, rather than the retrofit work being considered in isolation which could potentially affect the overall building performance.
- By ensuring that funding from banks and lenders is used towards good quality work which will actually improve the energy efficiency of housing, PAS 2035 is designed to improve the quality of retrofit work carried out on domestic properties.

# What is PAS 2035


- Assessors must have a copy of this
- Download from https://shop.bsigroup.com
- Forms part of the compulsory 6 hours of pre reading/CPD to be completed before this training
- Assessors must be a qualified DEA and optionally a GDA/NDEA level 4/energy advisor
- Read and understand the principles of heritage buildings
- Refer to website https://historicengland.org.uk/advice/heritage-at-risk/buildings/

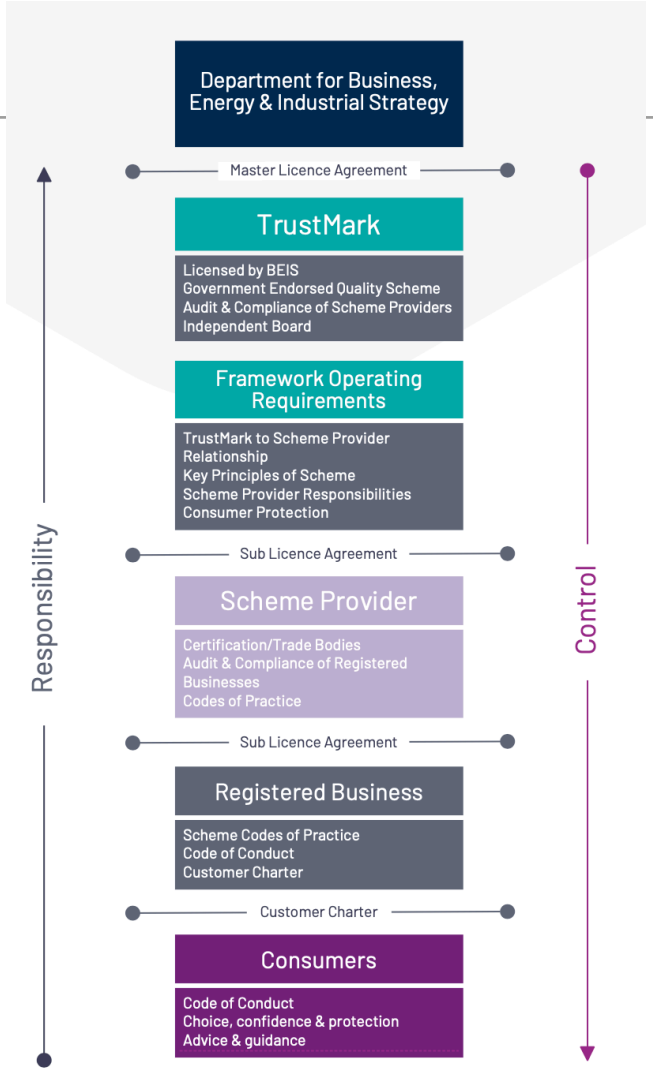
# Who are TrustMark?

TrustMark is the **only** Government-endorsed standards scheme for trades that operate in and around the home. Developed in 2005 with national government, industry and consumer protection bodies, it's aim is to give consumers confidence in firms to undertake work that is of high quality, is protected and delivered at agreed costs.
The scheme's operators and registered firms commit to meeting a set of core criteria, which are reviewed and updated annually.

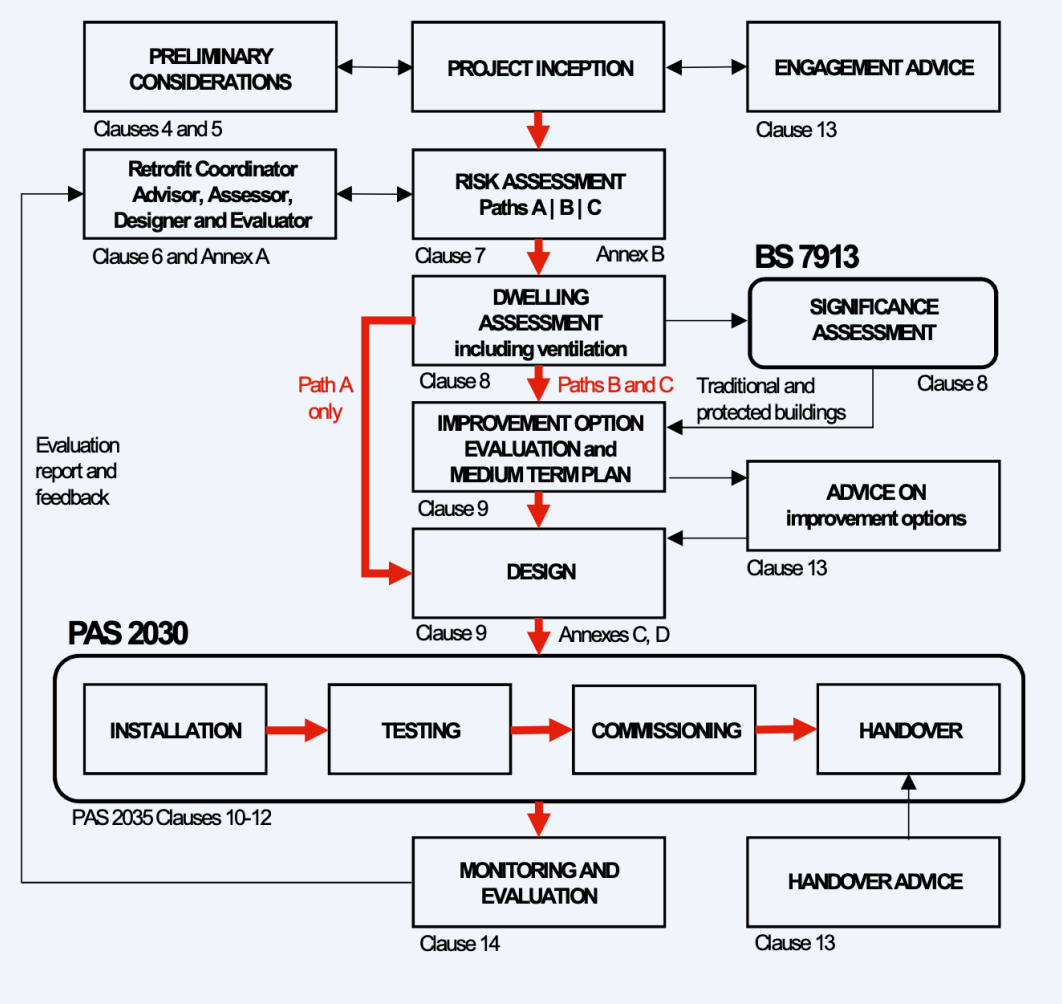
An annual audit of Ecmk ensures we are meeting the high standards expected from this scheme. Ecmk expect the highest quality and professionalism from all it's accredited members

TRUSTMARK
Government Endorsed Quality

# Your role?


Department for Business, Energy & Industrial Strategy
Master Licence Agreement
TrustMark
Licensed by BEIS
Government Endorsed Quality Scheme
Audit & Compliance of Scheme Providers
Independent Board
Framework Operating Requirements
TrustMark to Scheme Provider Relationship
Key Principles of Scheme
Scheme Provider Responsibilities
Consumer Protection
Sub Licence Agreement
Scheme Provider
Certification/Trade Bodies
Audit & Compliance of Registered Businesses
Codes of Practice
Sub Licence Agreement
Registered Business
Scheme Codes of Practice
Code of Conduct
Customer Charter
Customer Charter
Consumers
Code of Conduct
Choice, confidence & protection
Advice & guidance
Responsibility
Control

# Your role?

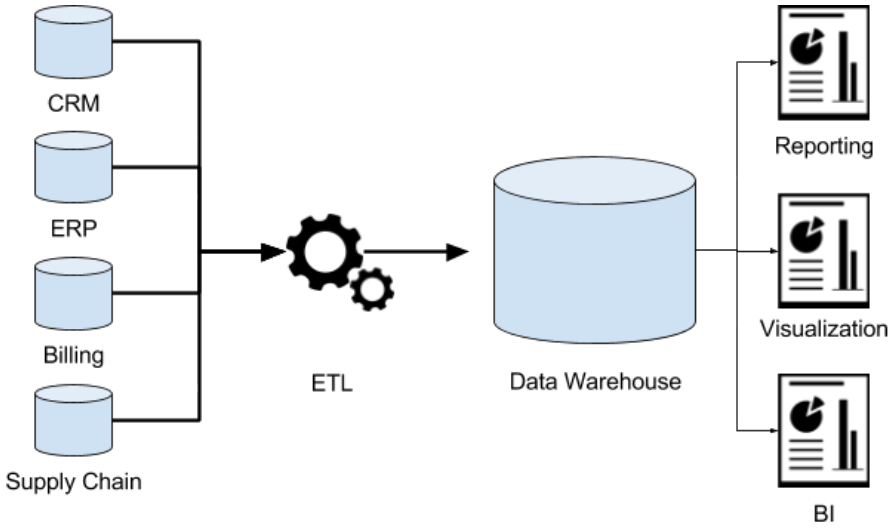

PRELIMINARY CONSIDERATIONS
Clauses 4 and 5
PROJECT INCEPTION
ENGAGEMENT ADVICE
Clause 13
Retrofit Coordinator Advisor, Assessor, Designer and Evaluator
Clause 6 and Annex A
RISK ASSESSMENT Paths A | B | C
Clause 7
Annex B
BS 7913
DWELLING ASSESSMENT including ventilation
Clause 8
SIGNIFICANCE ASSESSMENT
Clause 8
Path A only
Paths B and C
Traditional and protected buildings
Evaluation report and feedback
IMPROVEMENT OPTION EVALUATION and MEDIUM TERM PLAN
Clause 9
ADVICE ON improvement options
Clause 13
DESIGN
Clause 9
Annexes C, D
PAS 2030
INSTALLATION
TESTING
COMMISSIONING
HANDOVER
PAS 2035 Clauses 10-12
MONITORING AND EVALUATION
Clause 14
HANDOVER ADVICE
Clause 13

# Who are TrustMark?

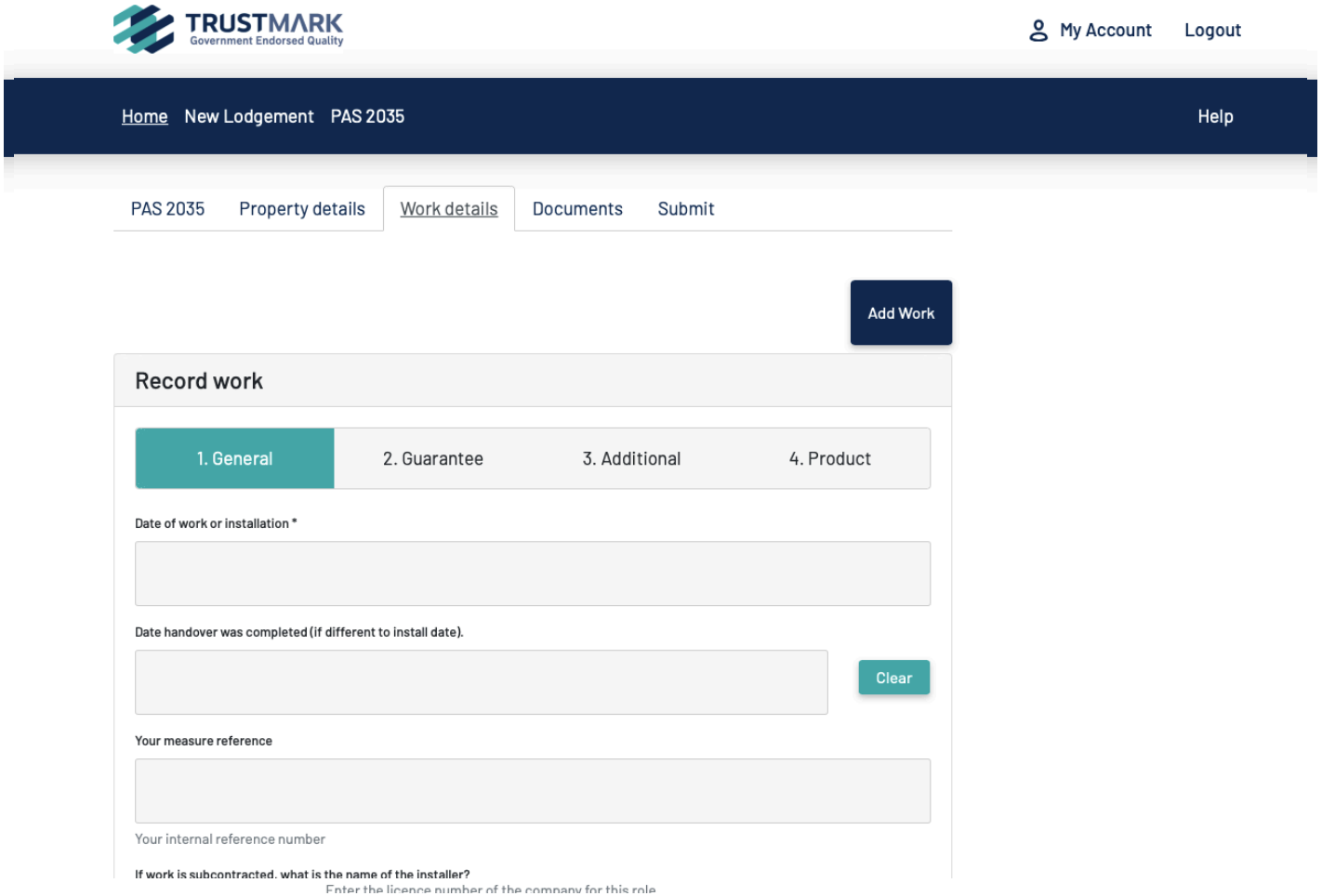
Reports will be stored (lodged) at the data warehouse

Similar to Landmark, to enable all parties to access the data produced by the Retro Fit Assessor

Below is an example of how this will operate. NB this is not the actual data warehouse



# Data Warehouse



# Who are TrustMark?

Important notes;

The data produced by the assessor is used by multiple third parties

It must be accurate

It must be clear and understandable

What other implications does this have on the Retro Fit Assessor?

# Risk Assessment

- What is a Risk Assessment?
- Select the correct Path of risk as per the PAS2035
- Refer to Annex B
- Assessors must answer the 5 mandatory questions as per the PAS2035

# Risk Assessment

## Annex B (Normative) Risk Assessments

B.1 The risk assessment process (**7.1**) shall consist of the assessment of risk grades for each of five criteria and their aggregation into an overall risk grade that is used to determine the relevant compliance path for the application of this PAS, in accordance with Table **B.1** and Table **B.2**.

**Table B.1** – Risk assessment table for determining PAS 2035 Path

| **Criterion 1: Number of dwellings in the project** | | |
|---|---|---|
| **The number of dwellings to be improved** | **Risk grade** | **Assessed grade** |
| 1–10 | A | |
| 11–30 | B | |
| More than 30 | C | |
| **Criterion 2: Number of measures per dwelling**[A] | | |
| **The average number of improvement measures per dwelling** | **Risk grade** | **Assessed grade** |
| 1–2 | A | |
| 3–5 | B | |
| More than 5 | C | |
| **Criterion 3: Measures proposed** | | |
| **The inherent technical risk of the highest risk measure** (from Table **B.2**) | **Risk grade** | **Assessed grade** |
| 1 | A | |
| 2 | B | |
| 3 | B | |
| **Criterion 4: Combination of measures** | | |
| **The highest risk combination of measures** (from the Measures Interaction Matrix, Figure **D1**) | **Risk grade** | **Assessed grade** |
| GREEN | A | |
| ORANGE | B | |
| YELLOW | B | |

# Risk Assessment

| Criterion 5: Construction and Built Form | | |
|---|---|---|
| **Construction and built form of buildings** | **Risk grade** | **Assessed grade** |
| Conventional [B], not high-rise, not protected [C] | A | |
| Traditional [D], not protected [C] | B | |
| System-built [E], not high-rise, not protected [C] | B | |
| High rise [F], any construction | C | |
| Protected [C], any construction or built form | C | |







Table B.1 – Risk assessment table for determining PAS 2035 Path *continued*

| Overall Risk Grade | | |
|---|---|---|
| **Highest assessed grade** (from Criteria 1 to 5 above) | **PAS 2035 Path** | **Assessed Path** |
| A | A | |
| B | B | |
| C | C | |

[A] For this risk assessment, the number of measures excludes any ventilation upgrade required by Annex **C**.

[B] Conventional means masonry cavity wall construction (brick and/or block) with or without render, tile hanging or other external cladding.

[C] For the purpose of this PAS, protected buildings include Listed Buildings and buildings in Conservation Areas or World Heritage Sites.

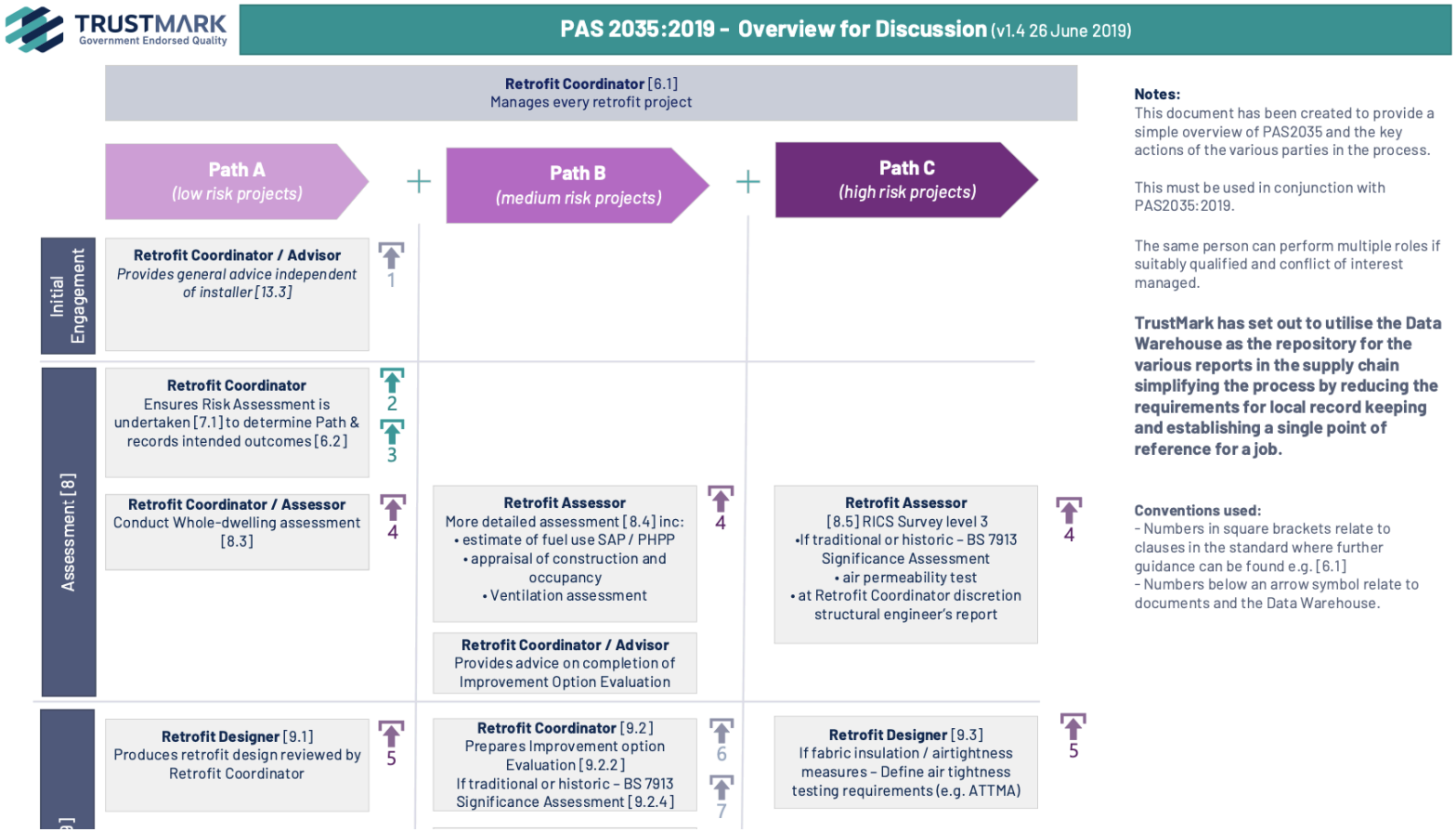
[D] Traditional means constructed with solid brick or stone walls, or timber-framed walls with any infill.

[E] System-built means frame (timber, steel or concrete) and pre-fabricated panel (concrete or timber, or a combination) construction, or timber-framed construction with brick or stone external cladding.

[F] High-rise means over 12 metres or over four storeys in height above the ground.

***NOTE** The format of Table **B.1** is provided as an example only; users of this PAS may meet the requirement for use of the content of the table in whatever manner is appropriate to their operation.*

# Risk Assessment




**Notes:**
This document has been created to provide a simple overview of PAS2035 and the key actions of the various parties in the process.

This must be used in conjunction with PAS2035:2019.

The same person can perform multiple roles if suitably qualified and conflict of interest managed.

**TrustMark has set out to utilise the Data Warehouse as the repository for the various reports in the supply chain simplifying the process by reducing the requirements for local record keeping and establishing a single point of reference for a job.**

**Conventions used:**
- Numbers in square brackets relate to clauses in the standard where further guidance can be found e.g. [6.1]
- Numbers below an arrow symbol relate to documents and the Data Warehouse.

# What is Retrofit

# What is Retrofit

- Retrofit is the process of improving the energy and environmental performance of a building through technical interventions

# Why retrofit buildings

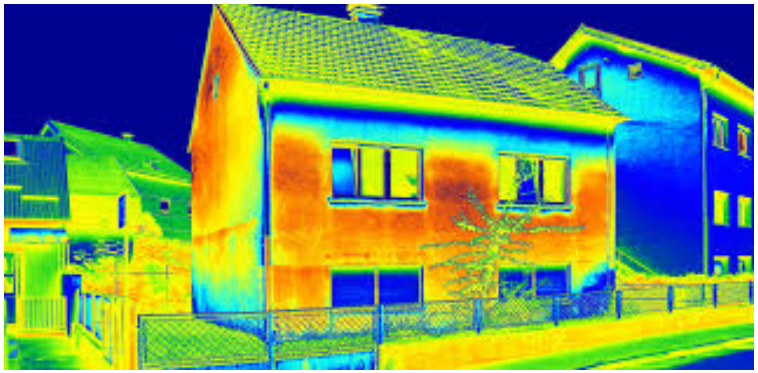
- Improve comfort and health
- Save money
- Reduce worry about fuel bills
- Improve the value of the property
- Legislation
- Reduce carbon emissions

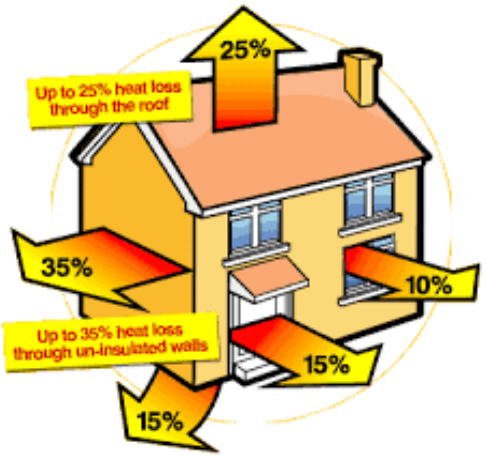
# Another initiative

- Expected energy use reduction has not been met
- Building fabric has been harmed
- Previous single approach and narrow focus to retrofit measures
- Disjointed and poor quality building process

# Whole building approach

- Fabric
- Services ( Heating and Ventilation )
- Human Behaviour





# Responsible Retrofit

- Should deliver sustained net reductions in energy use at minimal environmental impact, whilst maintaining or improving the built environment and making a positive contribution to human health
- Compromise will be required between competing values

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# Energy Assessment

# What is included in the assessement

Clause 8 of the PAS2035
The assessment shall include:
an appraisal of the dwelling's heritage, architectural features, structure, construction and condition and the installed building services (ventilation, heating, hot water and lighting) in sufficient detail to establish the suitability of the dwelling for improvement;
identification of any constraints imposed by the local planning authority (including requirements for planning permission, Listing as of Special Architectural or Historic Interest, Conservation Area constraints, Tree Preservation orders, etc.);
identification of the location and severity of any existing construction defects or structural defects or leaks, and of any condensation and/or mould growth in the dwelling; and
identification of any energy efficiency measures already installed or proposed.

# What is included in the assessment

a measured survey to establish the overall dimensions of the dwelling's heat loss envelope (including any basements and attics), the dimensions of all building elements (exposed floors, external walls, roofs, etc.) and the dimensions of all window and door openings;

- identification of constraints imposed by the site, e.g. elevation and exposure (to sun, wind and rain, major roads and industrial activity), access, party walls, rights of light, consideration of adjoining properties, etc.;
- identification of the installed building services (ventilation, heating, hot water and lighting systems and their controls), the locations of the equipment, the areas served and confirmation that the systems are working correctly (or otherwise);
- an appraisal of occupancy, including the number of occupants and any special considerations such as the presence of vulnerable persons, e.g. children or elderly people or those with disabilities;

# What is included in the assessment

an assessment of the existing ventilation in accordance with Annex **C**, including:

identification of the location and severity of any condensation and/or mould growth in the dwelling;

any intermittent extract ventilation fans or passive stack ventilators and where they are located;

any background ventilators (air inlets or “trickle ventilators”), and where they are located;

any other ventilation system and where it is located, including single-room heat recovery ventilators (srHRVs), positive input ventilation (PIV), whole-house mechanical extract ventilation (centralized cMEV or decentralized dMEV), and mechanical ventilation with heat recovery (MVHR); and

whether the identified ventilation systems are functional.

# What is included in the assessment

The data collected in accordance with **8.4.1** shall be sufficient for an estimate of annual fuel use, fuel costs and carbon dioxide emissions, under standard or actual occupancy (as appropriate) to be made by the Retrofit Assessor, Retrofit Coordinator or Retrofit Designer, using a recognized domestic energy model such as the Reduced Data Standard Assessment Procedure (RDSAP), the Standard Assessment Procedure (SAP) or the Passive House Planning Package (PHPP).

The whole-dwelling assessment, including the ventilation assessment, shall be recorded and reported to the Retrofit Designer, including any RDSAP, SAP or PHPP data file and a photographic record of all the recorded features of the building and of any identified defects.

# What is included in the assessment

If the information in the assessment is not sufficient to provide the basis of a retrofit design that complies with this PAS, the Retrofit Designer shall identify any missing information, which the Retrofit Coordinator shall arrange for the Retrofit Assessor to collate and include in an updated assessment report.

# Day 1 summary

- Retrofit Assessor Summary Day 1

- Who are Trustmark?
- What is the assessor's role within the structure of the PAS2035?
- What is the data warehouse?
- Why must information be clear and understandable?

# PHPP vs SAP vs RdSAP

# PHPP vs SAP vs RdSAP

- SAP (Standard Assessment Procedure)
- Calculates the typical annual energy costs for space and water heating, and lighting
- SAP is applied to new build properties and conversions
- Calculations are based on the actual U values of the material used
- Calculations achieved via specifications, so no inspection required
- As actual U values are used no assumptions made
- SAP certificate is the truest refection of the energy performance of a building
- PHPP Passive House Planning Package

# SAP vs RdSAP

| Summary of this home's energy performance related features | | |
|---|---|---|
| **Element** | **Description** | **Energy Efficiency** |
| Walls | Average thermal transmittance 0.21 W/mÂ²K | ★★★★★ |
| Roof | Average thermal transmittance 0.12 W/mÂ²K | ★★★★★ |
| Floor | Average thermal transmittance 0.13 W/mÂ²K | ★★★★★ |
| Windows | High performance glazing | ★★★★★ |
| Main heating | Air source heat pump, radiators, electric | — |
| Main heating controls | 2207 Time and temperature zone control | ★★★★★ |
| Secondary heating | None | — |
| Hot water | From main system | — |
| Lighting | Low energy lighting in all fixed outlets | ★★★★★ |
| Air tightness | Air permeability 4.7 mÂ³/h.mÂ² (as tested) | ★★★★☆ |

Thermal transmittance is a measure of the rate of heat loss through a building element; the lower the value the better the energy performance.
Air permeability is a measure of the air tightness of a building; the lower the value the better the air tightness.

Current primary energy use per square metre of floor area: 131 kWh/m² per year

# SAP vs RdSAP

- RdSAP (Reduced data Standard Assessment Procedure)
- For existing dwelling EPCs, uses a reduced version of SAP
- Properties assessed with RdSAP recorded using information available at face value.
- Assessments carried out via visual inspection of elements of the property
- Assumptions made on the U-values based on predefined values based on the property's age.
- Properties glazing area also predefined based on age.
- Predefined values can be over written when credible evidence is available

# SAP vs RdSAP

| Summary of this home's energy performance related features | | |
|---|---|---|
| **Element** | **Description** | **Energy Efficiency** |
| Walls | Solid brick, as built, insulated (assumed) | ★★★★☆ |
| Roof | Pitched, insulated (assumed) | ★★★★☆ |
| Floor | (another dwelling below) | — |
| Windows | Fully double glazed | ★★★★☆ |
| Main heating | Room heaters, electric | ★☆☆☆☆ |
| Main heating controls | Programmer and appliance thermostats | ★★★★☆ |
| Secondary heating | None | — |
| Hot water | Electric immersion, off-peak | ★★☆☆☆ |
| Lighting | No low energy lighting | ★☆☆☆☆ |

Current primary energy use per square metre of floor area: 207 kWh/m² per year

# Risks from responsible retrofit

- Risks to building fabric
- Risks from services
- Risks from human behaviour

ecmk

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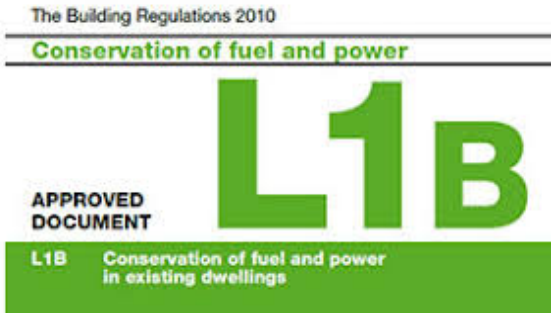
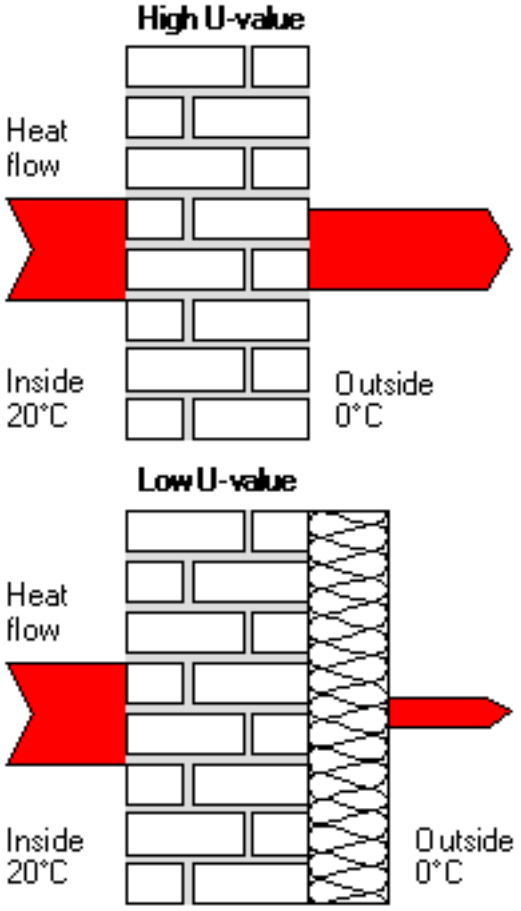
# Thermal Properties

# U Values

Definition

- A measure of heat transmission through a material or building part
- Please read and understand Building Regs Part L1B

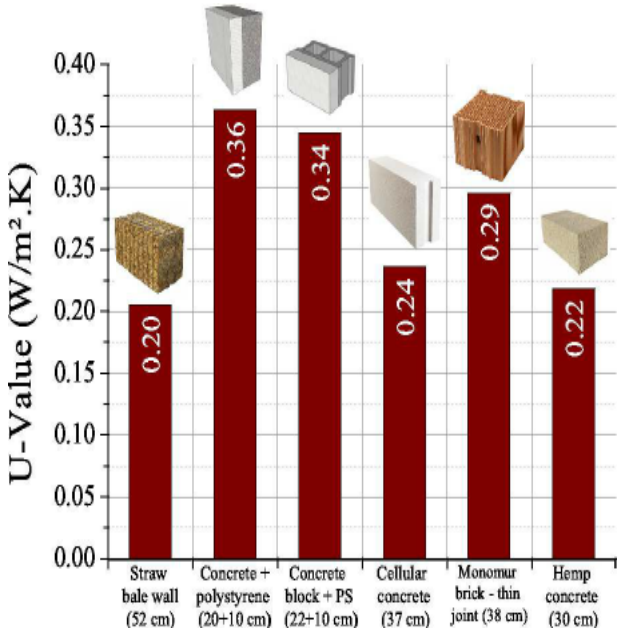


# U Values

What is a U Value

- Thermal transmittance is the rate of transfer of heat through a material or building part
- This can be a single material
- This can be composite materials
- The unit of measurement is expressed as W/m2k



# U Values

How is a U value measured

- U value is measured in watts per metre squared kelvin or W/m2k
- In other words
- The amount of energy in watts or W that travels through one square meter of material (m2) per every 1 degree of temperature difference between inside and outside

# U Values

How long have we been using U Values

- 1965
- National Building Standards were introduced in 1965
- Building regulations establish standards that had to be achieved in the construction of building
- Approved Documents

# U Values

Where can we find U values in RdSAP ?

- U values underpin the data inputs in RdSAP
- Appendix S
- Walls
- Roof
- Floors
- Windows
- Doors

# U Values

What makes a good U Value

- The better insulated a structure is the lower the U value will be
- 1965 Cavity Wall U value 1.60 W(m2k)
- 2012 Cavity Wall U Value 0.28 W/(m2k)
- You will use less heat
- You will spend less money

# U Values

Picture examples of Walls

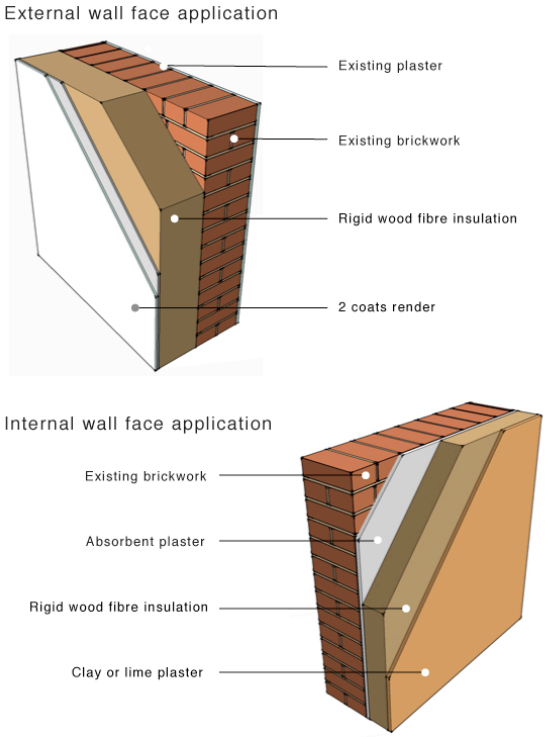
Solid brick wall

102mm brick with dense plaster – U Value 2.97

228 mm brick with dense plaster – U Value 2.11

343mm brick with dense plaster – U Value 1.64

Cavity Wall



# Property effects on health of low indoor temperature

- 21 to 24 Degrees Comfortable
- 18 Degrees Possible discomfort, No risk except for the vulnerable eg elderly
- 16 Degrees. Uncomfortable, risk of respiratory conditions
- 12 Degrees. Cardiovascular Risk
- 6 Degrees. Beyond 2 hours risk of hypothermia
- NB: Temperatures are for fit and healthy people

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# Occupancy Assessment

# Explaining Energy Data

- SAP and RdSAP applies Assumed Occupancy to EPC
- This Assumed Occupancy is used to calculate the cost of heating and lighting the property
- Potential savings are also calculated using Assumed  Occupancy
- As the same occupancy is applied to all certificates this allows comparisons to be made.
- The actual costs and savings likely to be very different.
- EPC unable to accommodate actual usage of energy within dwelling
- Dealing with vulnerable customers
- Standard occupancy currently is 11 hours/day is 9 hours on weekdays and 16 at weekends (standard SAP heating schedule), giving a weekly average of 11 hours/day

# Occupancy Assessment

What data do you require?

# Explaining Energy Data

- Recommendations for home improvements assume best case scenarios
- Does not take into account limiting factors which may prevent measures being installed.
  - E.g. building defects or planning restrictions
- Recommendations do not exceed existing parameters
  - E.g. report will never recommend changing fuel type unless other fuel type is available

# Explaining Energy Data

- Environment Impact, often overlooked as relegated to the back page.
- As greater focus is placed on reducing properties carbon footprint so too will the focus on this part.
- As before the calculation for carbon dioxide produced by the property is based on assumed occupancy .

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# Condition Survey

# Building Structure

Identification of the location and severity of any existing construction defects or structural defects or leaks.

BRE journals;

Non traditional housing

Rising damp in walls DG245

Condensation and dampness AP309

good repair guide

CI/SfB (27.2) (L27)

**Remedying condensation in domestic pitched tiled roofs**

**Good Repair Guide 30**

**One of the most common and cost-effective ways of saving energy in houses is to insulate the roof space, usually by laying insulation between the ceiling joists. But adding insulation increases the risk of condensation in the roof and can lead to damage to the contents of the loft, the insulation and possibly even the roof structure. This Good Repair Guide describes how to find out whether a pitched tiled roof is at risk from condensation and how to minimise it.**

**Why condensation occurs in the roof space**

Large amounts of water vapour are produced in houses, mainly in bathrooms and kitchens. Up to 30% of it can find its way into the roof space through holes in the ceiling, mostly through gaps round loft hatches and pipework. Smaller amounts get through gaps round light fittings and penetrate the ceilings themselves. When the warm air meets the cold surfaces in the roof space, the water condenses out into water droplets.

In recent years the risk of condensation in the roof has increased, due to a combination of factors. Houses are much better insulated and heated, so the air can hold larger quantities of water vapour and more finds its way into the roof space. Furthermore, the trend to higher levels of insulation means that roof spaces are colder. These factors combine to increase the risk of condensation. The best way of preventing this happening is to ventilate the roof space.

Current building regulations stipulate a minimum standard of roof ventilation and most modern roofs are properly ventilated. In many

**Condensation in the roof space can lead to mould growth and rot in the timbers**

**Insulation packed into the eaves has blocked ventilation paths. When the insulation quilt was lifted it was saturated with water condensate**

BRE

constructing the future

# Building Structure

- Assessing moisture in building materials
- Damage caused by trees
- Wood boring insects
- Wood Rot assessing

good repair guide

BRE

CI/SfB (L6)
January 1998

## Wood-boring insect attack:
### identifying and assessing damage

## Good Repair Guide 13
Part 1

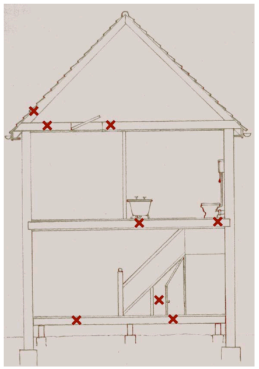
**Wood can be a food source for many insect species. Timber in buildings can be attacked by a range of wood-boring insects. Each insect has preferred timber species and some need the wood to be decayed. Structural weakening can result from infestation by some beetles. This Guide contains advice on inspecting timber for wood-boring insects, and identifying different types of attack. It should be read in conjunction with Good Repair Guide 12 on identifying and treating wood rot on timber.**

**Part 2 of this Guide**
For dealing with wood-boring insect damage – see Part 2

Many insect species use wood as a food source, causing damage to timber by tunnelling into standing trees, freshly felled logs or wet decaying timber. A few beetles attack dry timber in buildings.

Eggs laid by adult beetles on timber surfaces, or in cracks in timber, hatch to release small grubs (larvae) which bore into the wood, feeding on it and creating a network of tunnels. The larvae of most wood-boring beetles fill the tunnels with excreted wood pellets known as *bore dust* or *frass*. The size, shape and cross-section of the tunnels, and the characteristics of the bore dust are useful in identifying the species of beetle (see photographs on page 2 and Table 1).

After feeding, usually for several years, the larvae undergo a transformation within the timber, through a pupal stage into the adult beetle. The beetles emerge, leaving the familiar 'woodworm' exit holes in the surfaces of the timber. The adults do not themselves cause further damage but, after mating, females often reinfest by laying their eggs in suitable timber. Damp conditions generally encourage infestation by most insects and, in particular, death watch beetle and common furniture beetle.



Areas at greatest risk from attack, particularly if they are damp

# Day 2 summary

- Retrofit Assessor Summary Day 2

- Briefly explain the Risk Paths
- Explain the main benefits of Retrofitting a property?

# Building Structure

What areas of the building will you be assessing/analysing?

How do you record these defects?

# Building Structure

- Walls- pointing, flashing, spalling of the bricks, cracking of the walls

# Building Structure

# Building Structure

- External Walls
- Mortar must be intact when Retro fitted cavity wall insulation is recommended
- The cavities must be free from builders rubble prior to install
- Tree roots can cause brickwork to crack
- Cavity wall tie failure illustrated by horizontal cracking
- Bulging of gable end wall . The cause can be vibration from traffic or machinery

# Building Structure

- Internal wall: Damp, cracks, condensation

# Building Structure

- Walls- pointing, flashing, spalling of the bricks, cracking of the walls

# Building Structure

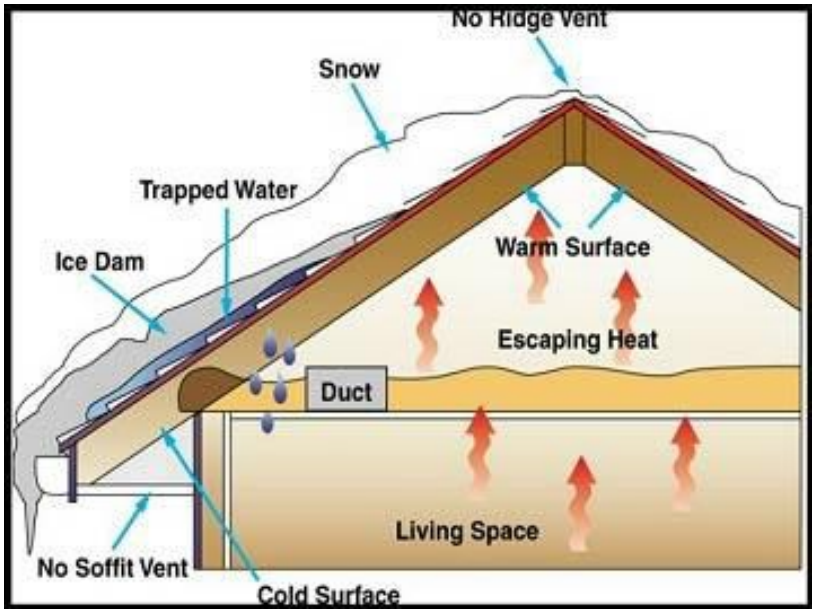
- Condensation: Where would you find?

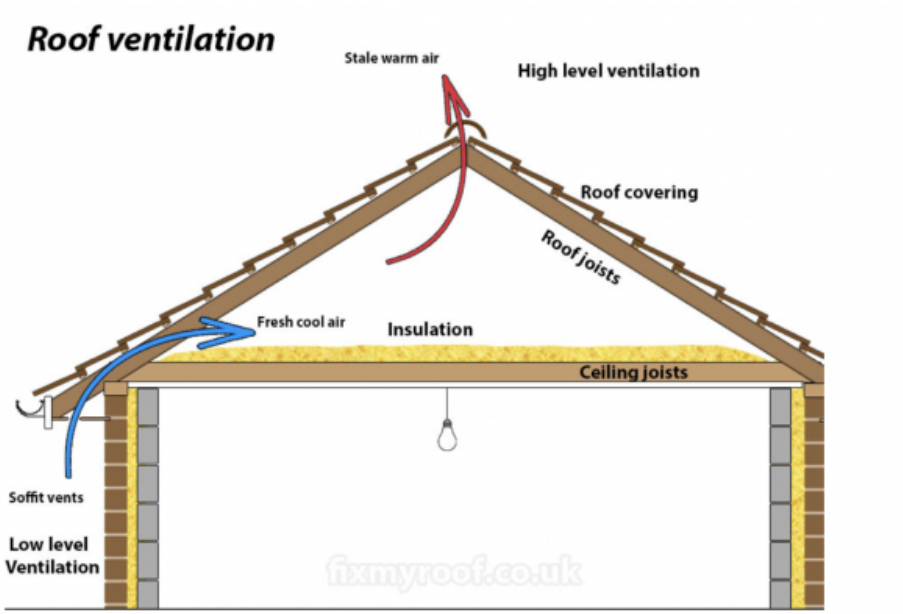

# Building Structure

- Roof spaces: Condensation, rotten timbers, unsafe to enter

# Building Structure

- Roof spaces: Condensation, rotten timbers, unsafe to enter

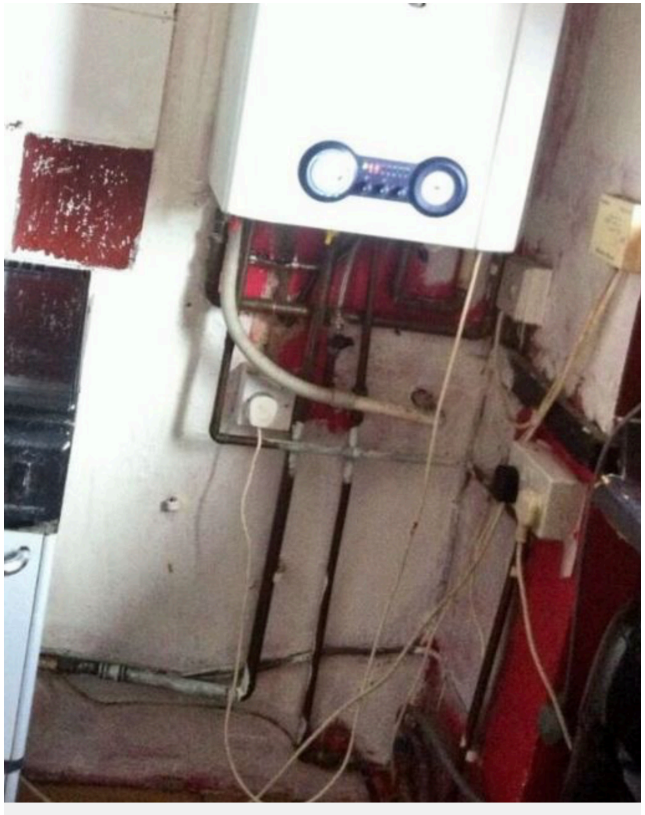


# Building Structure

- Access issues?
- Boiler?
- Flue location?
- Controls?
- Access ladders?

# Building Structure



# Building Structure


# Day 2 summary

- Retrofit Assessor Summary Day 2

- Briefly explain the Risk Paths
- Explain the main benefits of Retrofitting a property?

# Other considerations

# Tree Preservation Order

A tree preservation order is an order made by the local planning authority in England to protect specific trees group of trees or woodland

The order prevents

Cutting Down, Topping, Lopping, Uprooting,

Wilful damage, Wilful destruction

# Heritage Buildings

# Definition

- A building which is constructed in a way which means that special care is required to ensure that the installation of improvements does not result in damage to or deterioration of the building fabric
- As defined in building regulation document L1B2010

# Number of older buildings

How many older buildings do we have ?

- In England 4.7 million homes were built prior to 1919. This represents over 20% of our housing stock
- 1.1 million dwellings are in conservation area's
- 200,000 Listed buildings

# General Principles of Listing

- All buildings built before 1700 which survive in anything like their original condition are likely to be listed as are most buildings built between 1700 and 1850
- Careful consideration is required is required for buildings from the period after 1945
- Buildings less than 30 years old are normally considered to be of special architectural or historic interest because they have yet to stand the test of time
- Listed status covers the whole building both inside and out

# Type of Listings

- Grade I
- Buildings are of exceptional interest, sometimes considered to be internationally important
- 2.5% of listed buildings are Grade I
- Example of any Grade I buildings below

# Grade II*

- Buildings that are particularly important, buildings of more than special interest
- 5.8% of listed buildings are Grade II*

# Grade II

- Grade II building are nationally important and of special interest
- 92% of all listed buildings are in this class and it is the most likely grade of listing for a homeowner

# Listed building consent

- Listed does not freeze a building in time it simply means Listed Building Consent must be applied for in order to make any changes which might affect its special interest
- Listed Buildings can be:
- Altered
- Extended
- Demolished within planning guidance

Historic England

# Conservation Area

- Is the building in a conservation area ?
- Conservation areas are usually designated by local planning authorities
- In England there are over 9000 conservation areas
- Demolition of all buildings is controlled

# Conservation Area

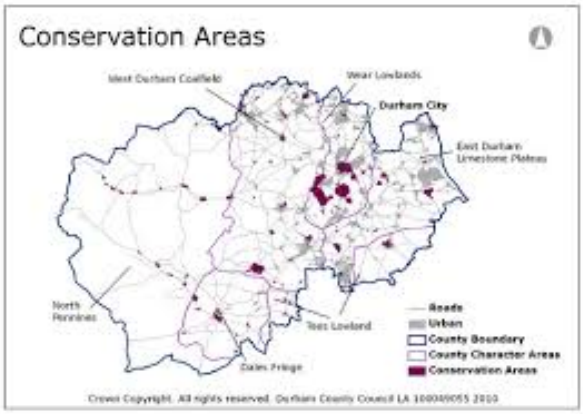
- In a conservation area the main emphasis is on the protection and enhancement of the area
- Great importance is attached to external appearance of the building
- Walls, Roof, Window, Doors, Roof lights
- The addition of external cladding and changing of the roof line will generally require planning permission. In some conservation areas planning permission may also be required for works such as replacement of doors and windows, roof lights, dormers, loft extensions

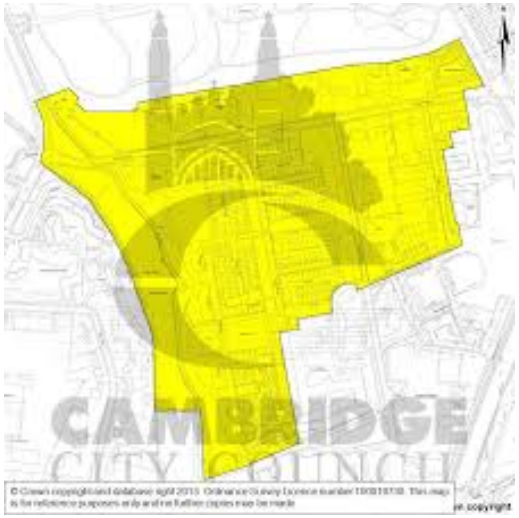
# Conservation Area

- Common internal works requiring consent may include
- Removal of internal walls
- Altering or removing fireplaces
- Painting over brickwork

# Conclusion

- Understand the significance of the building
- When carrying out the EPC assessment it is important to check any planning constraints that may affect the property
- Contact the conservation officer at the local planning authority



# What's Different About Older Buildings ?

# They need to breathe

- A key characteristic of older buildings is the use of permeable building materials which are able to absorb moisture and release it again without damage to the building
- By contrast, most modern buildings rely on impervious materials to keep moisture out
- Lime mortar is a key part of tradition construction. When driving rain strikes an external wall the bricks and mortar absorb large amounts of moisture. When the rain has stopped the moisture is able to evaporate freely particularly through the lime mortar joints. However, if a hard impermeable cement mortar is used this can trap moisture so it is not able to evaporate. This can lead to damp walls and damaged masonry

# Heat storing capacity

- Older masonry buildings were often constructed with thick external masonry walls as well as masonry internal walls incorporating chimney flues. This form of construction can readily absorb and store warmth as the building is heated. This stored heat is then slowly released as the building cools down

# Protection for older buildings

- Older building vary greatly in the extent to which they can accommodate change without harming special interest
- Some buildings or parts of buildings are of such importance that they should not be altered except in the most exceptional circumstances
- If possible alterations should be designed in such a way so that they can be reversed without damaging the existing fabric
- This is especially relevant to building services

# Areas of the EPC that need attention

- Selecting the correct age band
- The age band determines the default U values as well as the ratio of the floor area to window area
- Identifying the correct construction
- Often solid walls are wrongly identified as cavity wall construction. Failure to correctly identify the construction could result in an incorrect energy rating and recommendation for inappropriate works

# Areas of the EPC that need attention

- Understanding the condition of the building
- Lack of maintenance is one of the main contributory factors for decay in older houses.
- This could be from overflowing gutters
- Blocked ventilation
- Damp materials
- Such issues need to be tackled before measures to improve energy performance are undertaken

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# Solar Gains

# Solar Gain & Building Design

- Solar Gain and Building Design
- Solar gain can have both positive or negative effects depending on the climate. In the context of passive solar building design, the aim of the designer is normally to maximize solar gain within the building in the winter (to reduce space heating demand), and to control it in summer (to minimize cooling requirements). Thermal mass may be used to even out the fluctuations during the day, and to some extent between days.
- Control of Solar Gain
- In climate-responsive design for cold and mixed climates, windows are typically sized and positioned in order to provide solar heat gains during the heating season. To that end, glazing with a relatively high solar heat gain coefficient is often used so as not to block solar heat gains, especially in the sunny side of the house. SHGC also decreases with the number of glass panes used in a window. For example, in triple glazed windows, SHGC tends to be in the range of 0.33 - 0.47. For double glazed windows SHGC is more often in the range of 0.42 - 0.55.
- Different types of glass can be used to increase or to decrease solar heat gain through fenestration, but can also be more finely tuned by the proper orientation of windows and by the addition of shading devices such as overhangs, louvers, fins, porches, and other architectural shading elements.

# Solar Gain - Lighting

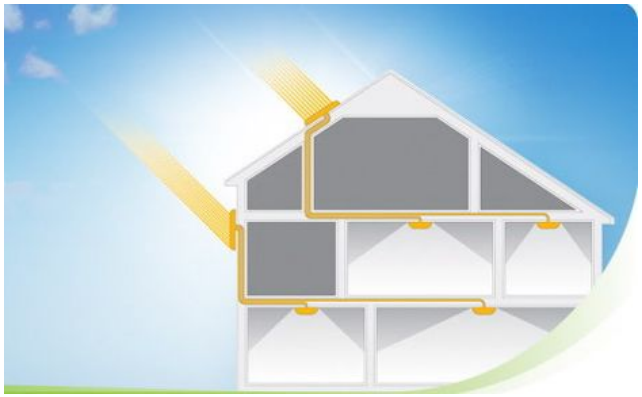
Benefits of natural lighting in our buildings

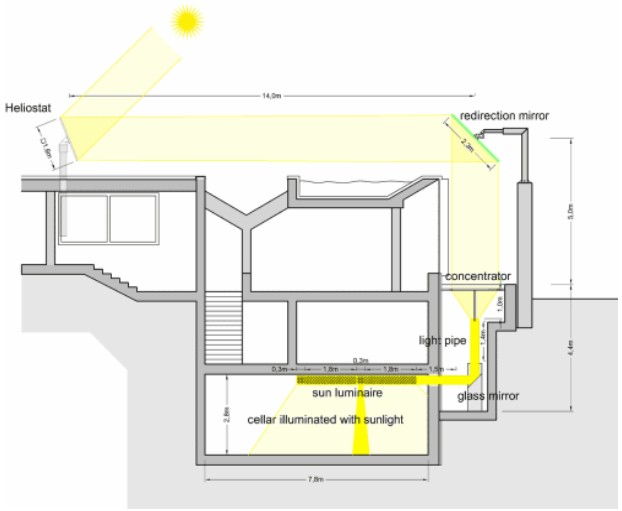
Natural light in our buildings is known to improve occupant comfort. Scientists suggest that good natural light can increase occupant productivity and comfort, providing the mental and visual stimulation necessary to regulate the human circadian rhythms. Implementing natural light into a design also leads to substantial energy savings, by way of reducing the electricity requirements for artificial lighting. It is possible to install daylight sensing controls to a lighting design to further reduce energy usage by between 20-60%.

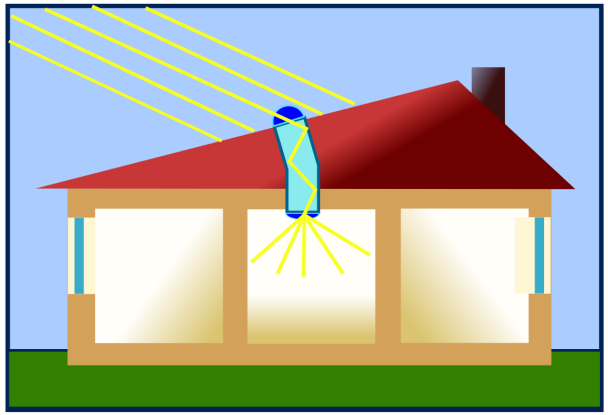
As long as glare is controlled and solar gain accounted for designed appropriately there is no question that natural lighting will improve occupant satisfaction, mood and productivity. Studies suggest that humans in modern cities now spend upwards of 90% of their lives indoors – which makes it more important than ever to ensure we are allowing users to experience the natural outdoor cycles and variation of illuminance levels from within the buildings.

# Solar Gain - Skylights

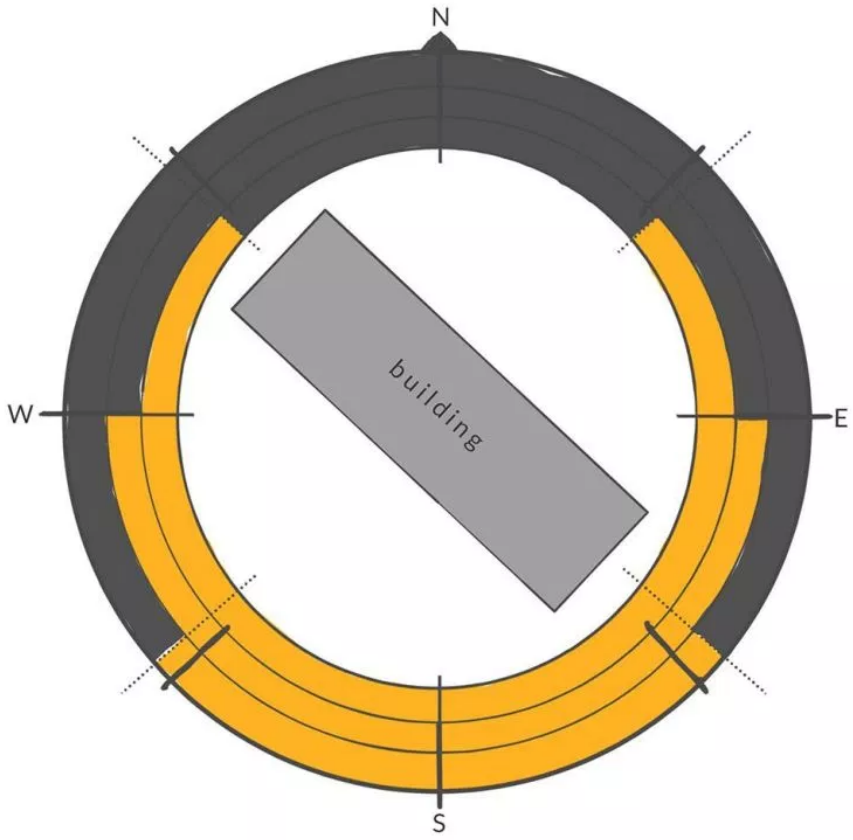
Examples of skylights and the benefits of providing natural light into a property





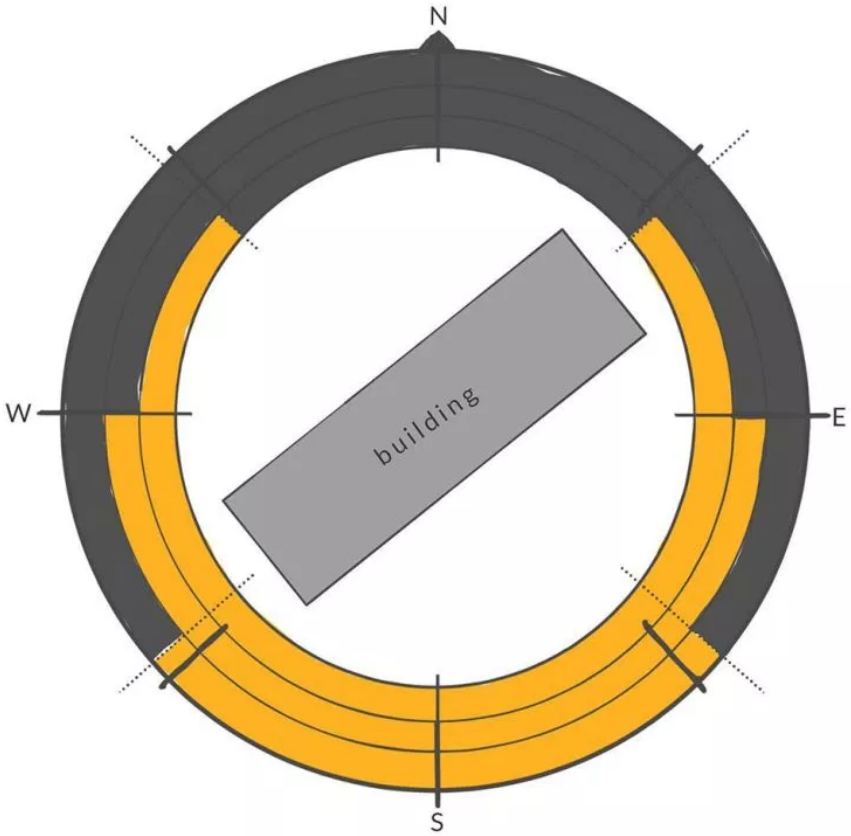



# Solar Gain




A North-West to South East block suits larger flats with bedrooms and utility to the north east and living rooms to the south west.

# Solar Gain



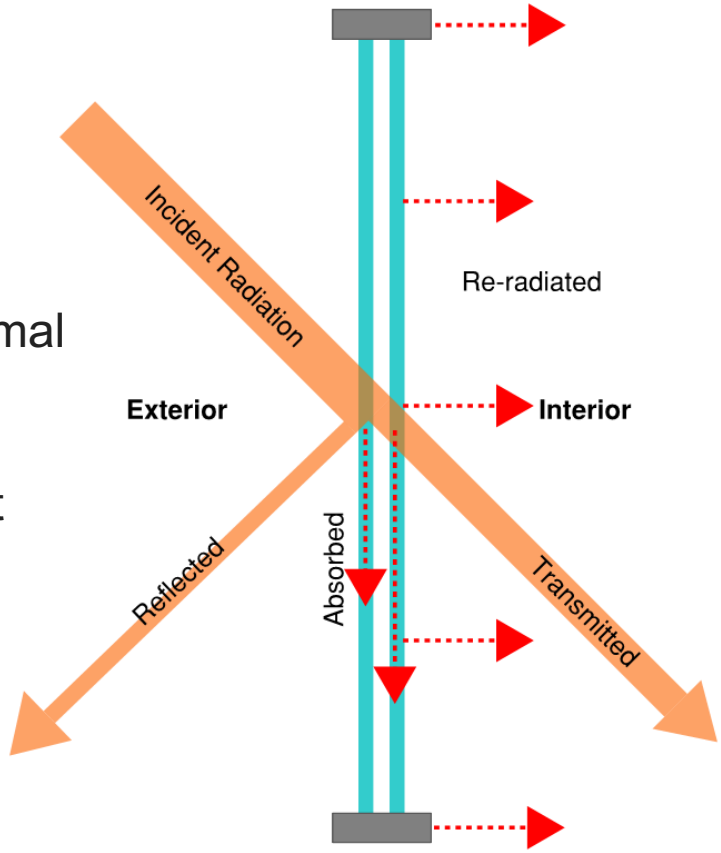

A North-East to South-West building is well suited to 3 and 4 roomed flats with the living and bedrooms to the south-east and utility and subsidiary rooms to the north-west.

It is worth noting that light from above is brighter and as such the inclusion of roof lights are often preferable too. 100% of light from the sky will reach a roof light, whereas only 33% of the light from the sky will reach the windows at the side of a building. This can be controlled with angled roof lights, shading, up stands and so on.

# SOLAR GAIN

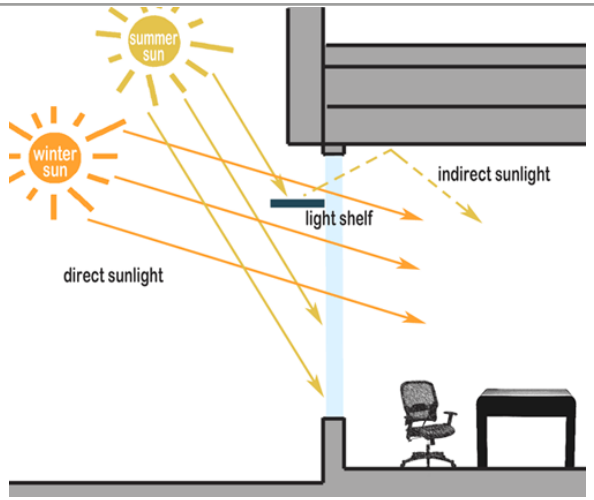
Solar gain through windows includes energy transmitted directly through the glass and energy absorbed by the glass and frame and then re-radiated into the space.

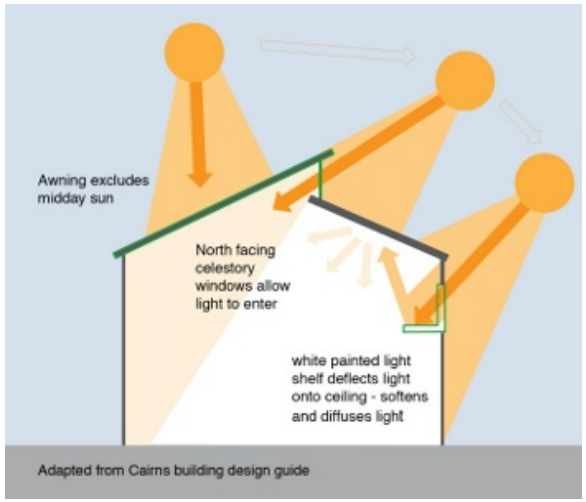
**Solar gain** (also known as **solar heat gain** or **passive solar gain**) is the increase in thermal energy of a space, object or structure as it absorbs incident solar radiation. The amount of solar gain a space experiences is a function of the total incident solar irradiance and of the ability of any intervening material to transmit or resist the radiation.



# Solar Gain - Windows

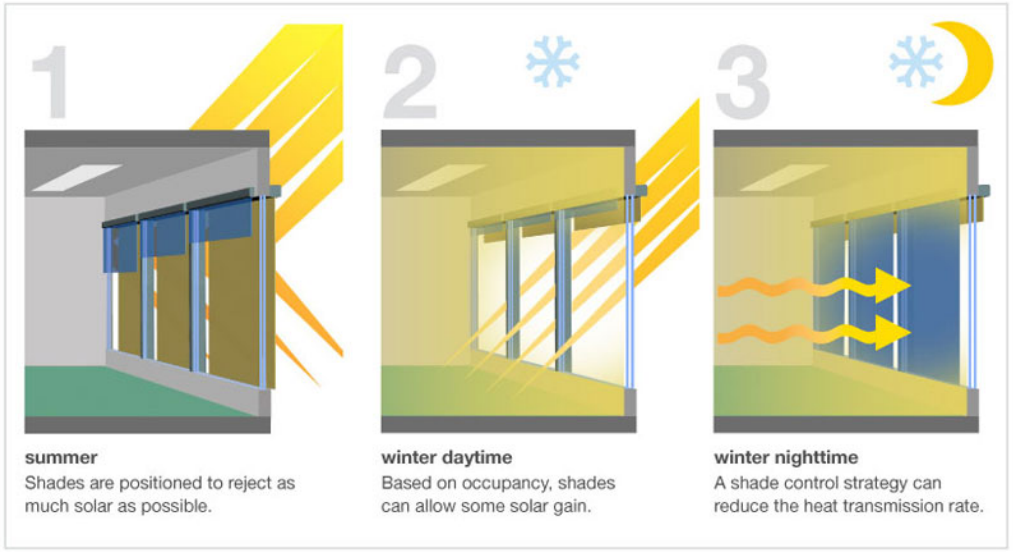
Windows are the most common way to admit daylight into a space. Their vertical orientation means that they selectively admit sunlight and diffuse daylight at different times of the day and year. Therefore, windows on multiple orientations must usually be combined to produce the right mix of light for the building, depending on the climate and latitude. There are three ways to improve the amount of light available from a window:

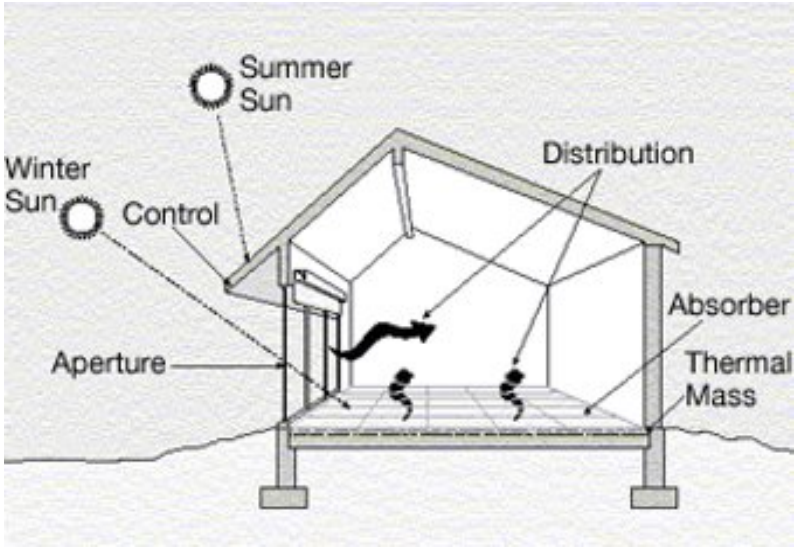


# Solar Gain – Heating & Cooling

- In **passive solar building design**, windows, walls, and floors are made to collect, store, reflect, and distribute solar energy in the form of heat in the winter and reject solar heat in the summer. This is called passive solar design because, unlike active solar heating systems, it does not involve the use of mechanical and electrical devices.[1]
- The key to designing a passive solar building is to best take advantage of the local climate performing an accurate site analysis. Elements to be considered include window placement and size, and glazing type, thermal insulation, thermal mass, and shading.[2] Passive solar design techniques can be applied most easily to new buildings, but existing buildings can be adapted or "retrofitted".



# Solar design

Elements of passive solar design, shown in a direct gain application

Darmstadt University of Technology in Germanywon the 2007 Solar Decathlon in Washington, D.C.with this passive house designed specifically for the humid and hot subtropical climate[19]

# Solar design

Brise Soleil on a domestic property

# Solar design

Solar shading film

One glazed door covered in solar shading film

# Day 3 summary

- Retrofit Assessor Day 3

- Explain what a u value is
- How can you identify a listed building?
- What considerations must be made for older, listed and conservation area properties?
- What are solar gains and what information must you gather on relation to solar gains?

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# Damp/Moisture

# Condensation

- Definition
- Condensation is the process by which water vapour in the air is changed into a liquid
- When or why does it change to a liquid?

# Why does condensation occur

- Air contains water vapour, the warmer the air the more vapour it can hold. If moist air comes into contact with a cold surface the air is cooled; if the air is cooled below a particular temperature the water vapour will condense on a cold surface. Therefore, whether or not condensation occurs depends on the amount of water vapour in the air and the temperature of the surface in contact with the air

# Recognition

- What to look for if condensation is present

- The wall has a misty surface
- Stains or streaks of water running down a wall and below windows
- Damp patches with no definite edges
- Dampness behind wall cupboards
- Dampness behind wardrobes located close to an external wall
- Patches of mould growth

# Why is condensation a problem

- Until 1960's most houses were well ventilated
- Modern houses with double glazing is almost a sealed unit. Therefore, ventilation is limited. The use of balanced flue boilers as opposed to open fires reduces natural ventilation
- Central heating systems are used intermittently
- More appliances in the house generate moisture

# Where does condensation occur

- Bathrooms
- Kitchens
- Utility areas
- In a badly vented roof space
- Living room walls and bedroom walls if intermittent heating is used in solid brick properties
- Ceiling if roof insulation is missing
- Concrete floors

# Where does moisture come from

- Typical of a 3 bedroom house per day

- A family asleep generate 1.5 to 2.0 kgs moisture
- A family during the day 2.5 to 3.5 kgs moisture
- Cooking 2.0 to 3.0 kgs moisture
- Washing and bathing 1.0 to 1.5 kgs moisture
- Washing clothes 0.4 to 0.6 kgs moisture
- Drying clothed indoors 3.0 to 5.0 kgs moisture
- Large dogs

# How can it be avoided

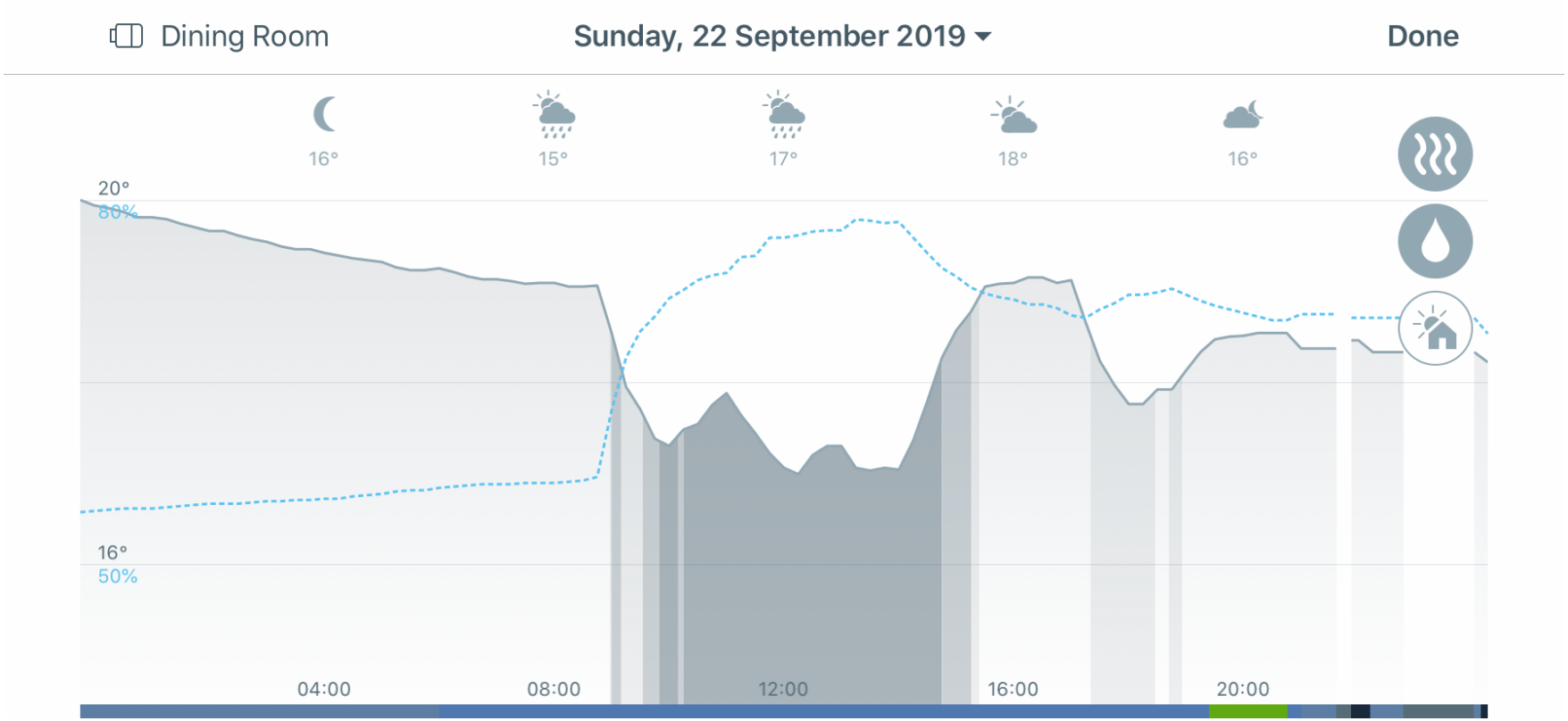
- Limiting the amount of moisture generated
- Ventilating the property
- Insulation
- Heating

- Dealing with condensation effectively can be a problem particularly when people have limited incomes and cannot afford to have the heating on
- Air moisture should be 40%-60%. Prolonged periods of >75% will cause condensation

# How can we reduce the amount of moisture

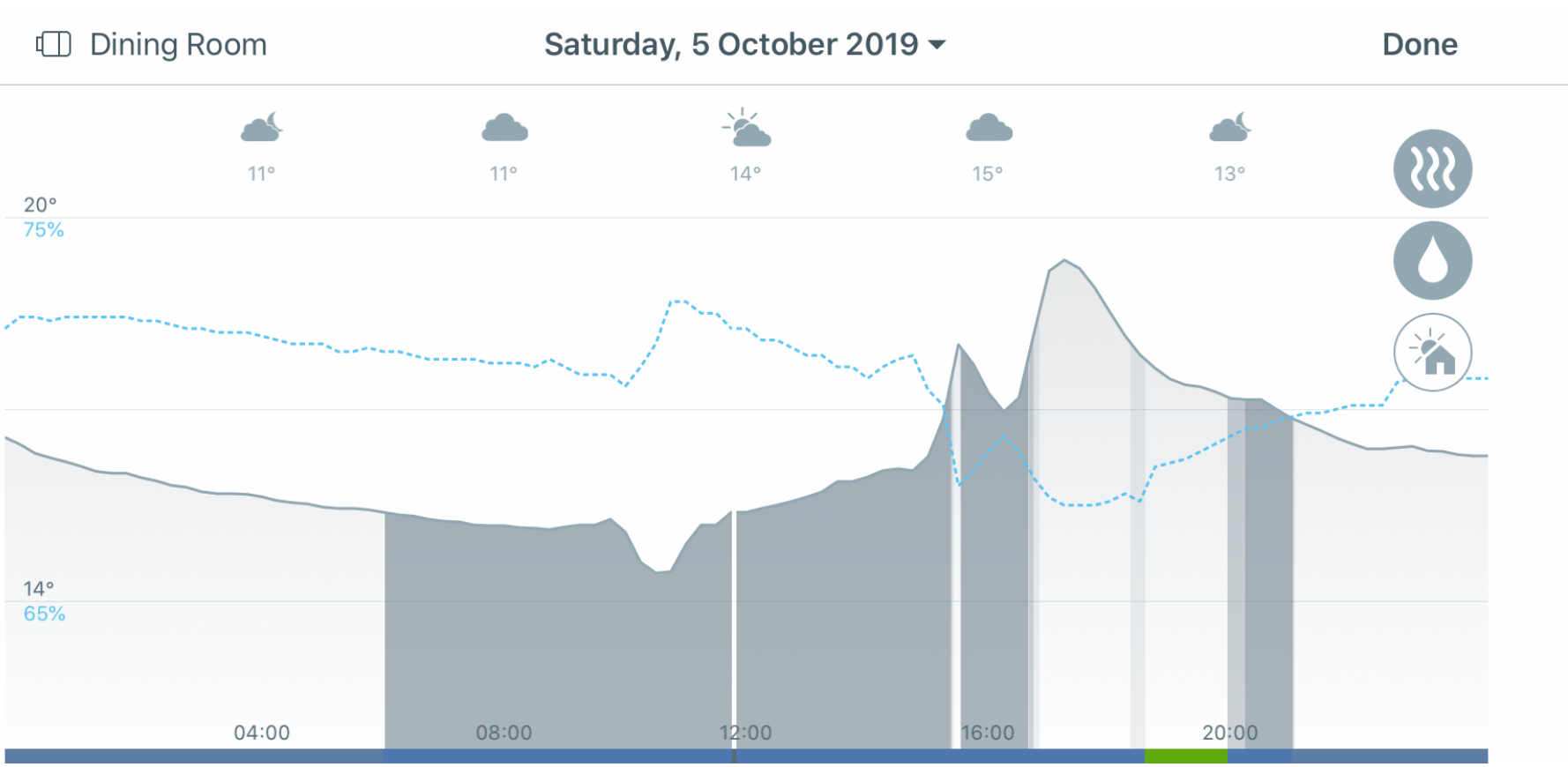
- Keep lids on pans during cooking
- Dry clothes outside whenever possible
- Ensure tumble dryers are ventilated externally
- Do not use paraffin or bottled gas heaters
- Put cold water in the bath before hot water
- Ensure that trickle ventilators are kept open, particularly at night
- Open windows when cooking or taking a bath
- Keep the water vapour in the room where it is generated to prevent it travelling to cooler areas

# How can we reduce the amount of moisture

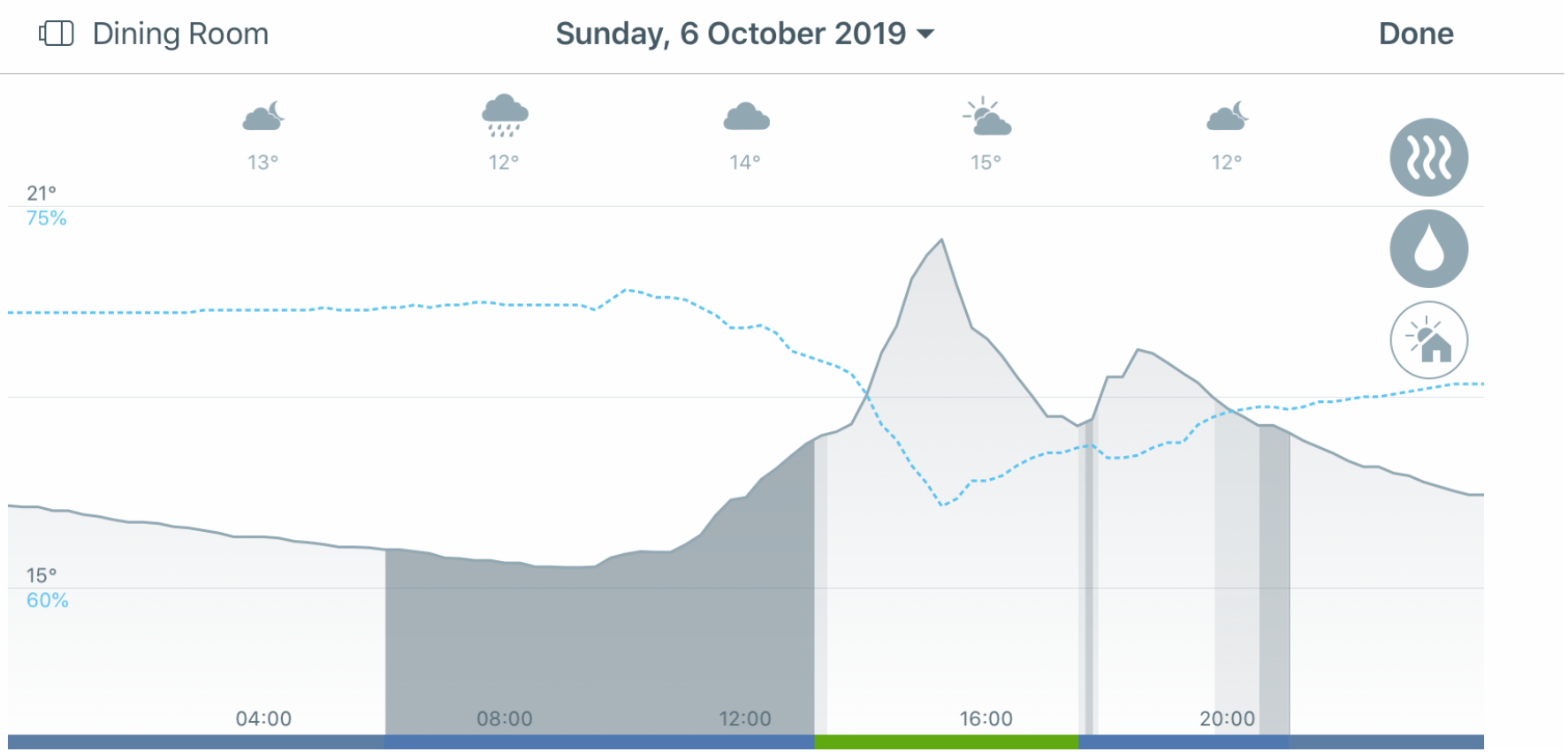



What is happening here?

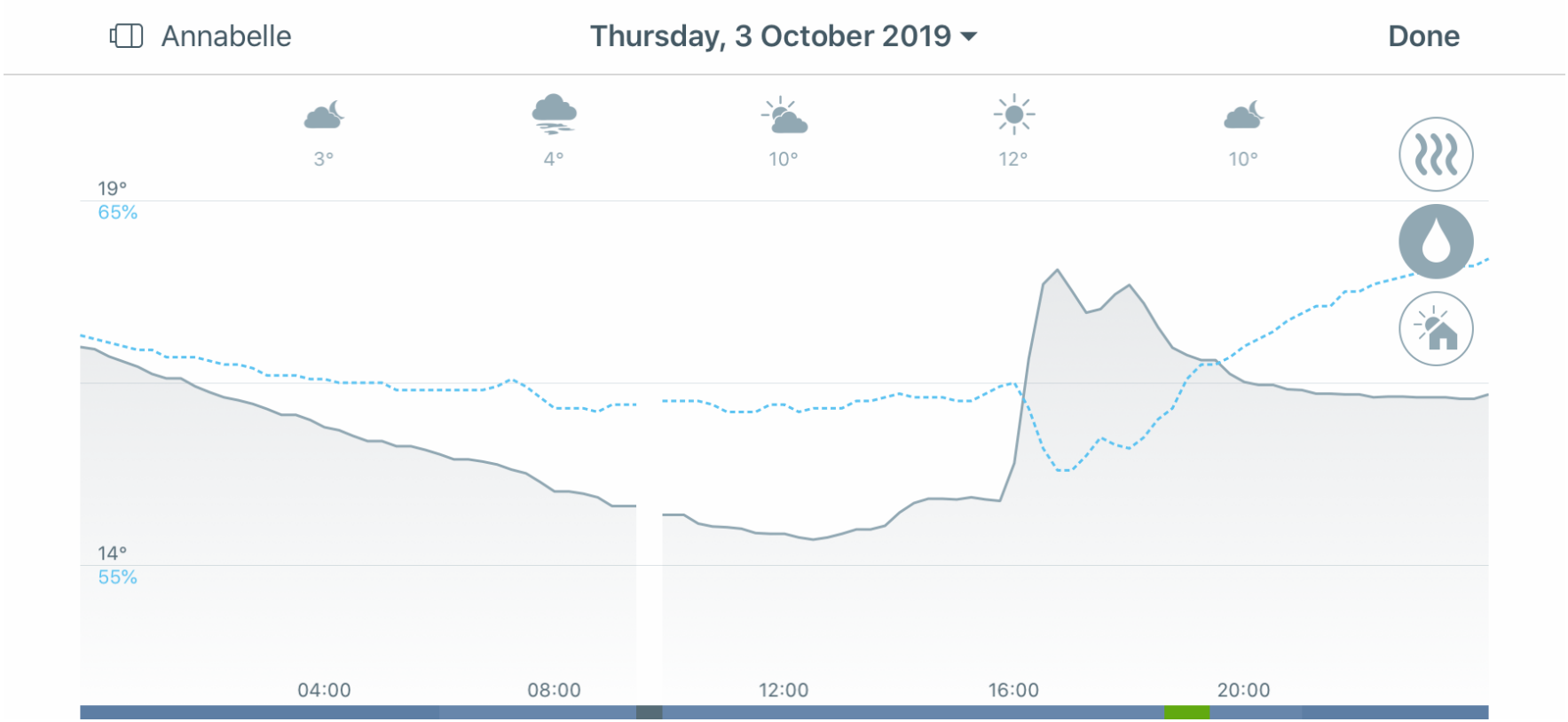
# How can we reduce the amount of moisture



# How can we reduce the amount of moisture

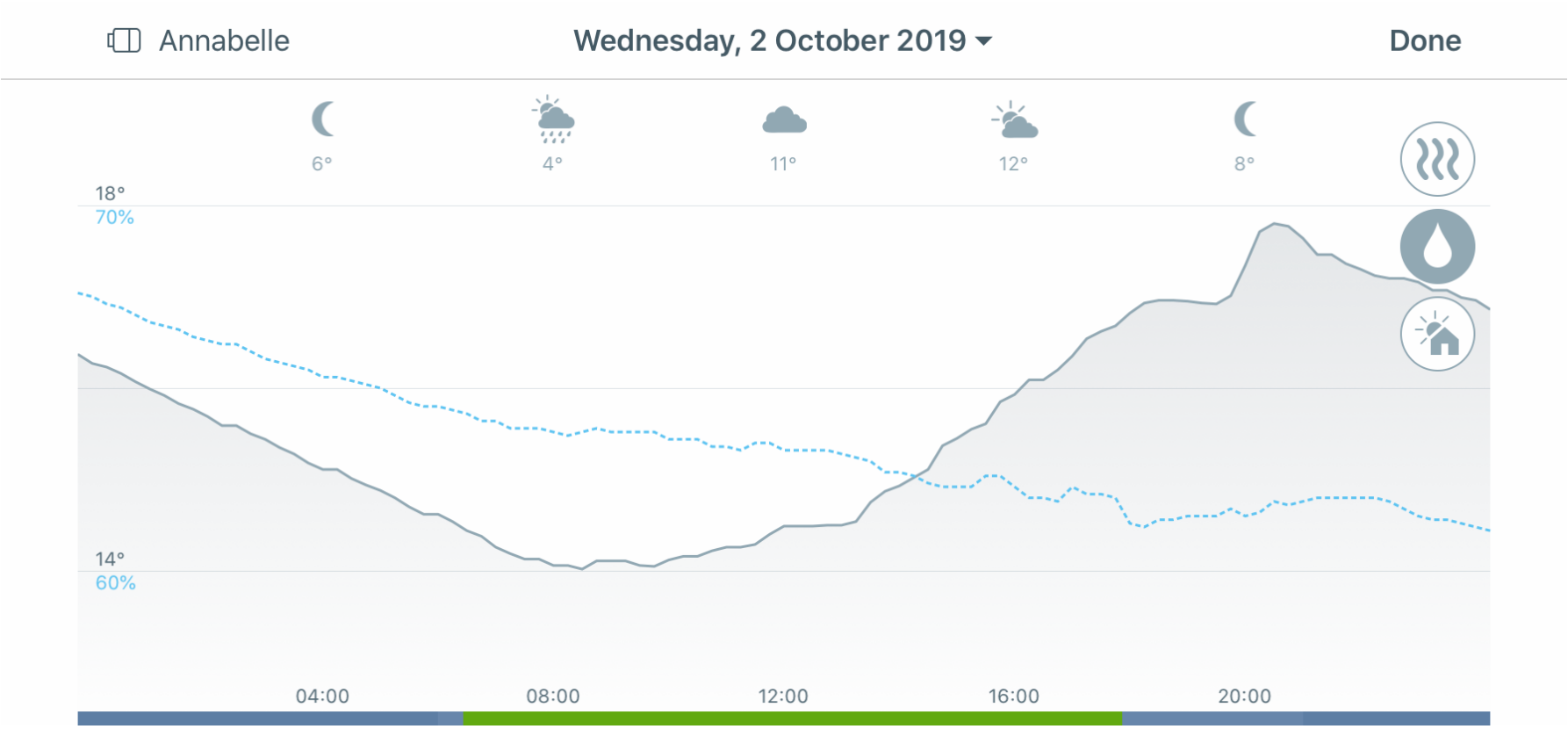


# How can we reduce the amount of moisture




Children's Bedroom (before)

# How can we reduce the amount of moisture




Children's Bedroom (after)

# Lifestyle changes

- Minor life style changes as outlined above can significantly reduce the incidence of condensation. Because there are no cost implications these are the areas to consider first

# Ventilation

- Ventilation plays an important part in combating condensation. However, ventilation alone will not prevent condensation occuring and may in fact lower the air temperature
- One air change per hour does have a marked effect on air temperature
- Clothes should not be left to dry in a room without adequate ventilation
- Trickle ventilators in windows are left open
- Extractor fans are working and used in Bathrooms and kitchens and utility areas

# Insulation and heating

- These two areas cannot be considered in isolation. Wall insulation on it's own will have little success in combating condensation unless heating is provided

# The role of dehumidifiers

- Dehumidifiers can be effective in combating condensation. We have to recogise their limitations
- Work well in well heated houses with high amounts of water vapour in the air
- With low air temperature the amount of vapour in the air is less and low amount of moisture will be extracted
- Can be noisy
- Can be bulky
- Cost prohibitive
- Need one in each problem room
- Need continuous power

# Condensation

- Not to be confused with Rising Damp which is moisture absorbed from the ground into a wall
- Not to be confused with Penetrating Damp which is water infiltration from outside of the property to the inside
- If the diagnosis is incorrect this means wasted resources and wasted effort

# Why ventilate

- The provision of fresh air to a building
- Correct ventilation helps keep a home energy efficient safe and healthy
- Without proper ventilation an insulated house and airtight house will seal in accumulated pollutants such as carbon and moisture that can damage a house
- Excessive moisture can lead to mould growth

# Part F Building Regulations

## Table 5.1a **Extract ventilation rates**

| Room | Intermittent extract | Continuous extract | |
|---|---|---|---|
| | **Minimum rate** | **Minimum high rate** | **Minimum low rate** |
| Kitchen | 30 l/s adjacent to hob; or 60 l/s elsewhere | 13 l/s | Total extract rate should be at least the ***whole dwelling ventilation*** rate given in Table 5.1b |
| Utility room | 30 l/s | 8 l/s | |
| Bathroom | 15 l/s | 8 l/s | |
| Sanitary accommodation | 6 l/s | 6 l/s | |

## Table 5.1b **Whole dwelling ventilation rates**

| | Number of bedrooms in dwelling | | | | |
|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** |
| Whole dwelling ventilation rate [a, b] (l/s) | 13 | 17 | 21 | 25 | 29 |

**Notes:**

a. In addition, the minimum ventilation rate should be not less than 0.3 l/s per $m^2$ of internal floor area. (This includes all floors, e.g. for a two-storey building add the ground and first floor areas.)

b. This is based on two occupants in the main bedroom and a single occupant in all other bedrooms. This should be used as the default value. If a greater level of occupancy is expected add 4 l/s per occupant.

# Types of ventilation - Natural

- Is uncontrolled air movement from windows
- This is the most common ventilation method. Allowing fresh outdoor air to replace indoor air in the home

# Types of ventilation – Spot ventilation

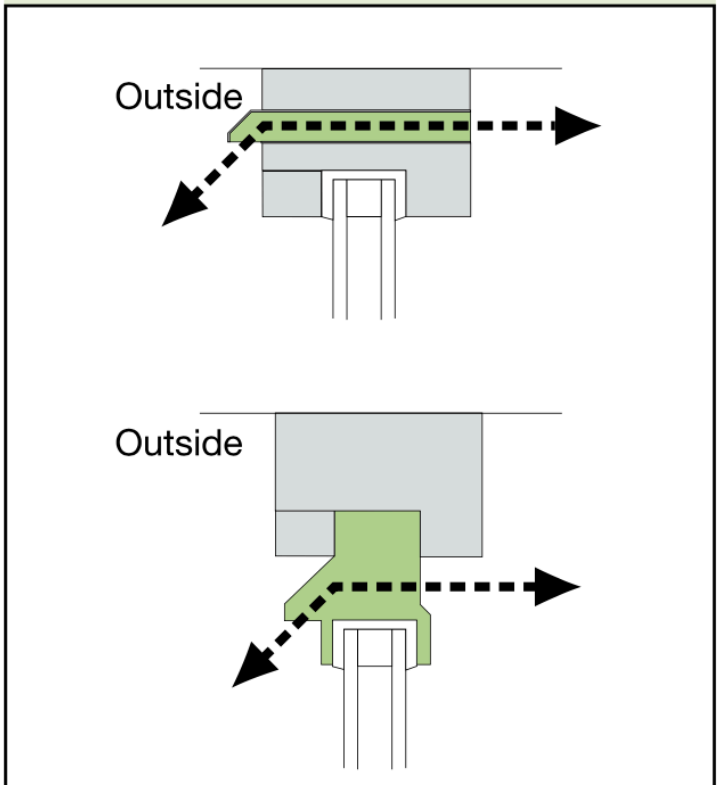
- Controls air movement by using localised exhaust fans to quickly remove pollutants and moisture at the source
- This is used in conjunction with other strategies. This will improve effectiveness of natural ventilation

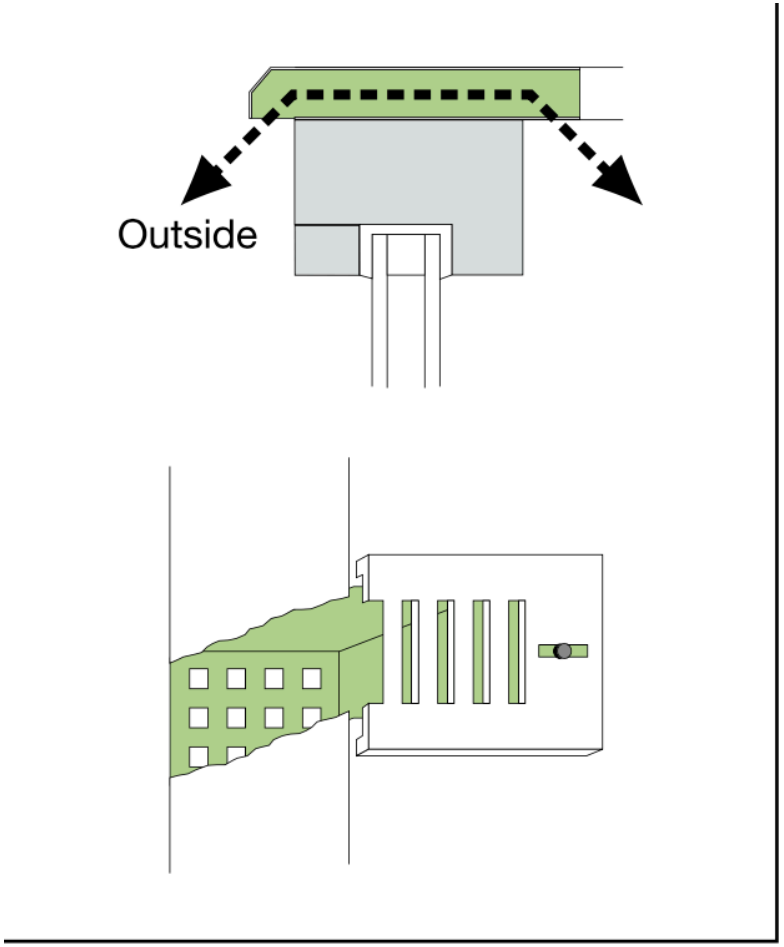
# Types of ventilation – Whole house

- Entails using one or more fans and ducted system to extract stale air and or supply fresh air into the house
- Whole house ventilation systems provides controlled, uniform ventilation throughout the home
- The systems maybe exhaust only or supply only or a balanced system that includes both exhaust and fresh air components

# Background ventilators

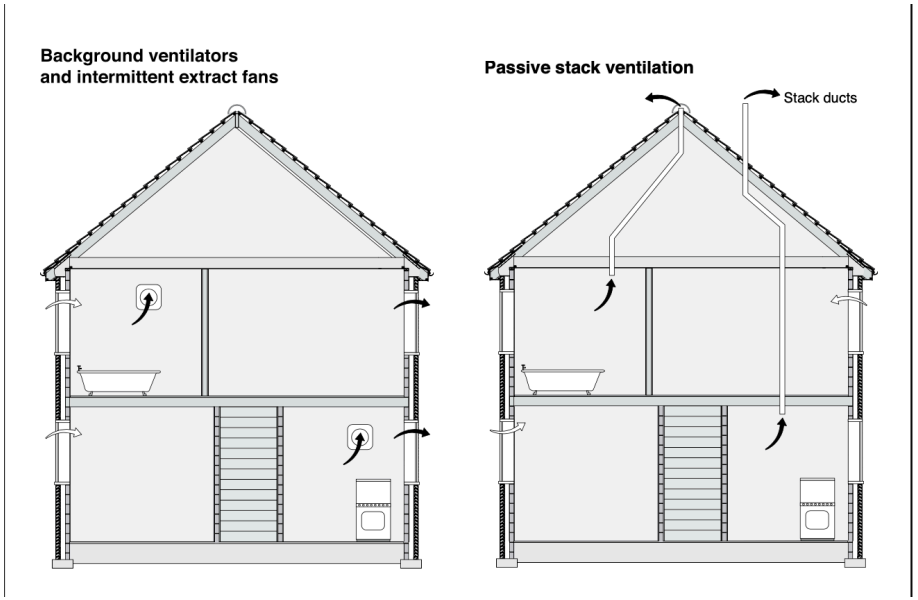
Diagram 1 **Provisions for background ventilation**



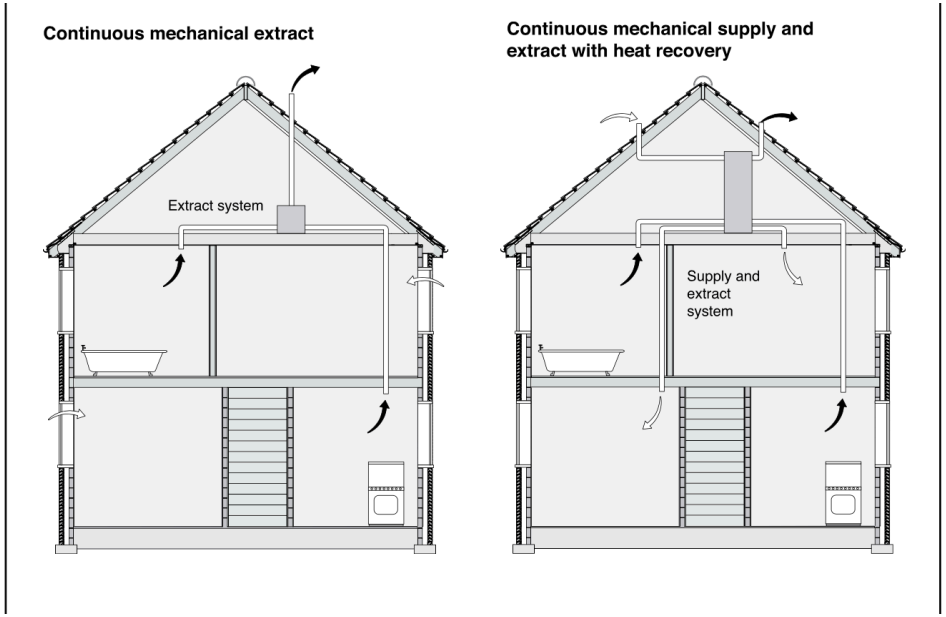
# Passive stack ventilation

- System 2
- Is the most effective natural ventilation strategy as it is uses a combination of crossflow ventilation and the wind passing over terminals causing a suction effect



# Mechanical extract ventilation system

- System 3
- These are centralised systems which provide ventilation helping to reduce excessive moisture
- MEV systems provide all year good indoor quality
- Protecting your home from condensation damp and mould



# Decentralised mechanical extract ventilation dMEV

- System 4
- The dMEV system works under the same principle as whole house mechanical extract ventilation (MEV) but with individual fans installed directly in the kitchen and every wet room/s in the property and are continually on at all times, not switched on and off by the homeowner

Lo-Carbon Response / SELV

Lo-Carbon Centra / SELV

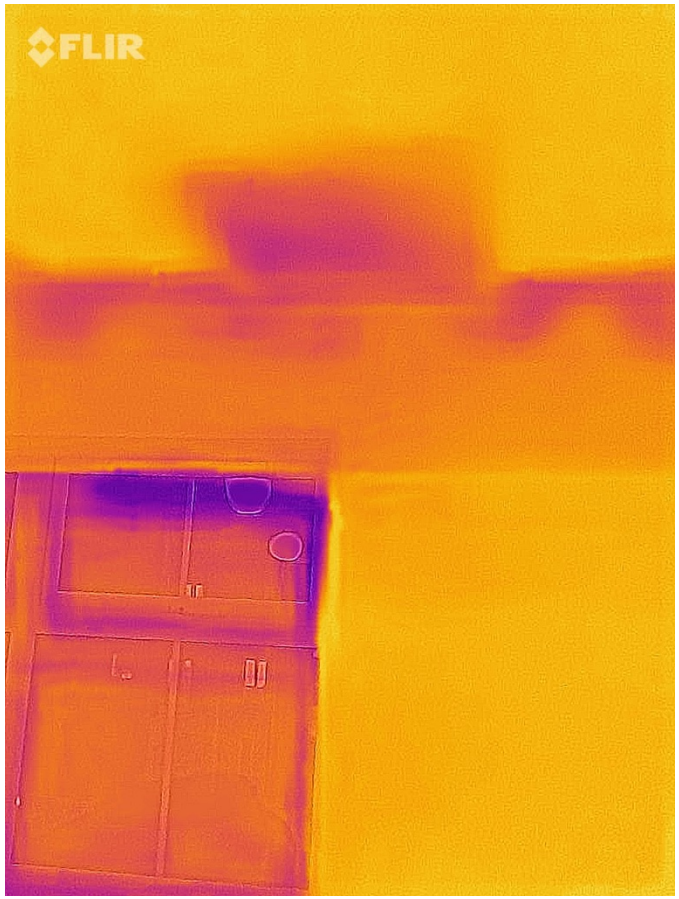
# Continuous mechanical supply and extract with heat recovery (MVHR)

- System 5
- Continuously extracts moist stale and polluted air from wet rooms in a property such as bathrooms, utility rooms and kitchens. This air is passed over an heat exchanger cell which recovers and retains the heat that would otherwise be lost from the extracted air. This heat is then transferred to the incoming fresh filtered air that the unit is resupplying back into habital rooms such as bedrooms and living rooms resulting in minimal heat losses and a more comfortable indoor environment

# PIV Positive input ventilation

- System 6
- Fresh air is supplied to the dwelling from the roof space usually by means of a small fan
- Mostly used in local authority or housing association owed properties

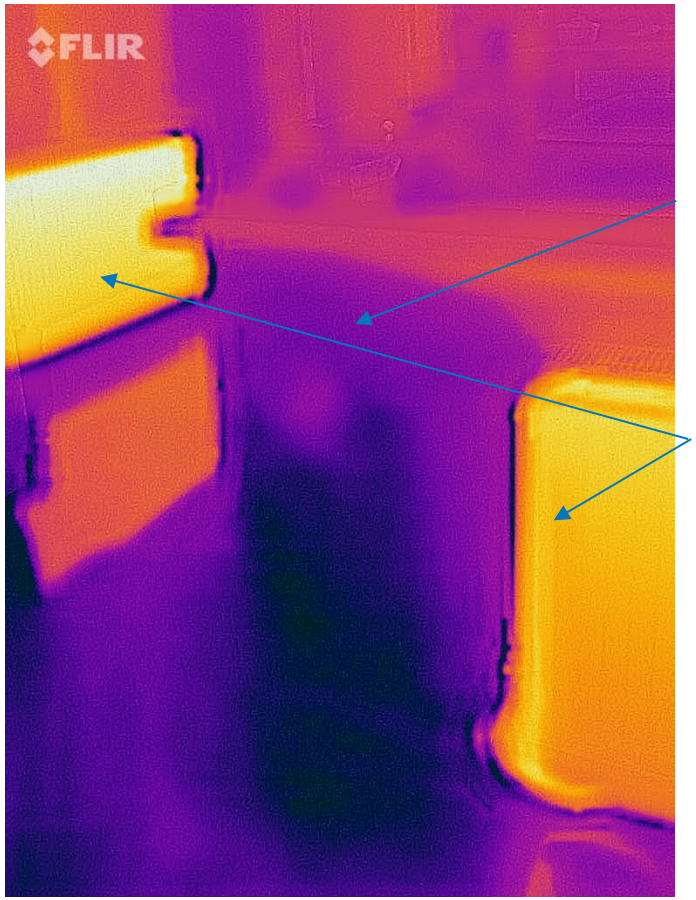
# Thermal Imaging





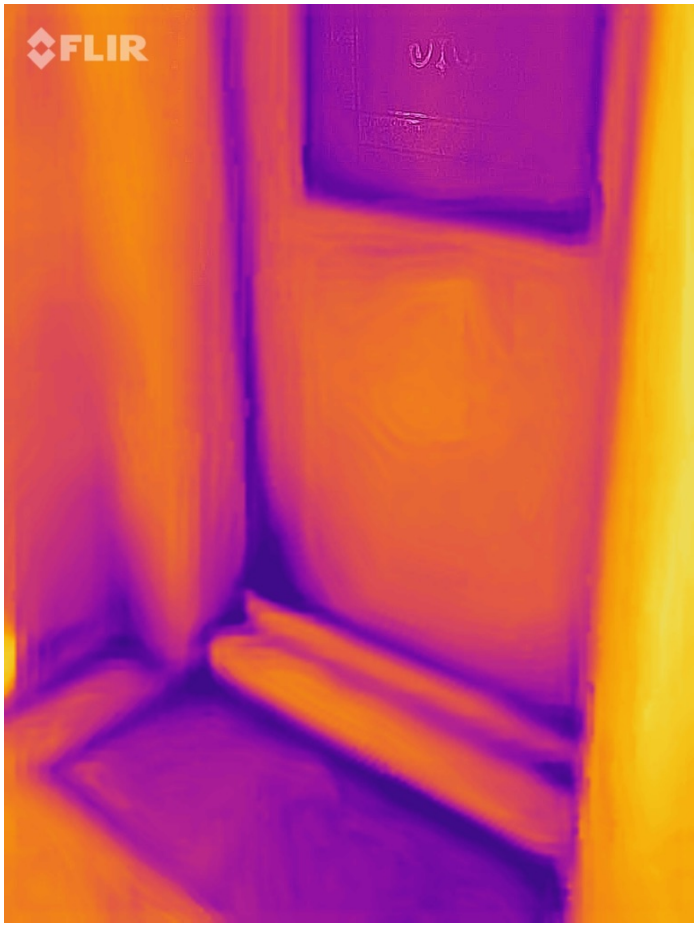
Bedroom ceiling showing missing loft insulation

# Thermal Imaging




Uninsulated wall

Radiators




Wooden Front Door

# Carbon Monoxide

- Carbon monoxide is a colourless , odourless deadly gas produced as a by product of combustion of natural gas and propane gas
- CO detectors are highly recommended for homes with any fuel burning appliances because they sound an alarm when CO2 levels reach potentially dangerous levels


# THE END

# Day 4 summary

- Retrofit Assessor Day 4

- Explain the difference between rising damp and condensation
- Why is ventilation important


EXAM

# Test cases