Carbon Co-op

Home Health Check

Webinar

2nd April 2020
Aneaka Kaur Kellay

www.carbon.coop / @carboncoop

Introductions

- About Carbon Co-op
- About me
- And you...

Training Structure

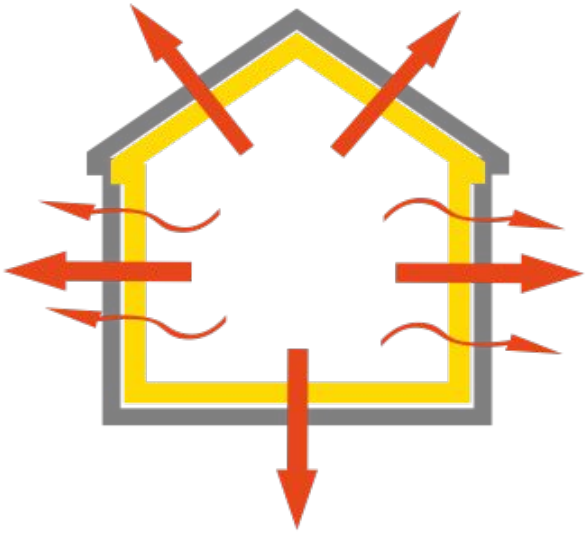
- Whole House Approach
- Indoor Air Quality and Health
- Ventilation Basics
- Standards and Regulations
- Ventilation Systems
- Simple things to do now

Whole House Approach

The Whole House Approach

The house is a system with...

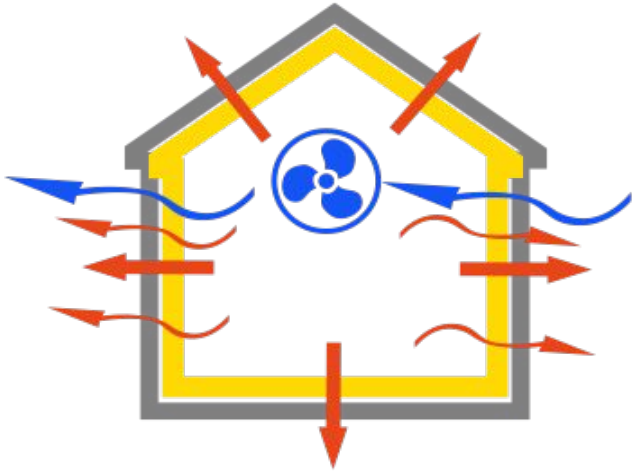
- Heat loss



The Whole House Approach

The house is a system with...

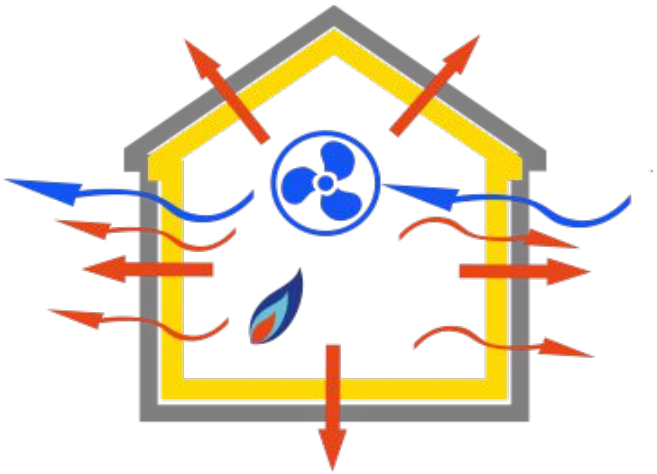
- Heat loss
- Ventilation



The Whole House Approach

The house is a system with...

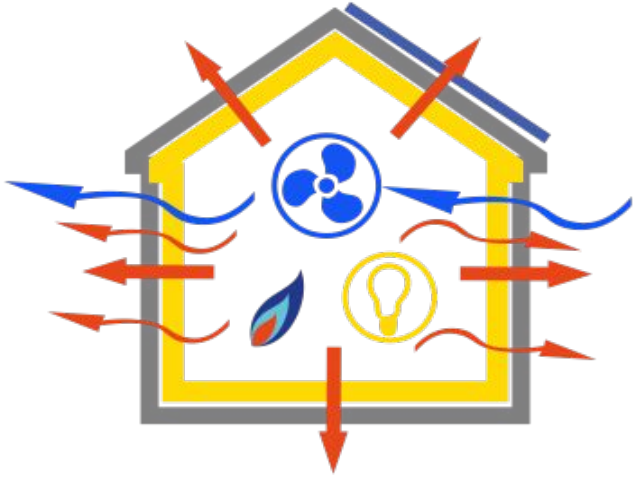
- Heat loss
- Ventilation
- Heating



The Whole House Approach

The house is a system with...

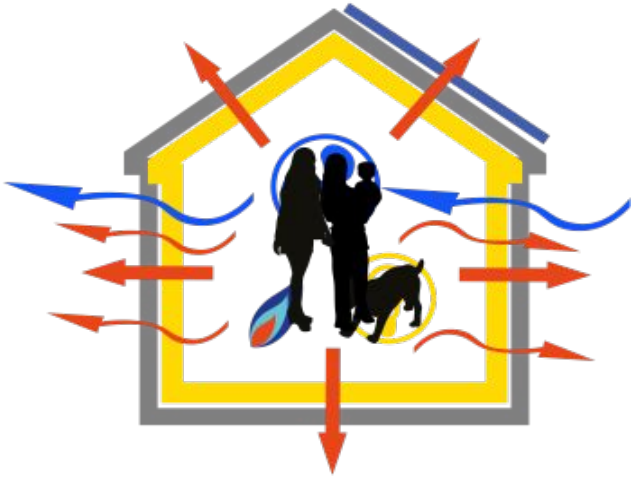
- Heat loss
- Ventilation
- Heating
- Lighting and Appliances



The Whole House Approach

The house is a system with...

- Heat loss
- Ventilation
- Heating
- Lighting and Appliances
- and People!



The Whole House Approach

The house is a system with...

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- Ventilation
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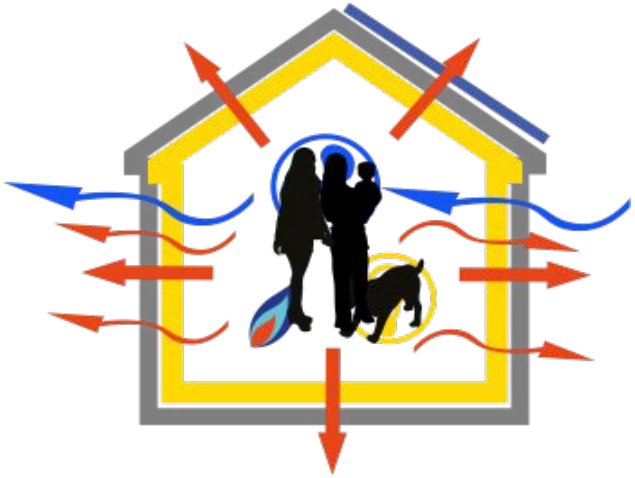
- Lighting and Appliances
- and People!

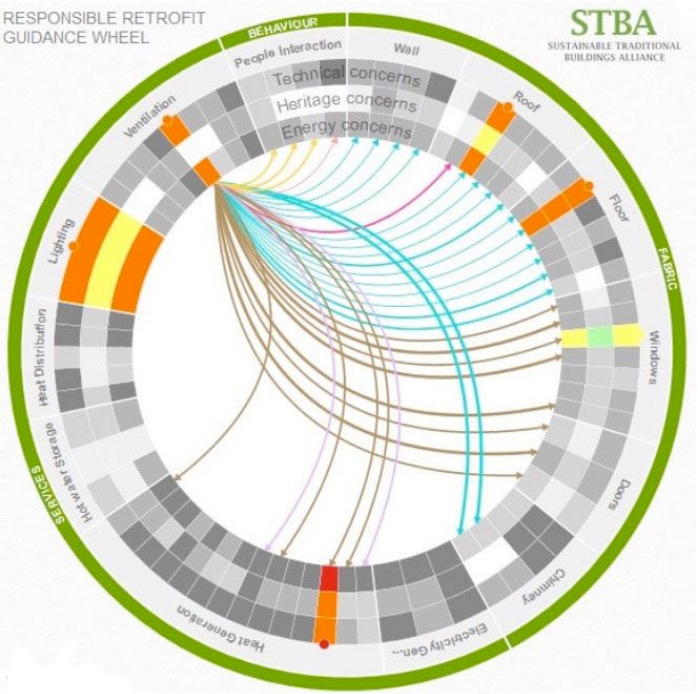


....and all of these systems interact.

Sometimes in ways that are easy to understand, but hard to predict in detail in a given circumstance.

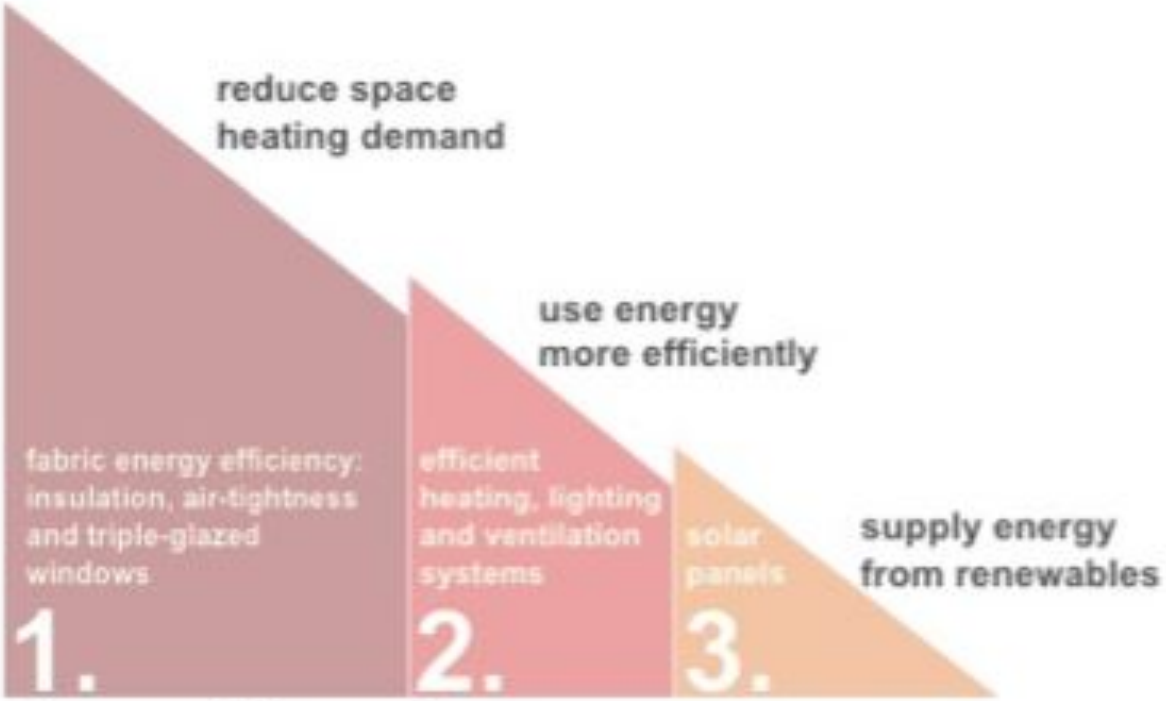
The Whole House Approach - Risk Management

- Houses are complex systems
- We take a context specific and ‘risk management’ approach
- Be aware of potential unintended consequences
- Any new measures must be well considered, well designed, well installed and understood by the resident.



http://responsible-retrofit.org/wheel/

The Whole House Approach - Fabric First

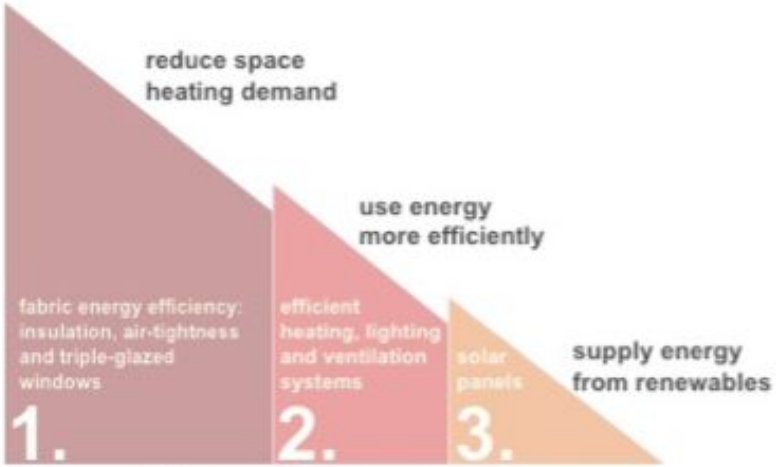


Energy Hierarchy

The Whole House Approach - Fabric First

Why?

- More effective planning of building services
- Low maintenance through buildings life
- Reduced ongoing running costs
- Better living conditions and wellbeing
- Avoid ‘eco-bling’

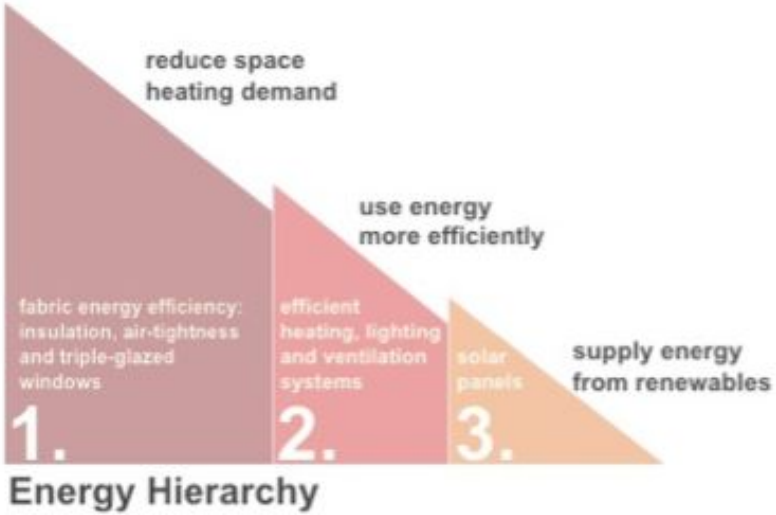


Energy Hierarchy

The Whole House Approach - Fabric First

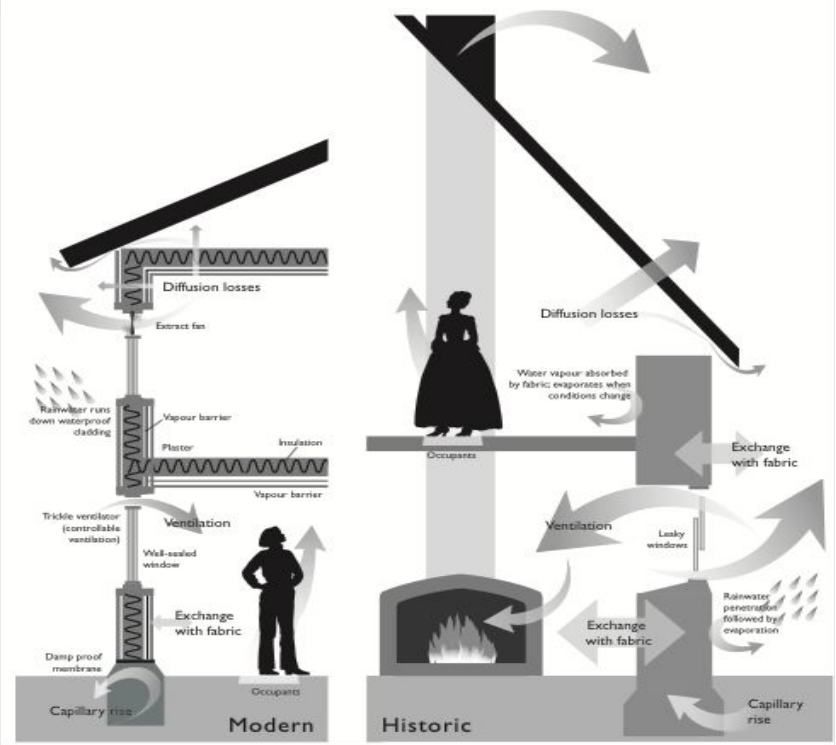
Strategically:

- Reduces fuel poverty
- Homes future-proofed
- Reducing demand makes it easier to achieve target CO2 savings i.e. its riskier to rely on technology to meet targets



The Whole House Approach - Changes in building type

- Building design and materials, ventilation and heating has changed dramatically
- Older homes heated with coal and made of ‘breathable’ material
- Adaptations to ‘modern’ homes changes the way buildings work
- Ventilation now needed in ways it wasn’t before.

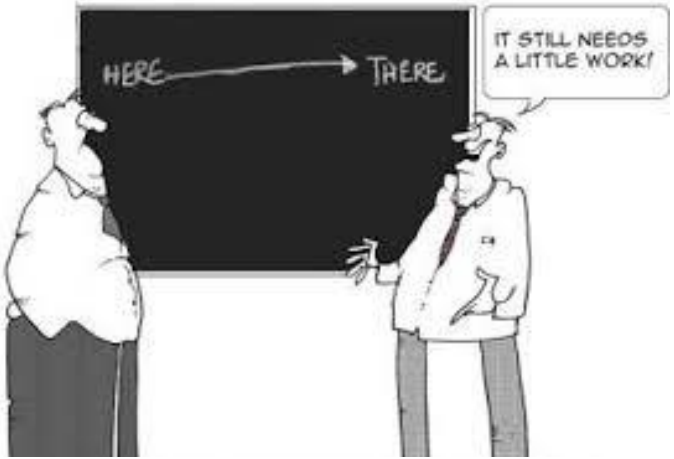


http://www.english-heritage.org.uk/publications/energy-efficiency-historic-buildings-ptl/

The Whole House Approach - Making a plan!

Doesn’t mean doing everything at once.

But it is important to have a plan!



Step by Step Retrofits with Passive House Components, EuroPHit, http://europhit.eu/sites/europhit.eu/files/EuroPHit_Handbook_final_Optimized.pdf

Indoor Air Quality and Health

Indoor Air Quality and Health - The Symptoms

We spend around 90% of our time indoors.

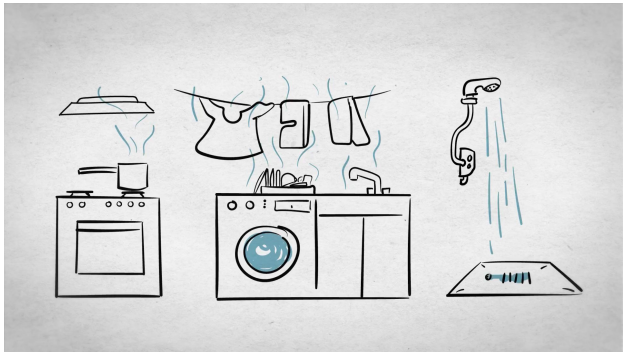
Indoor pollution is a serious health risk!

Indoor Air Quality and Health - The Symptoms

- Asthma, allergies and other respiratory problems.
- Headaches and nausea
- Shortness of breath
- Sinus congestion, sneezing and coughs
- Eye, skin, nose and throat irritations
- Memory loss, dizziness, fatigue and depression.

Indoor Air Quality and Health - Managing Moisture

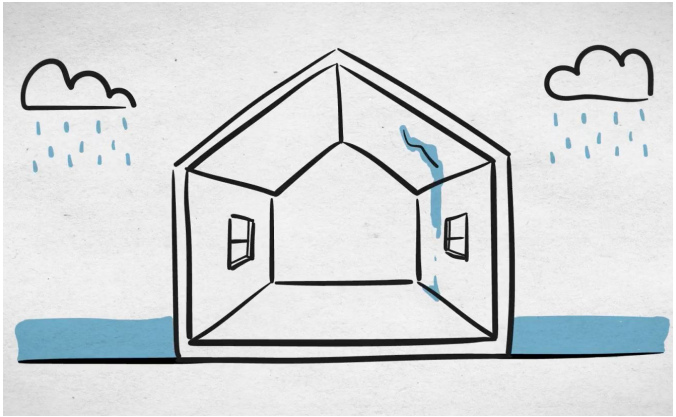
- Water vapour is one of the biggest air-quality issues
- Produced by our daily activities
- You can change your behaviour to reduce the amount produced
- Although there are limits to this...



UK Centre for Moisture in Buildings: http://www.ukcmb.org/research-areas/projects/mima

Indoor Air Quality and Health - Managing Moisture

- In very damp places like Manchester managing moisture is not easy.
- Relative humidity is high for much of the year
- If you live near a water course or with a high water table this can increase the moisture load on your home.
- If your ground floor is not well sealed water vapour will track into living spaces.



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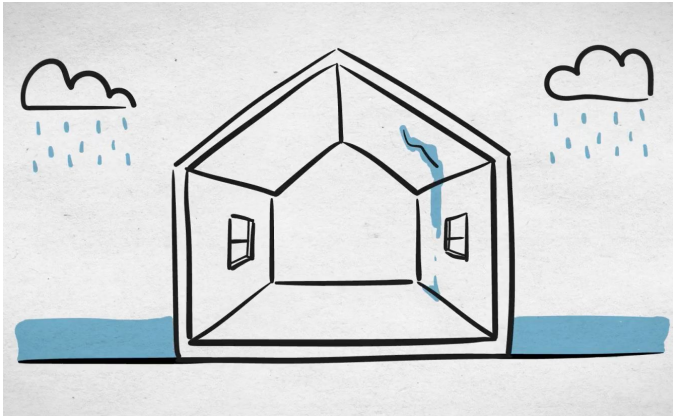
Indoor Air Quality and Health - Managing Moisture

In this context you need ventilation!



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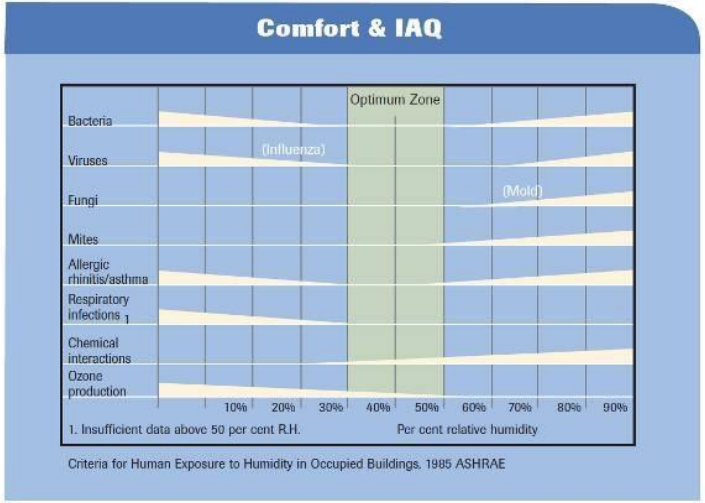
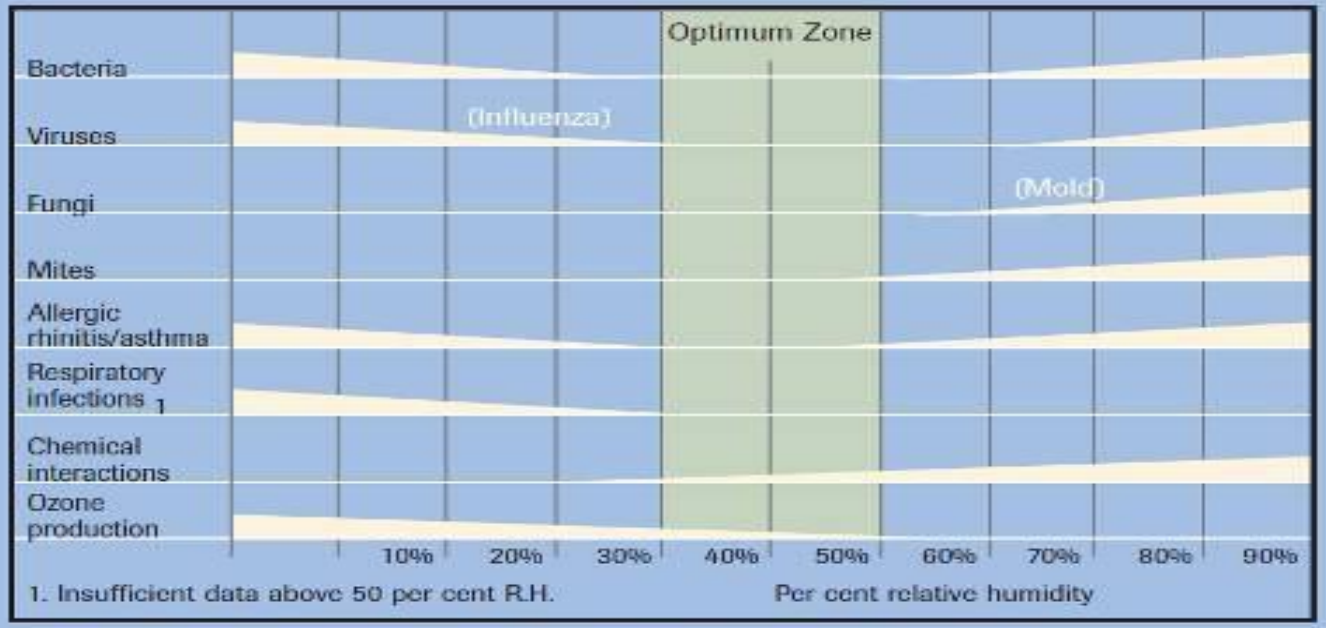
Indoor Air Quality and Health - Managing Moisture

- Ideally, internal relative humidity (RH) should be between 40% and 65%.
- Below this, the air is too dry and this can cause illness and irritation.
- Above this, the air is too damp and conditions may lead to an increase in mould and dust mite populations.

Diagram shows the comfort and health reasons why experts recommend indoor relative humidity levels be held between 40% and 60%.



Comfort & IAQ

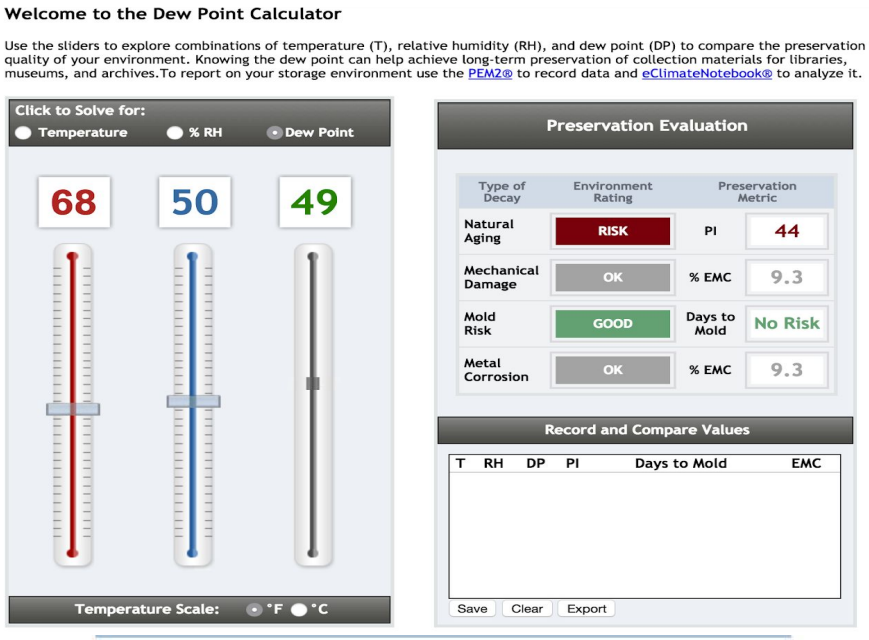


Criteria for Human Exposure to Humidity in Occupied Buildings. 1985 ASHRAE

Indoor Air Quality and Health - Managing Moisture

Relative humidity (RH) is a measure of how saturated the air is: how close it is to reaching its maximum holding capacity.

When this is at 100%, the air is saturated. It has reached ‘dew point’ - so any more water added to the air will condense into liquid form. For example as fog, or condensation on a window pane.

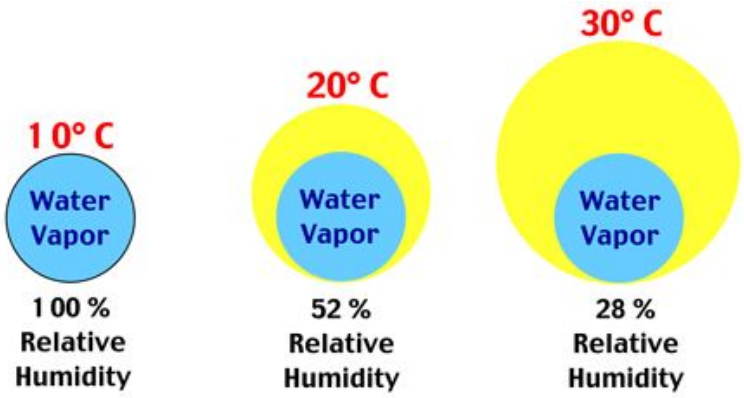


http://www.dpcalc.org/

Indoor Air Quality and Health - Managing Moisture

Warm air can hold a lot more water vapour than cold air

I.e. the ‘holding capacity’ of air increases as temperature increases



For more on Psychrometric (Humidity) Charts:
https://www.youtube.com/watch?v=IVwniWExPgA
http://en.wikipedia.org/wiki/Psychrometrics

Indoor Air Quality and Health - Managing Moisture

And the opposite is true, if air cools down it can ‘hold’ less water.

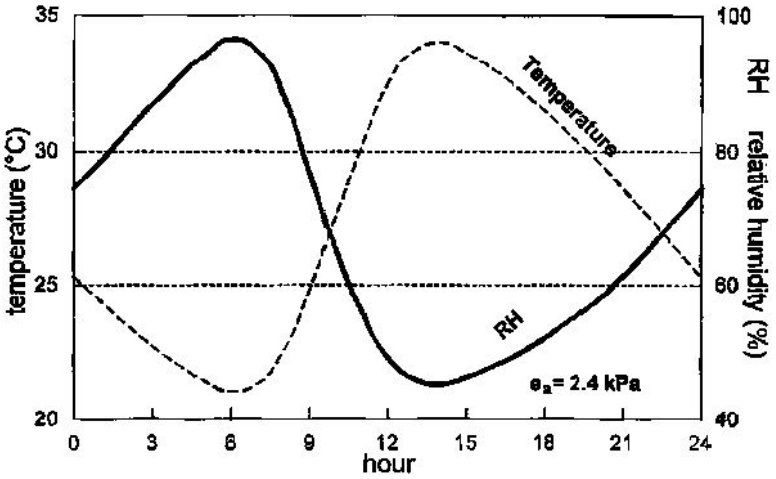
So air that is holding a lot of moisture, and then cools down - for example by hitting a cold surface like a window - the water will condense and form water droplets.

This is why you get condensation on windows after a shower.

Indoor Air Quality and Health - Managing Moisture

There is a direct inverse relationship between relative humidity and temperature.

If the total amount of water in the air stays the same (the absolute humidity), but the temperature goes up, the relative humidity goes down, and vice versa.



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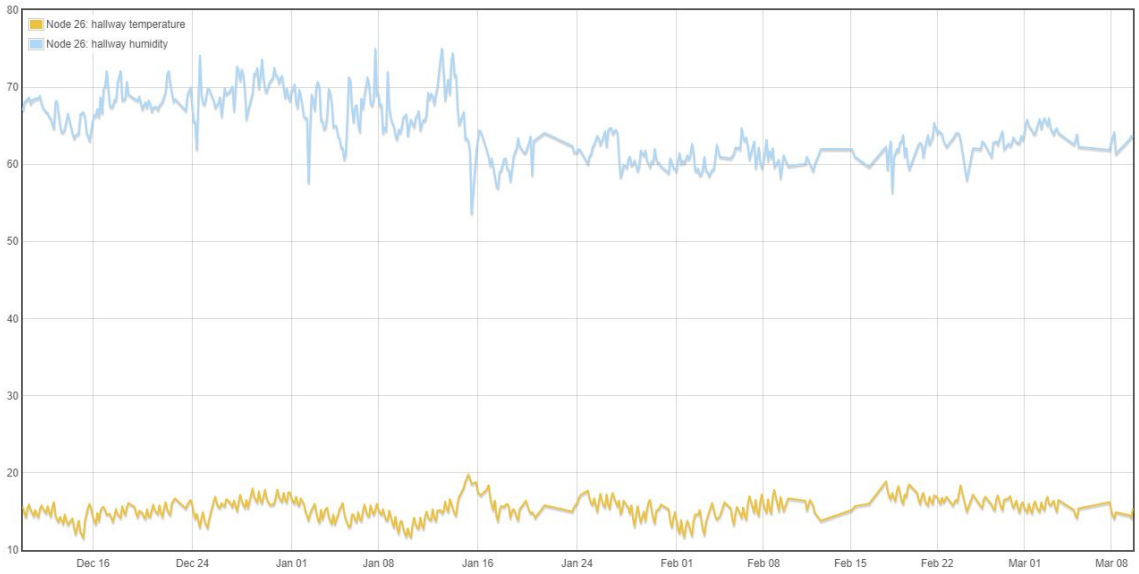
Indoor Air Quality and Health - Managing Moisture

- If your home is often 14 - 18C, you will likely have relative humidity levels 70% and higher.
- If you can you should probably turn your heating up and see how that impacts the relative humidity



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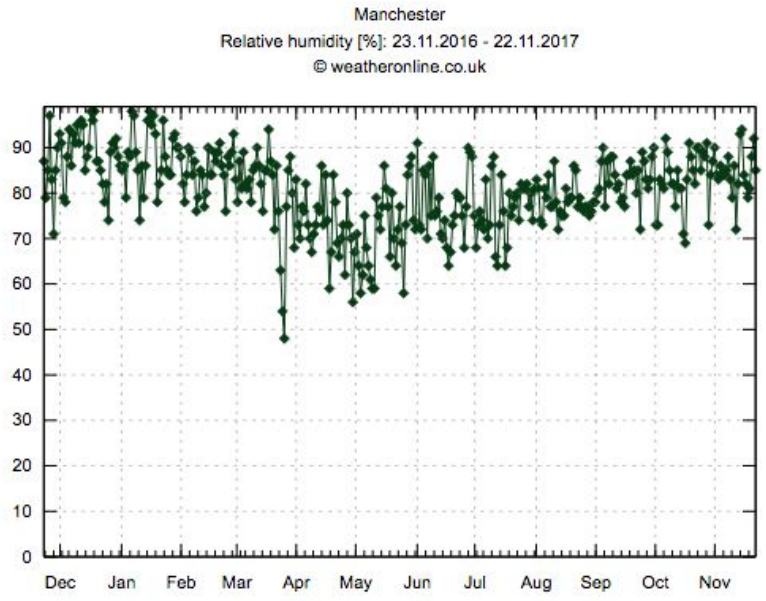
Indoor Air Quality and Health - Managing Moisture

Throughout the year, external relative humidity and absolute humidity change with the climate.



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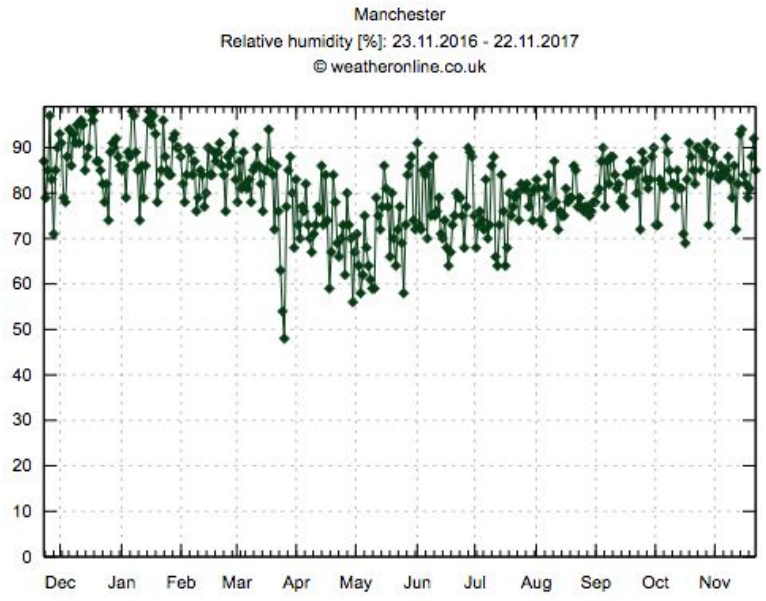
Indoor Air Quality and Health - Managing Moisture

In summer, relative humidity is generally lower.

Absolute humidity - the total amount of water in the air - will be higher.

As temperatures are also higher, the air does not get as close to saturation point.



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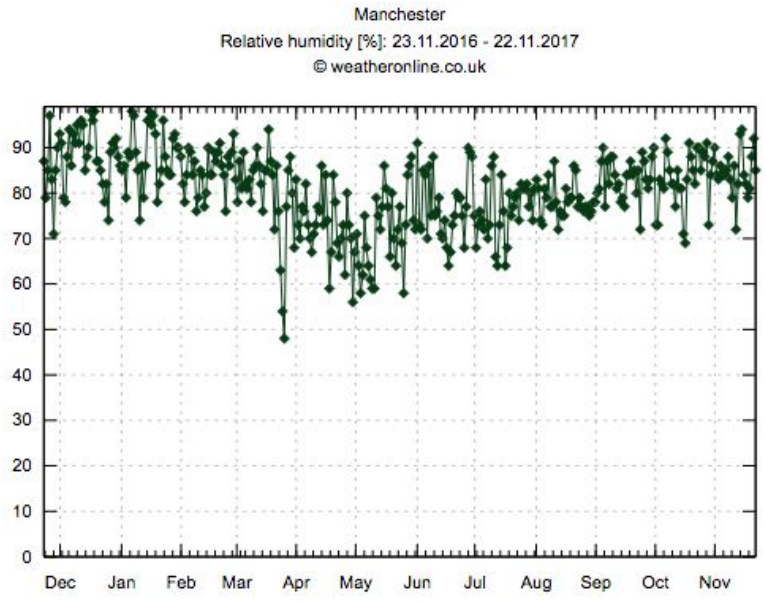
Indoor Air Quality and Health - Managing Moisture

In winter, relative humidity may hover around 100%, but the air is much colder, so is carrying less moisture in total.

When you bring cold and high relative humidity air into your home, and heat it from 5C to 20C, the total amount of water vapour in the air may not change, but the relative humidity will drop.



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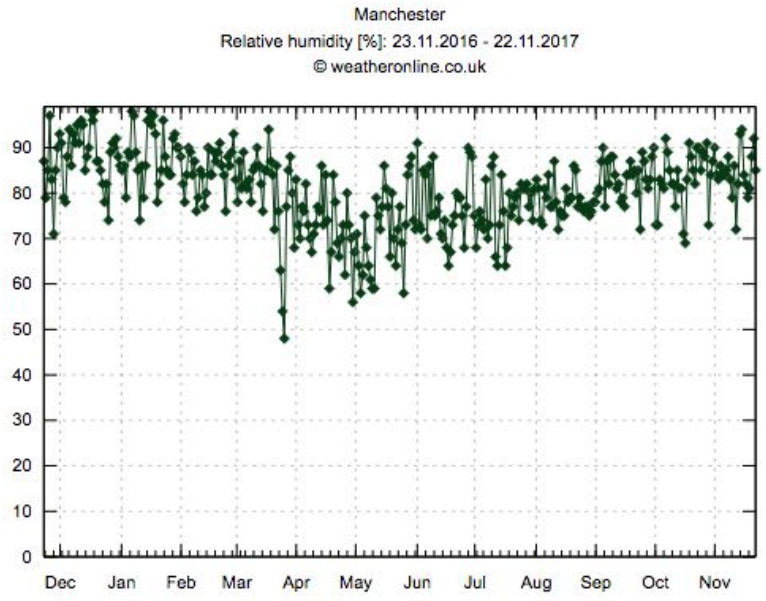
Indoor Air Quality and Health - Managing Moisture

This means that better ventilation in winter should keep humidity down - and over ventilation may even dry out the air too much.

If levels of humidity are high in winter you have an issue!



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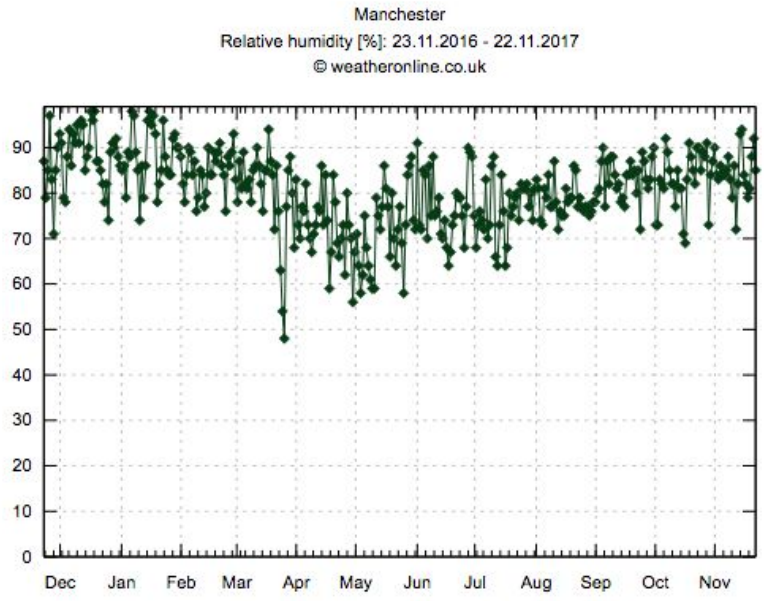
Indoor Air Quality and Health - Managing Moisture

However in Spring, Summer and Autumn, when internal and external temperatures are a lot closer, it will have a lesser effect, as you won't be increasing the temperature of the air to the same degree from outside to inside.

So don't worry too much if relative humidity is a bit high in these months.



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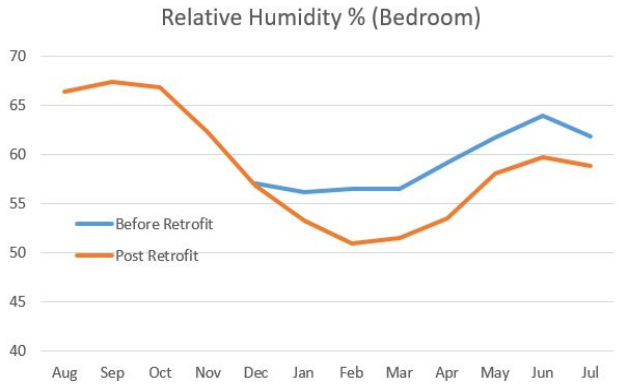
Indoor Air Quality and Health - Managing Moisture

Unlike heat, humidity is quite hard for humans to sense - though is linked to sensations of stuffiness and dryness.

Cheap monitoring is possible - look for a hygrometer in a hardware shop.

More advanced and continuous monitoring is also possible.



Graph from monitoring on Carbon Coop 'Go Early' property, credit Dom McCann

Indoor Air Quality and Health - Managing Moisture

It is possible for internal finishes to help moderate humidity to a small degree. This is known as ‘hygroscopic buffering’.

Hempcrete insulation and lime and clay plasters are known to do this, as does timber - materials that are common in older properties.

However, this does not negate the need for proper ventilation - there is more to worry about than just moisture

http://www.conservationphysics.org/wallbuff/wallbuff.php

Indoor Air Quality and Health - Pollution from fuel burning

Other pollutants need to be removed - the most concerning of these are Carbon Monoxide (CO) and small particulates (PM2.5), that aggravate asthma and other conditions.

The biggest source of these is fuel burning appliances - both gas and solid fuel. These are often independently ventilated, with their own air-source.

FIT A CARBON MONOXIDE MONITOR!

Indoor Air Quality and Health - Radon

Radon gas is a naturally occurring substance across much of the UK.

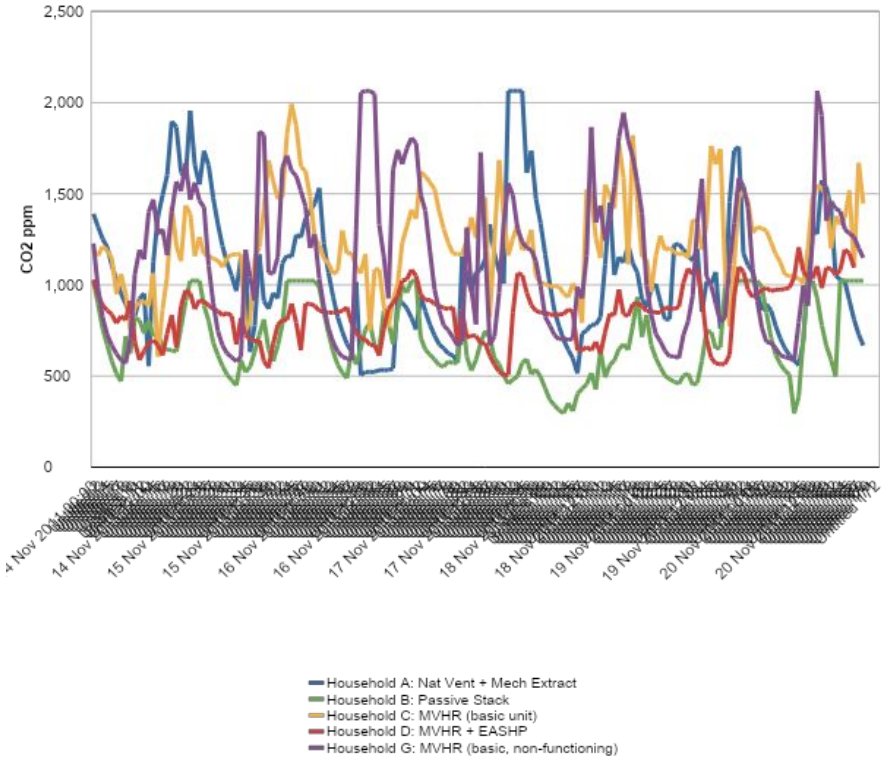
It enters homes through unsealed ground floors. So they either need to be sealed - usually with a plastic radon barrier - and/or the gas needs to vented away to stop it from building up.

http://www.ukradon.org/information/ukmaps

Indoor Air Quality and Health - Carbon Dioxide

Carbon dioxide (CO2) is created both by combustion from fuel burning appliances and from respiration (breathing).

It needs to be removed, and ideally concentrations should be kept below 1000ppm.



Indoor Air Quality and Health - Indoor Air Pollution

There are lots of other potential sources of indoor pollution that need to be controlled:

- Smells and odours
- Off-gassing and 'volatile organic compounds' (VOCs) floor coverings and furniture.
- Mould and mildew
- Cleaning chemicals
- Pollen
- Pets and pet hair
- Dust mites.....

Indoor air quality standards

Recommended Maximum Concentrations for Specific Classes of Contaminants

Parameter	Limit for Acceptable Indoor Air Quality	units
Suspended / Respirable Particulate Matter	150	$\mu g/m^3$
Volatile Organic Compounds (VOC)	3	ppm
Total Bacterial counts	500	CFU/m^3
Total Fungal Counts	500	CFU/m^3

https://www.theguardian.com/environment/2018/feb/15/cleaning-products-urban-pollution-scientists

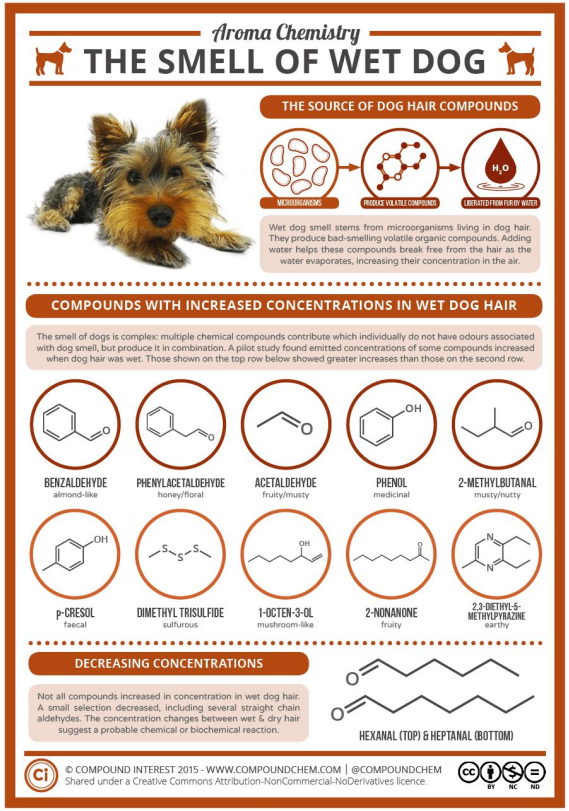
Indoor Air Quality and Health - Indoor Air Pollution

Controlling ‘at source’ is a good idea - for example by using low VOC paints and finishes.

After that, a good planned ventilation system is needed to remove and dilute the pollution.

Indoor Air Quality and Health - Smells and Odours

More unpleasant than dangerous, but still important!



http://www.compoundchem.com/2015/07/28/wet-dog/

Ten minute break

Ventilation Basics

Ventilation Basics

What is ventilation?

A planned exchange of air with the external environment in living spaces.

To provide ‘fresh air’, remove pollutants and moderate temperatures.

Ventilation Basics

Two basic types:

- ‘purge’
- ‘background’ or ‘trickle’

Two basic methods:

- ‘natural’ (?!?)
- ‘mechanical’

...but there is lots of variation within these types.

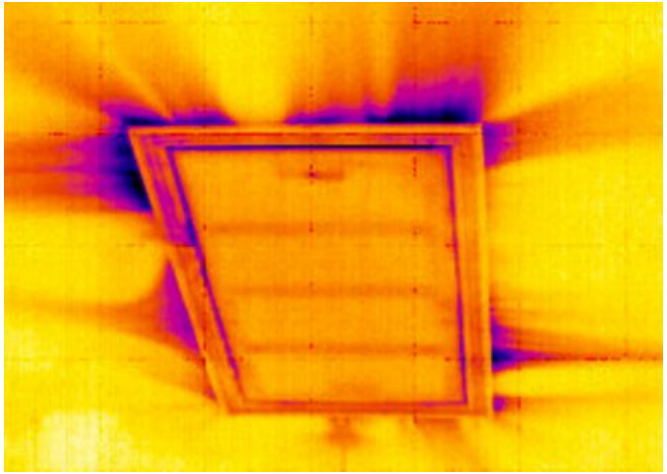
Ventilation Basics

Not to be confused with infiltration i.e. draughts!

This is unplanned air-movement through cracks and gaps in the building fabric.

This should be avoided! It takes warm and wet air into places in the building fabric where it can cause problems.

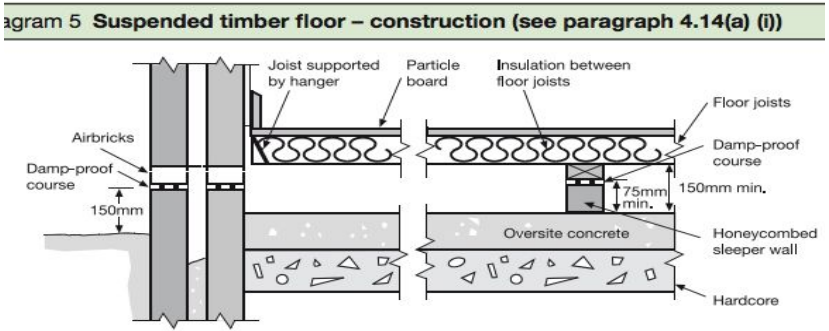
It’s also no guarantee of a good internal environment - even very draughty homes can have poor air quality.



Ventilation Basics - Construction Ventilation

Ventilation may also be required within the building construction:

- In sub-floors, to remove moisture and prevent damp and rot.
- In roofs, to prevent condensation.
- In walls with rain-screens or ventilated cladding.



....but that's not the type of ventilation we're concentrating on today, and it's usually outside the 'thermal envelope' of the building.

Ventilation Basics - Protect the building fabric

Ventilation can protect the building fabric.

If water vapour continually condenses on surfaces, or within a wall, roof or floor, can damage the materials and cause rot and decay.

So needs to be moderated and removed.

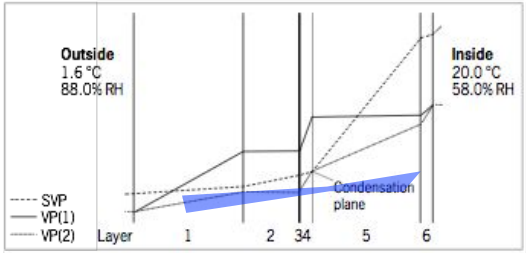


Figure 1 Saturated vapour pressure and vapour pressure profiles through a timber framed wall
Layers: 1 = back, 2 = cavity, 3 = breather membrane, 4 = plywood, 5 = insulation, 6 = plasterboard

Ventilation Basics - Moderate Overheating

Risks of over-heating also need to be considered.

A growing problem in a changing climate.

Combined with a sensible shading and glazing strategy, most likely overheating can be tackled with good ventilation (that also considers noise!)

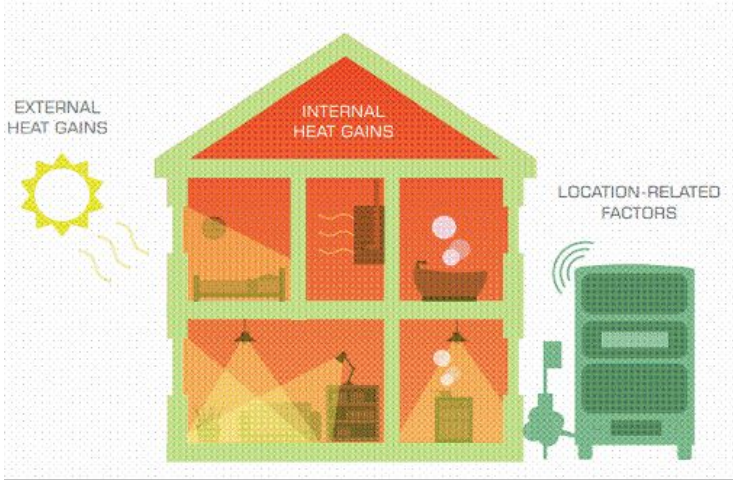


Image taken from the 'Climate Just' project, which considers climate adaptation for communities: http://www.climatejust.org.uk/1-adapting-buildings-what-are-we-concerned-about

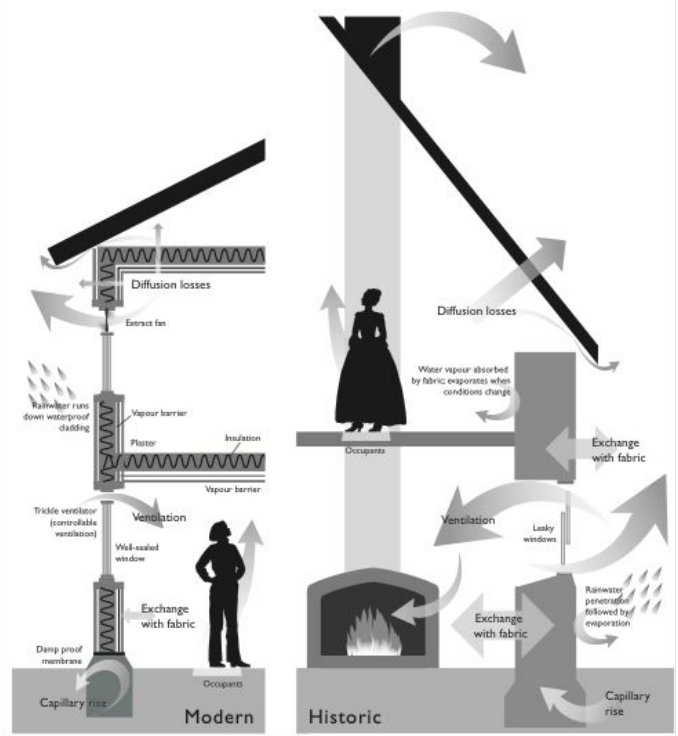
Ventilation Basics - Essential in Retrofit!

Retrofit changes the existing dynamics of heat, ventilation and moisture movement.

Draught proofing and improved air-tightness works change air movement patterns - as do changed surface temperatures due to ventilation.

“Any retrofit project that does not consider ventilation is a condensation project”

Colin King, Building Research Establishment

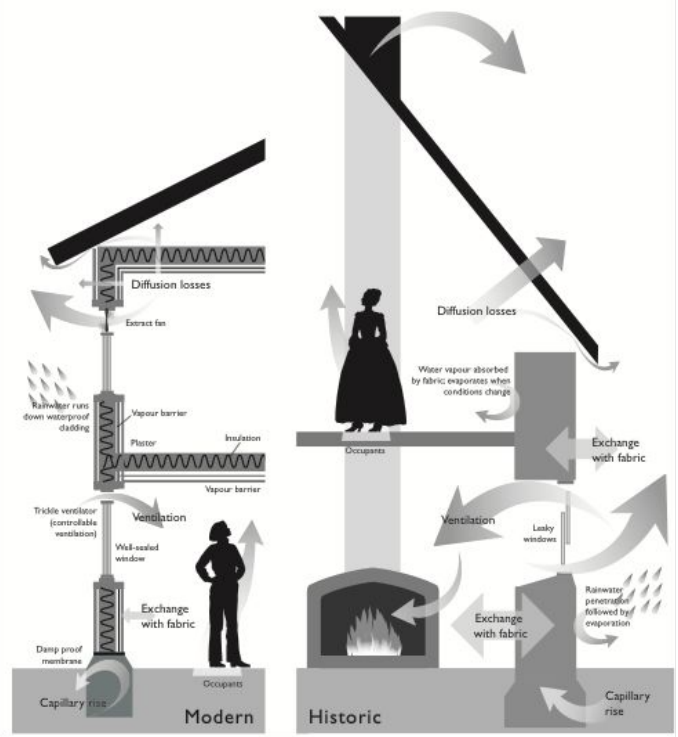


Ventilation Basics - Essential in Retrofit!

There appears to be an unavoidable conflict between ‘energy efficiency’ and ventilation. Extracting air means heat losses.

However, if considering wider issues of sustainability, it’s clear this isn’t really the case.

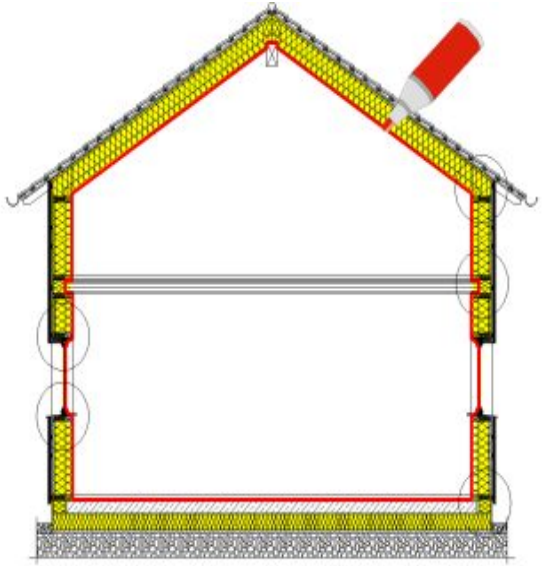
To be sustainable in the long term, a home has to be healthy - and for that, you need a functioning ventilation system. Need to consider a ‘whole house’ solution.



Ventilation Basics - Seal Tight, Ventilate Right!

By sealing gaps and cracks in building fabric, you reduce heat loss.

You then need to ventilate to ensure good air quality.



https://passipedia.org/planning/airtight_construction/general_principles/principles_for_improving_airtightness

Standards and Regulations

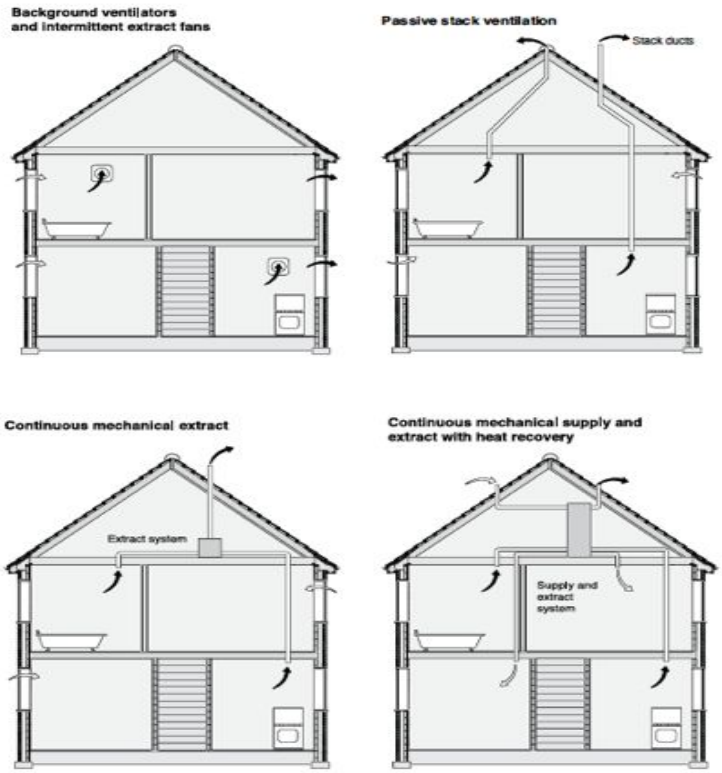
Standards and Regulations

Be aware of:

- Building Regulations
- Passive House
- AECB Building Standard/ CarbonLite Retrofit
- Fuel Burning Appliances

Standards and Regulations - Building Regulations

In existing buildings, key requirement is to not make matters worse. But in a retrofit project you will be making big changes - so you must:

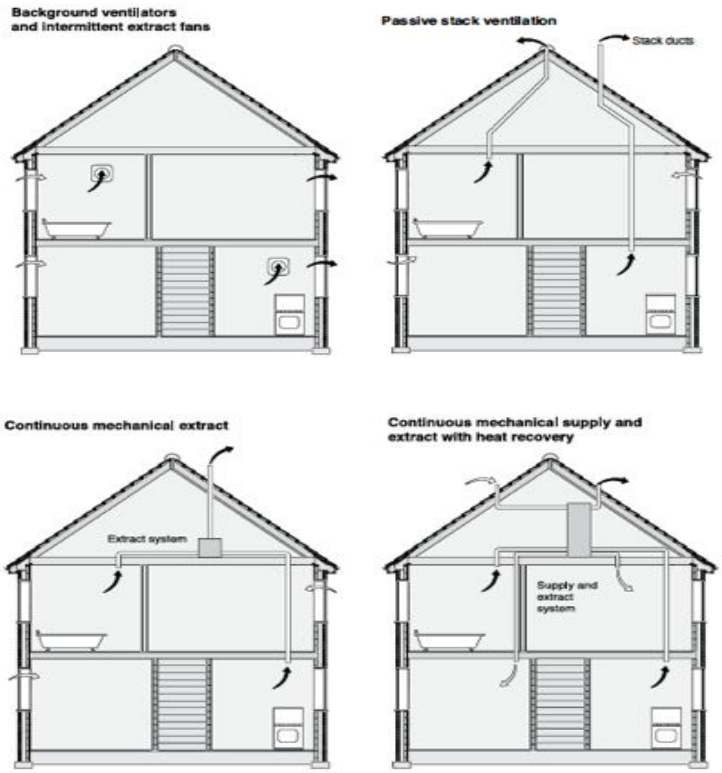


Standards and Regulations - Building Regulations

Part F - Ensure adequate fresh air is provided: http://www.gov.uk/government/publications/ventilation-approved-document-f

Part J - Ensure dangerous pollutants from fuel burning appliances are removed: http://www.gov.uk/government/publications/combustion-appliances-and-fuel-storage-systems-approved-document-j

Part C - Protect the structure from moisture, by adequately ventilating roof, floor and wall constructions where required: http://www.gov.uk/government/publications/site-preparation-and-resistance-to-contaminates-and-moisture-approved-document-c



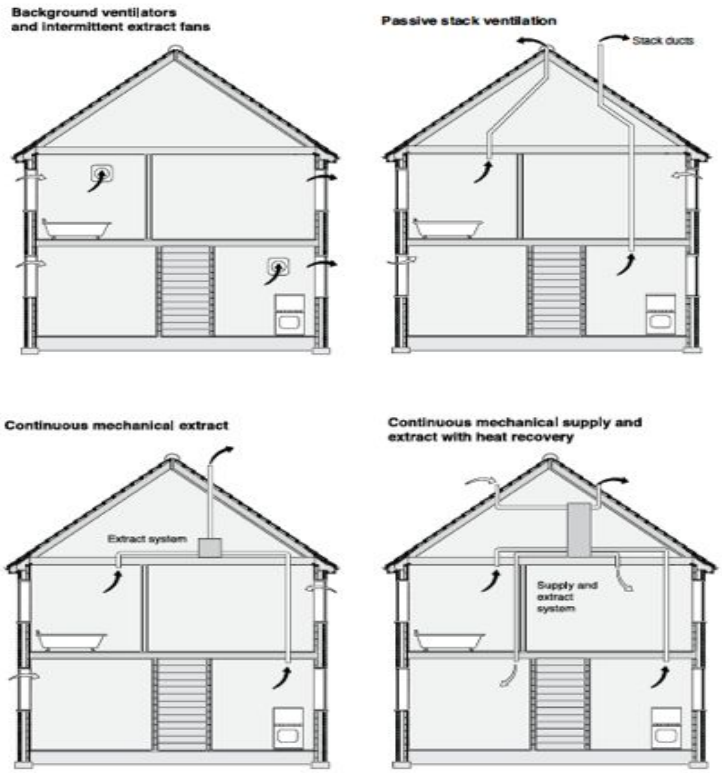
Standards and Regulations - Building Regulations

Part F is currently being reviewed and updated (in concert with Part L, which covers Conservation of Fuel and Power) - it is recognised it’s not really working at the moment. Many homes, including new homes, don’t meet the minimum standard.

It does not require you to consider noise issues from the ventilation system. Unlike Passive House, which sets minimum standards for audible noise from a ventilation system.

Part L considers fan efficiency as part of overall calculations.

Passive House is a tougher standard - prescribing a minimum efficiency.



Standards and Regulations - Passive House

Ventilation system: >75% heat recovery efficiency and....

Controllability:
The ventilation volume flow rate must be adjustable for the actual demand. In residential buildings the volume flow rate must be user-adjustable for each accommodation unit (three settings are recommended: standard volume flow / standard volume flow +30 % / standard volume flow -30 %).

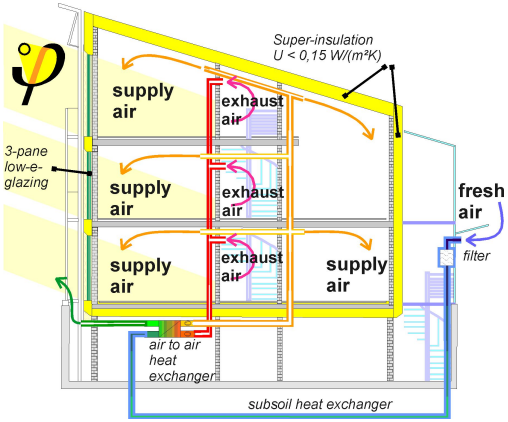
Ventilation in all rooms
All rooms within the thermal building envelope must be directly or indirectly (transferred air) ventilated with a sufficient volume flow rate. This also applies for rooms which are not continuously used by persons provided that the mechanical ventilation of these rooms does not involve disproportionately high expenditure.

Excessively low relative indoor air humidity
If a relative indoor air humidity lower than 30 % is shown in the PHPP for one or several months, effective countermeasures should be undertaken (e.g. moisture recovery, air humidifiers, automatic demand-based (zone) control, extended cascade ventilation, or monitoring of the actual relative air humidity with the option of subsequent measures).

Sound level
The ventilation system must not generate noise in rooms with prolonged occupancy.
Recommended values for the sound level are

- ≤ 25 db(A): supply air rooms in residential buildings, and bedrooms and recreational rooms in non-residential buildings
- ≤ 30 db(A): rooms in non-residential buildings (except for bedrooms and relaxation rooms) and extract air rooms in residential buildings

Draughts
The ventilation system must not cause uncomfortable draughts.



Standards and Regulations - AECB Building Standard

AECB Building Standard
https://www.aecb.net/aecb-building-certification/

Parameter	Target	Notes
Delivered Heat and cooling	≤ 40kWh/(m².a)	According to PHPP * and Passivhaus methodology.
Primary Energy demand	Varies Wh/(m².a)****	ditto
Air tightness (n50)	≤ 1.5 h^{-1} (≤ 3 h^{-1})	With MVHR (with MEV) **
Thermal Bridges ***	$Psi_{external}$ <0.01 W/mK	Calculated if > 0.01 W/mK
Summer overheating	<10%	<5% recommended

* Passive House Planning Package.

** it may not be possible to meet the heat demand target without MVHR for some buildings.

*** Standard Passivhaus methodology is used. If no calculation is submitted, then the decision as to whether a detail is thermal bridge free may be queried at the discretion of the AECB.

****PE demand varies by country according to each nations PE ratio. As of PHPP 9.6 UK PE is 135 Wh/(m².a) Note: The Primary Energy requirements have changed because PHI have updated PHPP – the latest version of PHPP recognises national variations in Primary Energy factors. If your project was started using an older version of PHPP i.e. the calculations use PHPP 9.1 or earlier, then please continue to use the same 120 kWh.m2.yr PE limit that your version of PGPP requires for 'Classic Passivhaus' in order to certify your project.

AECB Carbon Lite Retrofit
https://www.aecb.net/the-aecb-carbonlite-retrofit-online-training-course/

AECB CarbonLite

The AECB CarbonLite retrofit training course concentrates on developing a good understanding of issues related to heat and moisture in buildings to help retrofitters avoid and/or manage any unintended consequences arising from the repair, insulation, draught proofing and ventilation of existing UK buildings. This online course is aimed principally at UK construction professionals and those whose role involves decision making around retrofit. It brings together a wealth of knowledge on low energy building retrofit experience and methodology.

Standards and Regulations - Fuel Burning Appliances

See Part J of the Building Regulations.

Also refer to HETAS
http://www.hetas.co.uk/

and GAS SAFE
http://www.gassaferegister.co.uk/

Table 1 Air supply to solid fuel appliances

Type of appliance	Type and amount of ventilation (1)
Open appliance, such as an open fire with no throat, e.g. a fire under a canopy as in Diagram 23.	Permanently open air vent(s) with a total equivalent area of at least 50% of the cross sectional area of the flue.
Open appliance, such as an open fire with a throat as in Diagrams 22 and 29.	Permanently open air vent(s) with a total equivalent area of at least 50% of the throat opening area. (2)

Other appliance, such as a stove, cooker or boiler, with a flue draught stabiliser.	Permanently open vents as below:
	If design air permeability >5.0m^3/(h.m^2) then
	300mm^2/kW for first 5kW of appliance rated output
	850mm^2/kW for balance of appliance rated output
	If design air permeability ≤5.0m^3/(h.m^2) then
	850mm^2/kW of appliance rated output (4)

Other appliance, such as a stove, cooker or boiler, with no flue draught stabiliser.	Permanently open vents as below:
	If design air permeability >5.0m^3/(h.m^2) then
	550mm^2/kW of appliance rated output above 5kW
	If design air permeability ≤5.0m^3/(h.m^2) then
	550mm^2 per kW of appliance rated output (4)

Notes:

1. Equivalent area is as measured according to the method in BS EN 13141-1:2004 or estimated according to paragraph 1.14. Divide the area given in mm^2 by 100 to find the corresponding area in cm^2
2. For simple open fires as depicted in Diagram 29, the requirement can be met with room ventilation areas as follows:

Nominal fire size (fireplace opening size)	500mm	450mm	400mm	350mm
Total equivalent area of permanently open air vents	20,500mm^2	18,500mm^2	16,500mm^2	14,500mm^2

3. Example: an appliance with a flue draught stabiliser and a rated output of 7kW would require an equivalent area of: [5 x 300] + [2 x 850] = 3200mm^2
4. It is unlikely that a dwelling constructed prior to 2008 will have an air permeability of less than 5.0m^3/(h.m^2) at 50 Pa unless extensive measures have been taken to improve air-tightness. See Appendix F.

Standards and Regulations - Airtightness and Ventilation Systems

As noted earlier, just because you have a leaky house, doesn't mean you'll have good air quality.

However, it is important to consider the leakiness of the house when thinking about which ventilation system to choose.

Generally, the more air-tight the house, the more there will definitely be a need for continuous and probably mechanically assisted ventilation.

Leakiness, or air-permeability, is usually measured in a pressure test, where the house is pressurised to 50 pascals. The Building Regulations and Passive House each measure these slightly differently (q50 vs n50). We've included a table of approximate air-permeability ratings, with reference to the building regulations here. (Passive House use units of 'air changes per hour' - ACH).

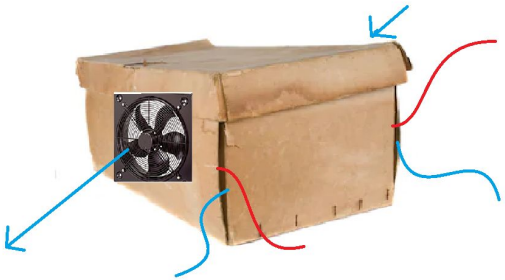
Description	**Air-permeability (m3/m2.hr @50pa)**
Average existing house	12-20
Building Regulations maximum (new house)	10
Current Industry 'Good Practice'	5
Current Industry 'Best Practice'	3
AECB Building Standard (Silver)	2-3 (<1.5 ACH)
EnerPHit	<1 -1.5 (< 1.5ACH)
Passive House	< 0.5-1 (< 0.6 ACH)

Standards and Regulations - Airtightness and Ventilation Systems

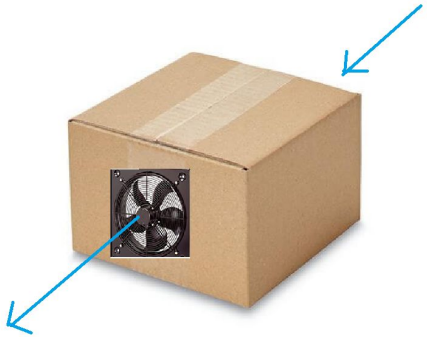
It is harder to create controlled airflow through a draughty house. Imagine an extractor fan in an old cardboard box as opposed to a new and airtight box.

So this means:

- Airtightness should be considered alongside ventilation
- If you can't make your home air-tight aim for a less complex system (as a more complex system just won't work well)
- AND A REMINDER a draughty home does not mean it will be well ventilated.



Uncontrolled airflow
Unpredictable and inefficienct



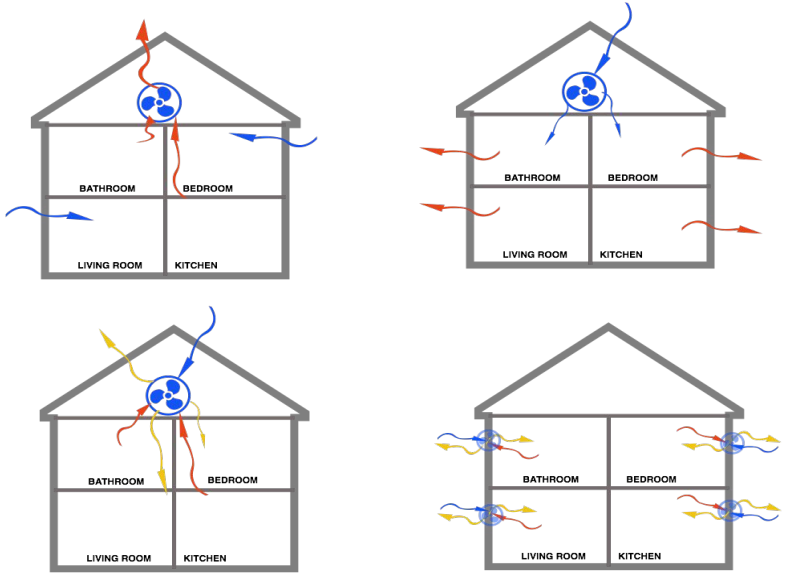
Controlled airflow
Predictable and efficient

Ventilation Systems

Ventilation Systems

Lots to choose from, and lots of room for confusion.

- mechanical vs passive
- whole house vs single room
- extract only vs supply + extract



Ventilation Systems - ‘Natural’

(Not mentioned in Building Regs)

- Background vent: open windows
- ‘Purge’ vent: open wider!

Pros:

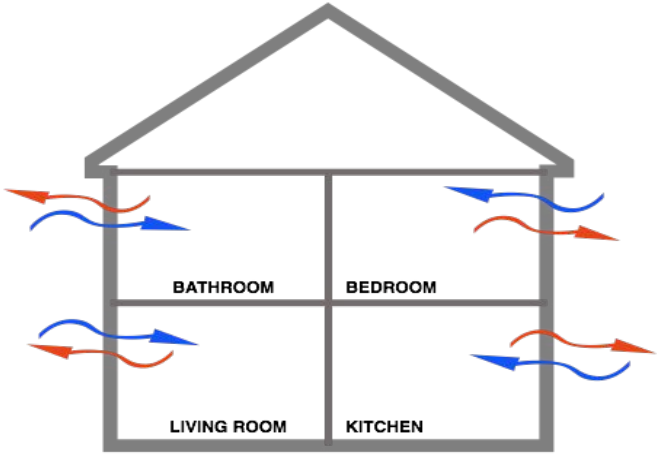
- Very simple (?)

Cons:

- Very context and weather dependent.
- Subject to human error.
- No guarantee air goes where you need it to.
- Not adequate to provide good air quality.
- Potentially excessive heat loss and discomfort.

Air-tightness suitability: ?

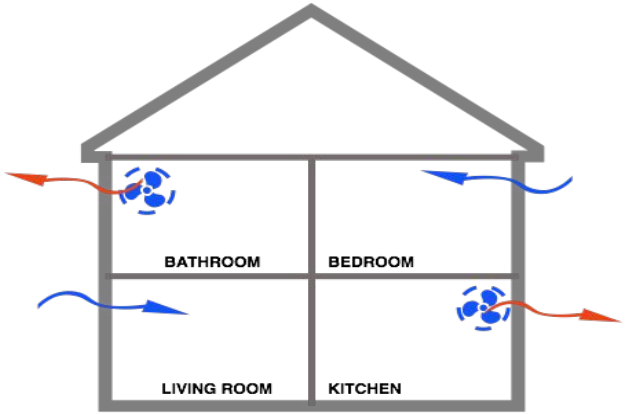
Cost: n/a (windows?)



Ventilation Systems - Intermittent Extract

(B Regs System 1)

- Background vent: trickle vents in walls/windows
- 'Purge' vent: Fans in wet rooms - activated by switch - can be attached to light, humidity controlled, on a presence sensor.



Pros:

- Simple and relatively cheap to install and run.

Cons:

- Not sufficient to ensure good air quality - especially in more air-tight homes.
- Can be noisy.
- Comfort? - cold air supply.

Air-tightness suitability: Above 5 m3/m2.hr @50pa(?)
Capital cost: Approx £100 per unit.

Ventilation Systems - Passive Stack

(B Regs System 2)

- Background vent: hot air rises in ducts to roof, assisted by a pressure difference between inside and outside, stack effect (hot air rises) and wind suction over the roof. Air is supplied by trickle vents in walls/ windows.
- 'Purge' vent: Window opening or fan assisted within ducts.

Pros:

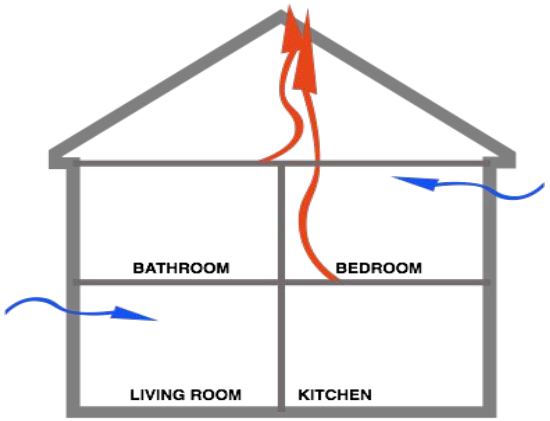
- Few moving parts and very little maintenance required.
- Can be demand controlled or humidity controlled.
- No/ low energy use.

Cons:

- Context and weather dependent - on still warm days will work less well than on cold windy days.
- Sometimes comfort issues from 'draughts' on intake vents.

Air-tightness suitability: Above 5m3/m2.hr - not suitable for more air-tight homes.

Capital cost: £500-2000, depending on size and complexity.



See for example - http://www.passivent.com/

Ventilation Systems - Positive Input Ventilation

(not mentioned in building regs)

- Background vent: Air continually pumped in from fan in loft, escapes through trickle vents and building fabric.
- ’Purge’ vent: Window opening or boost to fan.

Pros:

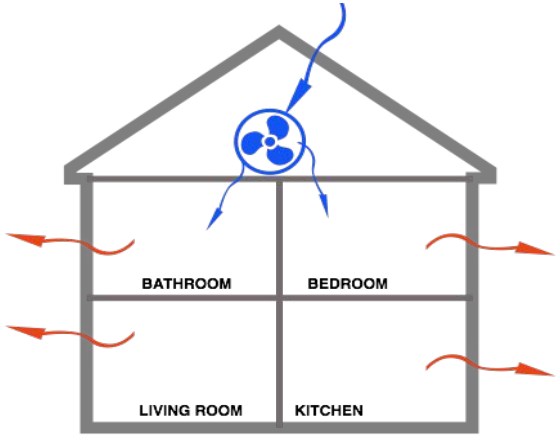
- Simple and relatively cheap to install.

Cons:

- Can be costly to run, with poor energy efficiency.
- Comfort issues as cold air is pumped into rooms.
- Pressurises house, so forces warm/wet air into building fabric - a risk?

Air-tightness suitability: ??

Capital cost: £300 - 500 approx.



Ventilation Systems - Centralised Mechanical Extract

(Building Regs System 3)

- Background vent: Continuously running extract from wet rooms to central fan unit and exhaust.
- Purge vent: Boost function on fans - activated by light, humidity controlled, or a presence sensor.

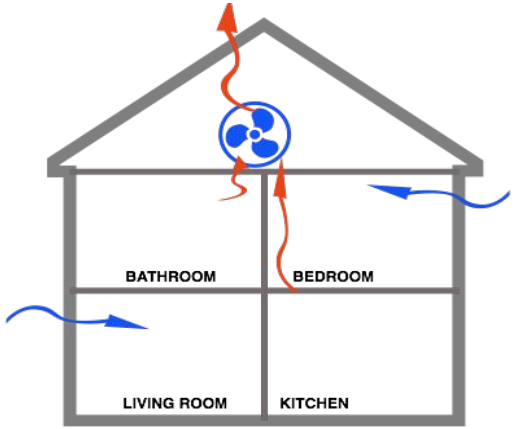
Pros:

- Limits number of 'holes' in building fabric.
- Reduces energy use by having single fan.
- Maintenance
- Possible to acoustically separate.

Cons:

- More complex and expensive to install - need space and routes for ducts.
- Comfort - cold air supply.

Air-tightness suitability: Above 1.5 m3/m2.hr
Capital Cost: £500-1000



Demand Controlled CME:

AERECO

Ventilation Systems - Decentralised Mechanical Extract

(Building Regs System 3?)

- Background vent: Continuously running extracts in wet rooms. Supply from trickle vents in walls/windows.
- Purge vent: Boost function on fans - activated by light, humidity controlled, or a presence sensor.

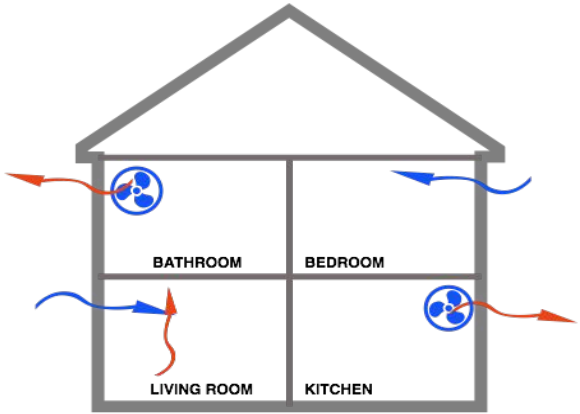
Pros:

- Simple and relatively cheap to install and run.
- Provides continuous ventilation.
- Low-noise fans available.

Cons:

- Questions over energy efficiency and noise.
- Comfort - cold air supply.

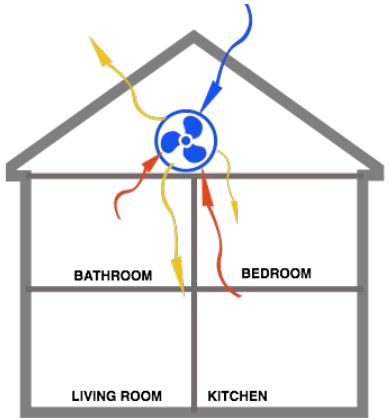
Air-tightness suitability: Above 3 m3/m2.hr
Capital Cost: Approx £200 per unit.



Ventilation Systems - Mechanical Ventilation with Heat Recovery (MVHR)

(Building Regs System 4)

- Background vent: Continuously running extract from wet rooms to central fan unit and exhaust, with continuous supply from same unit to living rooms.
- Purge vent: Boost function on fan - activated by manual switch, light, humidity or presence sensor.

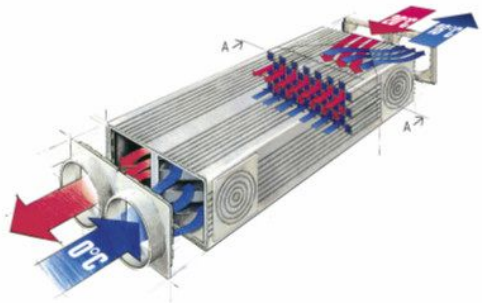


Pros:

- Limits number of 'holes' in building fabric and reduces energy use by having single fan.
- Limits noise from outside.
- Very energy efficient.
- Good comfort.

Cons:

- Complex and expensive to install - needs space that may not always be available in retrofit.
- Good quality design and install requires attention to detail and appropriate resources.
- Requires regular maintenance - filter changes etc.



Air-tightness suitability: Most energy efficient below 1.5 m3/m2.hr - but could be fitted for noise, IAQ and comfort reasons at worse permeabilities with an energy penalty.

Capital Cost: £4000+

Ventilation Systems - Mechanical Ventilation with Heat Recovery (MVHR)

(Building Regs System 4)

- Background vent: Continuously running extract from wet rooms to central fan unit and exhaust, with continuous supply from same unit to living rooms.
- Purge vent: Boost function on fan - activated by manual switch, light, humidity or presence sensor.

Pros:

- Limits number of 'holes' in building fabric and reduces energy use by having single fan.
- Limits noise from outside.
- Very energy efficient.
- Good comfort.

Cons:

- Complex and expensive to install - needs space that may not always be available in retrofit.
- Good quality design and install requires attention to detail and appropriate resources.
- Requires regular maintenance - filter changes etc.

Air-tightness suitability: Most energy efficient below 1.5 m3/m2.hr - but could be fitted for noise, IAQ and comfort reasons at worse permeabilities with an energy penalty.
Capital Cost: £4000+

Ventilation Systems - Decentralised MVHR

(Building Regs System 4(?))

- Background vent: Continuously supply and extract with integrated heat recovery in individual rooms.
- Purge vent: Boost function on fan - activated by manual switch, light, humidity or presence sensor.

Pros:

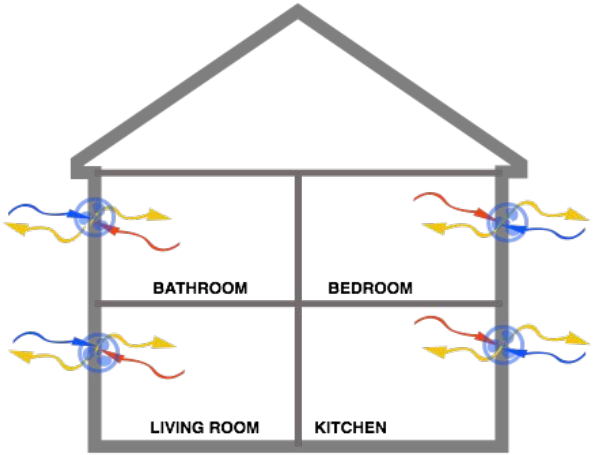
- Relatively simple to install.
- Heat recovery improves energy efficiency.

Cons:

- Requires regular maintenance, filter changes etc.
- Potential for over-ventilation? Higher power use?
- Uncertainty over how can be balanced across whole house.

Air-tightness suitability: ???

Capital Cost: £300 per unit.



Quick Wins

- Get a carbon monoxide monitor!
- Get a simple hygrometer.
- If you have trickle vents - use them!
- If you have manual switches for kitchen and bathroom extracts, make sure they're on when they need to be.
- Clean any fans you have now - dust and dirt makes them run less efficiently.
- Think about where you dry your clothes, and how this can be better ventilated.
- Use low VOCs paints and materials when refurbishing.
- Put lids on pans when cooking.

Thank you to URBED

Carbon Co-op

www.carbon.coop / @carboncoop