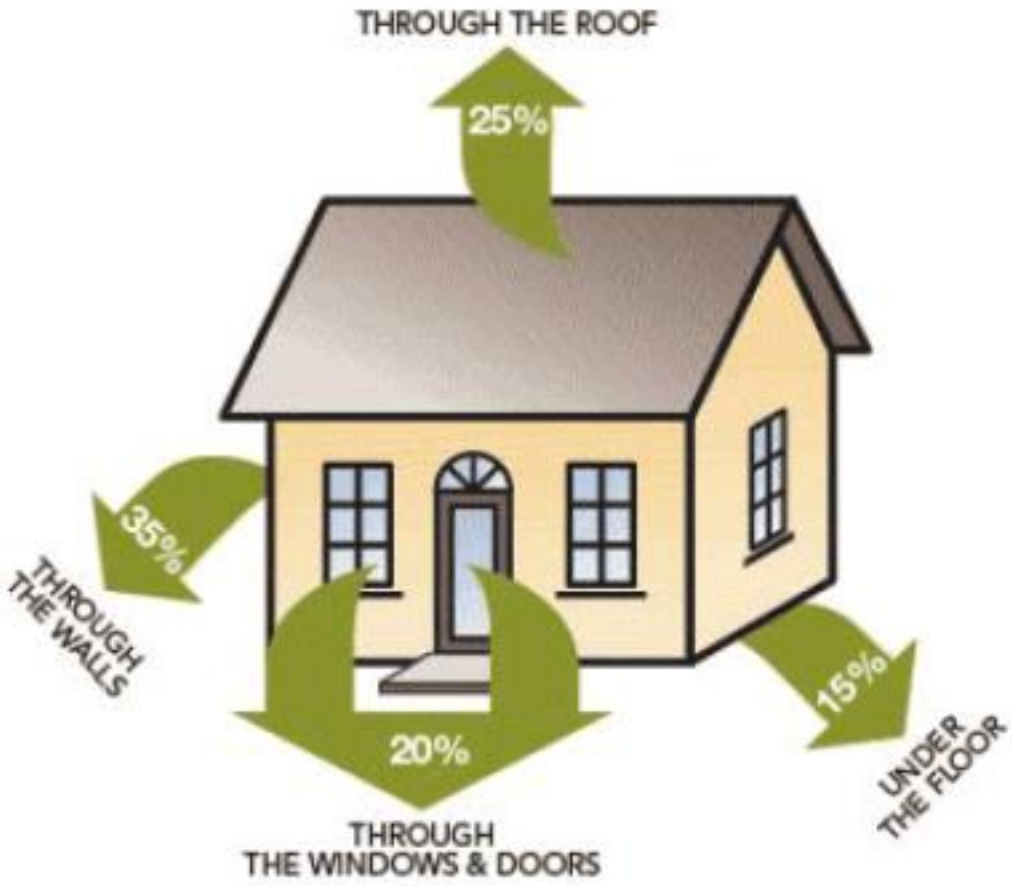
Sustainable Building Design Principles

STUDY TOUR 18/10/2018

STRUCTUREFIRST – SERVICES SECOND – TECHNOLOGY LAST

FIRST REDUCE HEAT DEMAND

- by improving insulation and cutting heat lost to the outside



THEN IMPROVE EFFICIENCY OF ENERGY USED

- by fitting the best boilers, lighting and control systems

FINALLY CONSIDER USING RENEWABLE TECHNOLOGY

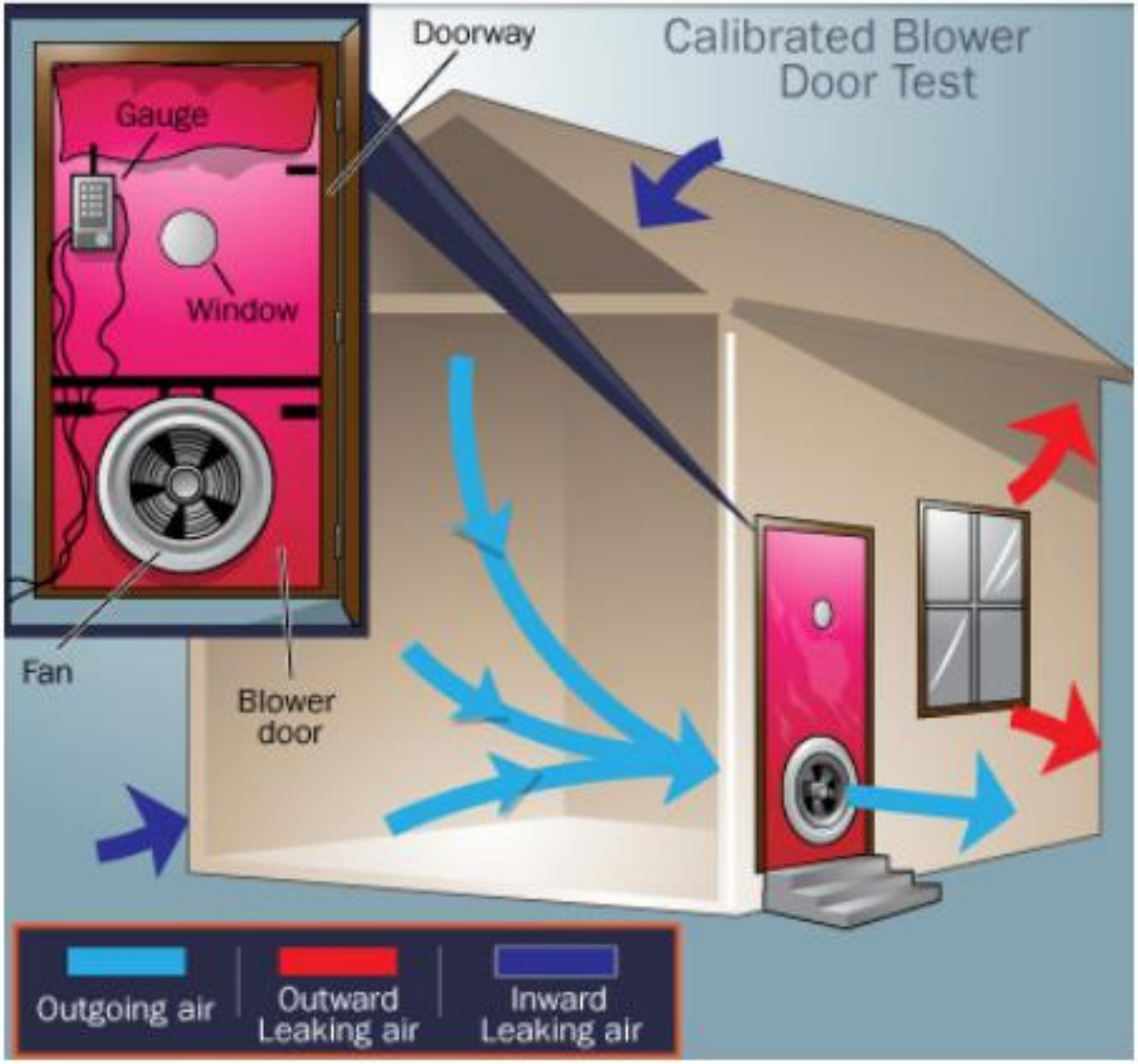
- in order to generate your own energy in the most sustainable way

“Build Tight, VentilateRight ”

Airtightness

Dr Arne Elmroth,
Professorat the Royal Institute of Technology, Stockholm1980

Building air tightness test



All of the air leakage paths occurringwithin a dwelling will haveparticular aerodynamic characteristics that are dependentupon the directionin which the air is flowing.

Air permeability results. Comparisons in dwellings

	Building Regulations 2010	Code for Sustainable Homes levels 1,2,3	Code for Sustainable Homes levels 4,5,6	Good Practice Energy Efficiency	Best Practice Energy Efficiency
Air permeability at 50 Pascal, $m^3/(m^2h)$	**10**	**3.0**	**1.0**	**4** (dwelling with HRV) **7** (dwelling with other ventilation systems)	**3**

Passivhaus require 0.6

Solar gain is the name given to the increase in temperature in a space, object orstructuredue to solar radiation, i.e. theheat fromthe sun .

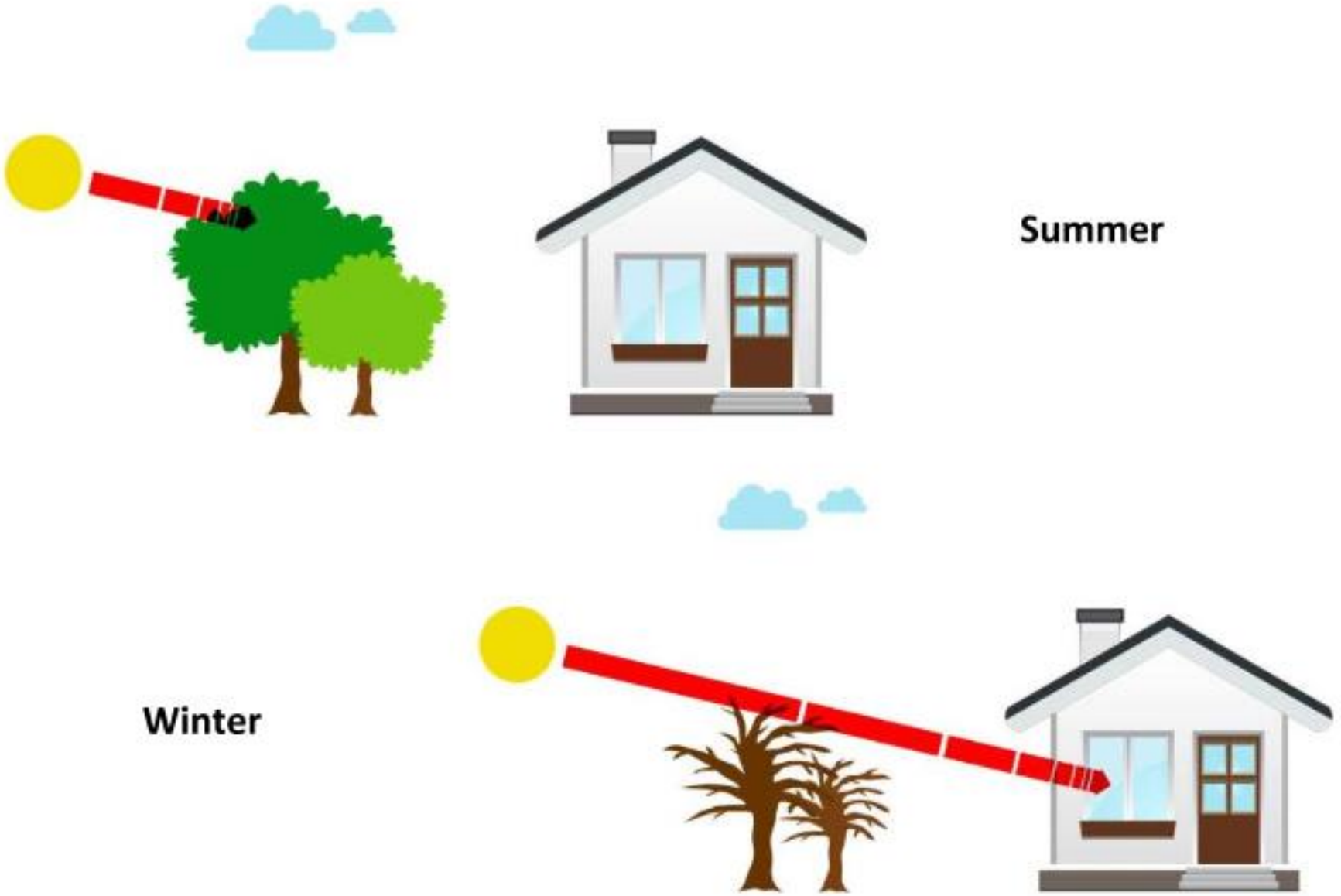
Making the most of the sunlight….

- **Solar gain can be optimised by:**
- Altering the location/size number of windows
- Building orientation
- Using construction materials with a high thermal mass

Too much sunlight....

- **Solar gain can be reduced by:**
- Limiting the size and area ofopenings such as doors andwindows
- Shading or orientating doors and windows from direct sunlight
- Using reflective materials onthe glassand building fabric
- Ventilating roof spaces

Passive design



Factors that determine thermal mass

Specific heat capacity

Specific heat capacity refers to a material's capacity to store heat for every kilogram of mass. A material of 'high' thermal mass has a high specific heat capacity. Specific heat capacity is measured in J/kg.K

Density

The density refers to the mass (or 'weight') per unit volume of a material and is measured in kg/m^3. A high density material maximises the overall weight and is an aspect of 'high' thermal mass.

Thermal conductivity

Thermal conductivity measures the ease with which heat can travel through a material. For 'high' thermal mass, thermal conductivity usually needs to be moderate so that the absorption and release of heat synchronises with the building's heating and cooling cycle. Thermal conducitivity is measured in units of W/m.K

Passivhaus design

Sustainable Building Futures

Passivhaus is a performance-based set of design criteria for very low energy buildings, which can help create buildings whichuse around 90% less energy than standard UKbuildings.

Developedin Germany at the beginning of the 1990s by Professor Wolfgang Feist withProfessorBo Adamson from Lund University, Sweden, Passivhaus design is based on well researched and proven building physics.

PASSIV HAUS INSTITUT

investing in your future

European Regional Development Fund

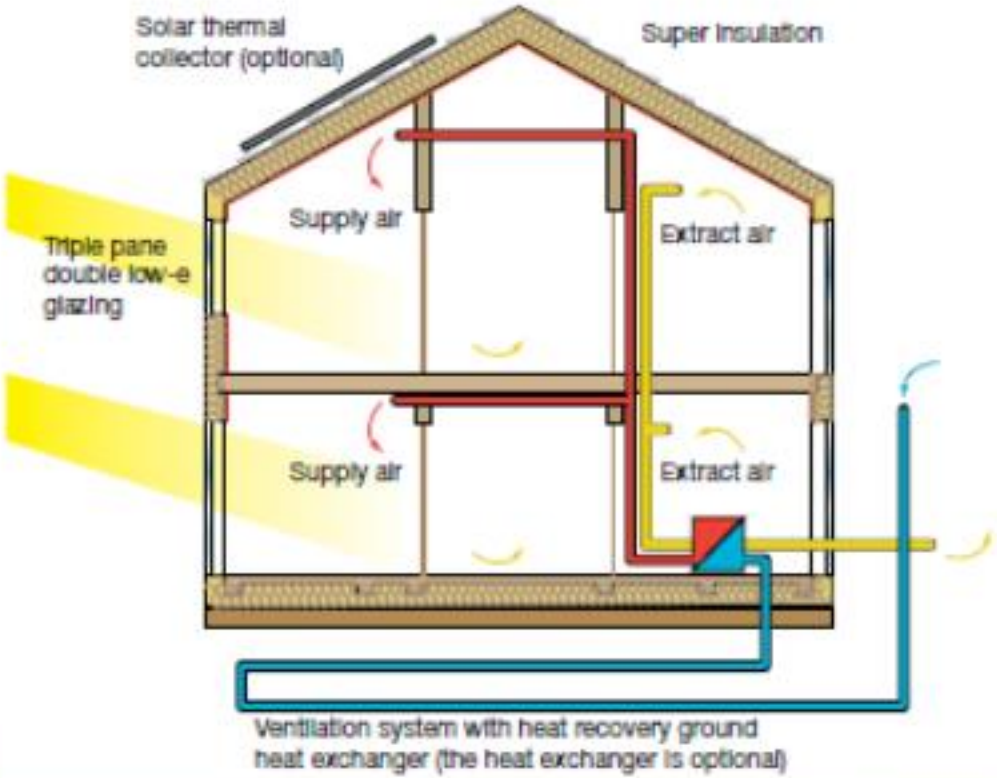
European Union

Coventry University

Passivhaus design criteria

Sustainable Building Futures

Building energy performance	
Specific heating demand	≤ 15kWh/m².yr
or Specific Peak load	≤ 10 W/m²
Specific cooling demand	≤ 15kWh/m².yr
Primary energy demand	≤ 120kWh/m².yr
Elemental performance requirements	
Airtightness	≤0.6 ac/h (n50)
Window U value	≤ 0.80 W/m²K
Window installed U value	≤ 0.85 W/m²K
Services performance	
MVHR heat recovery efficiency	≥ 75%*
MVHR electrical efficiency	≤ 0.45 Wh/m³



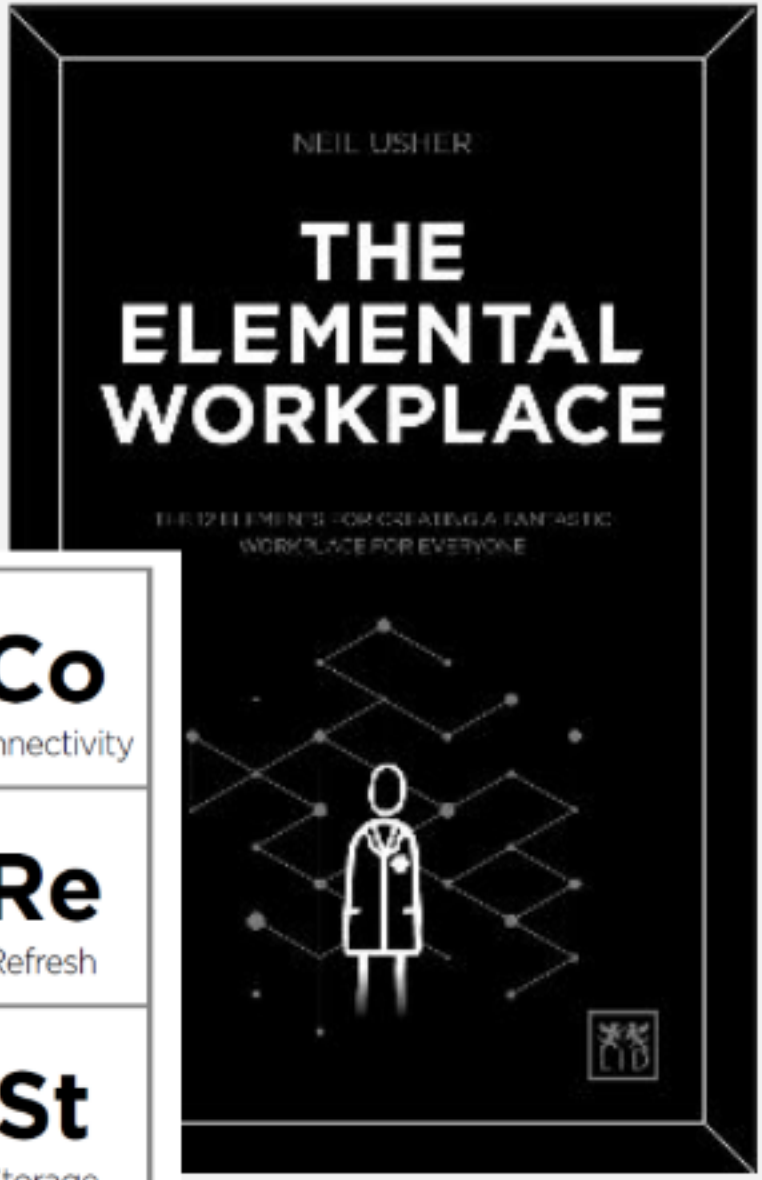
Source: BRE 'Passivhaus Primer – Designer Guide.'

Efficientspace planning ?

The Productive worker

Neil Usher - ex Director of Workplace at Sky Central– often seen as Europe's most innovative and agile work space.

Move awayfrom designing the workplace based on ***image*** to one that createsa ***positive environment*** for workers.



1 **Da** Daylight				2 **Co** Connectivity
3 **Sp** Space	4 **Ch** Choice	5 **In** Influence	6 **Cn** Control	7 **Re** Refresh
8 **Se** Sense	9 **Cf** Comfort	10 **Ic** Inclusion	11 **Wa** Wash	12 **St** Storage