Live Better – Pushing Sustainable Boundaries

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EXETER
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Live Better – Pushing Sustainable Boundaries

Exeter City Council

Exeter Vanguard Event
3rd October 2018

Good Homes Alliance

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Social
Responsibility
Financial
Responsibility
Environmental
Responsibility

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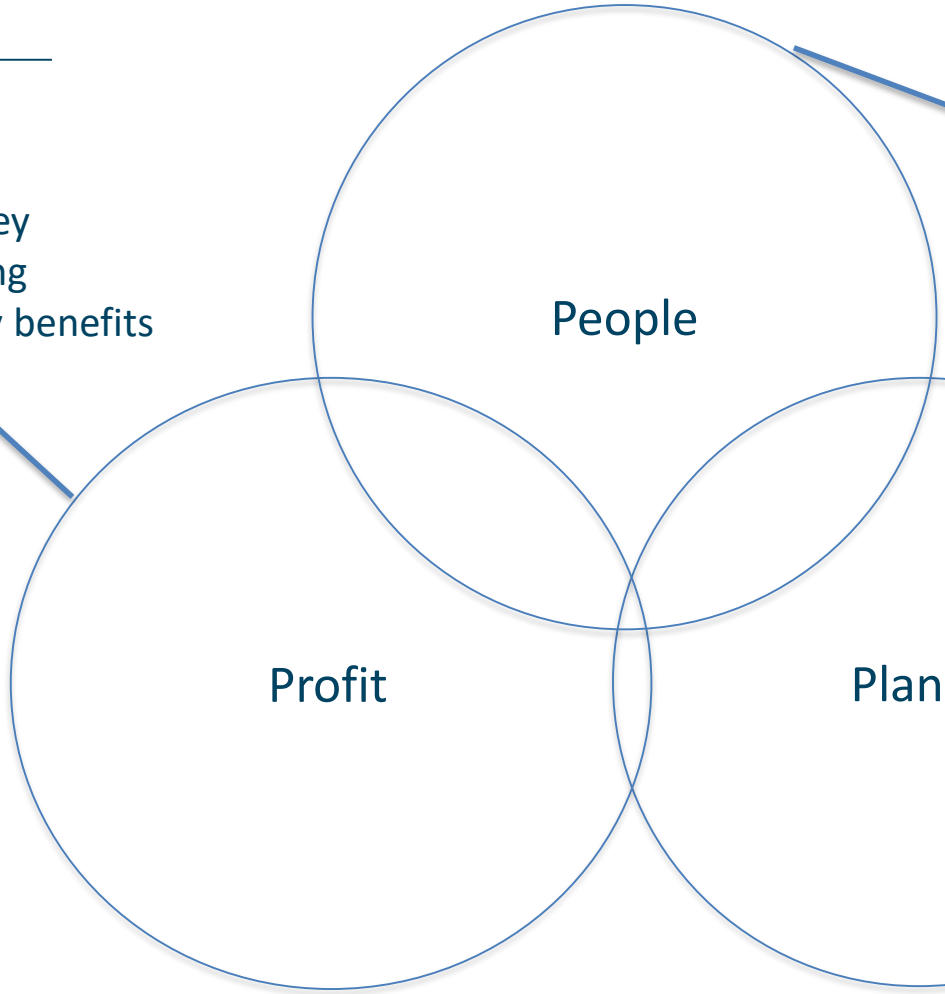

Human Centred
- Great design
- Healthy (Bau-biology)
- Comfortable (Passivhaus)

- Value for money
- High Performing
- Local economy benefits

- Climate ready
- Low carbon
- Low energy

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"If nature had been comfortable, mankind would have never invented architecture"

Oscar Wilde

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Passivhaus

- Voluntary energy standard & a design methodology
- 40,000 + examples globally, 3,500 certified by PHI as Quality Approved Passivhaus, 150 certified home in the UK
- Three Criteria:-
  - Energy Criteria
  - Comfort Criteria
  - Hygiene Criteria
- Very simple & 'relatively easy' to achieve

PHI functional definition:
'A Passivhaus is a building, for which thermal comfort can be achieved solely by post-heating (or post-cooling) of the fresh air, which is required to maintain sufficient indoor air quality'……..meaning no other conventional heating system will be required.

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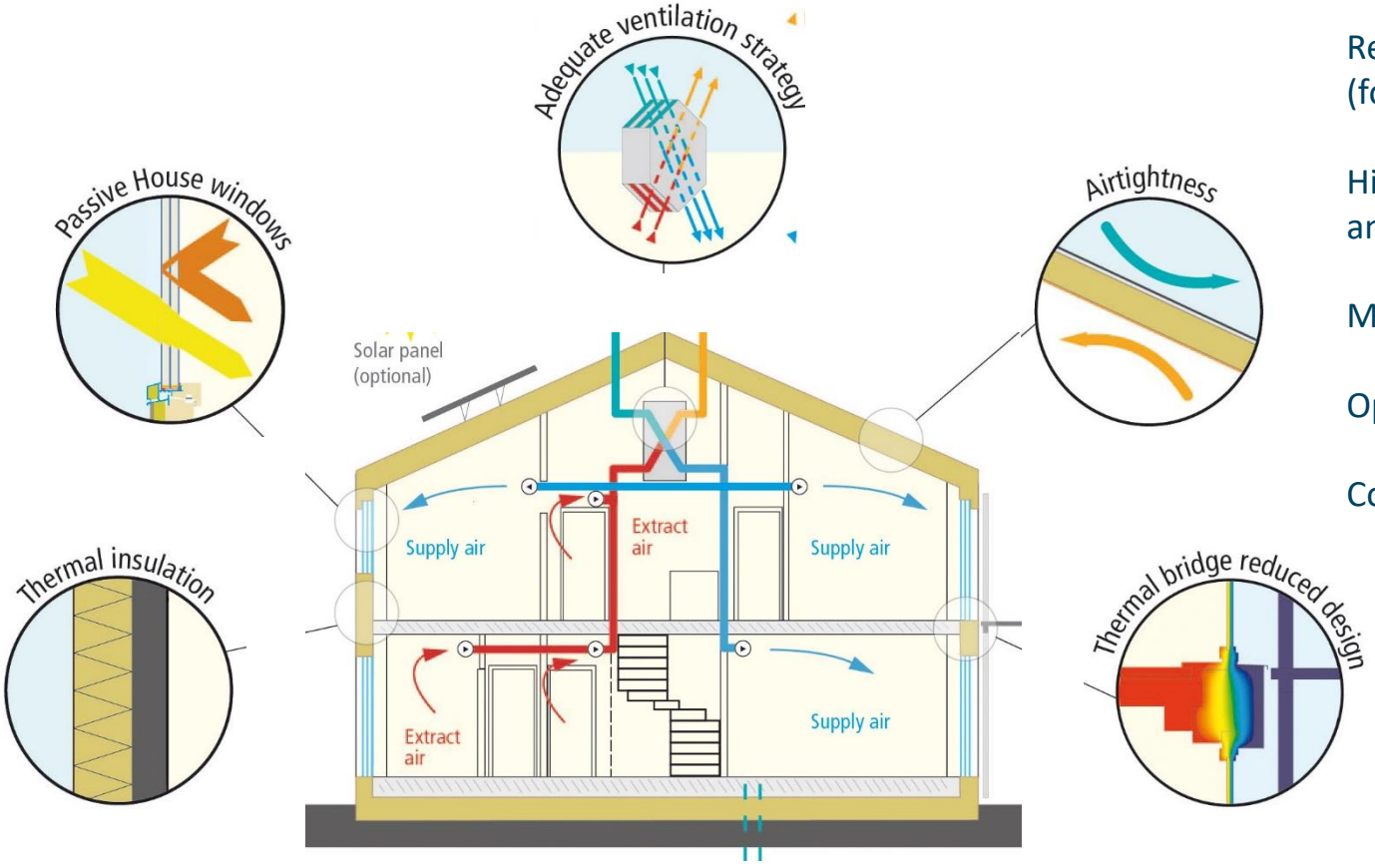
Passivhaus – How Does it work?



Insulation
U value <0.15 W/m2K

Continuous Air tight Barrier

Reduced Thermal Bridging!
(following the PH method)

High Performance Windows and Doors

MVHR >75% efficient

Optimized Solar Orientation

Compact Building Form

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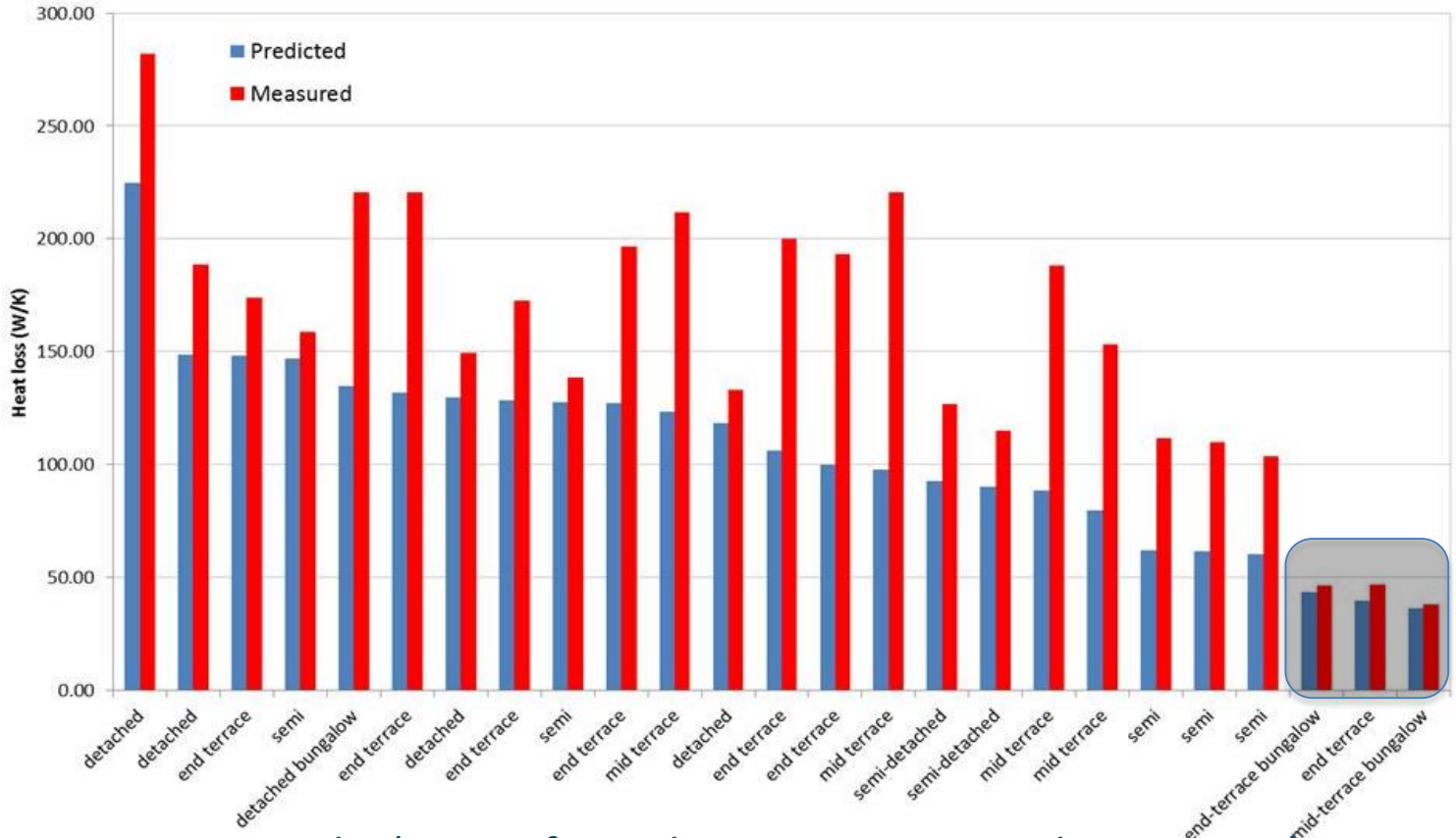
Passivhaus

- Tried & tested. Minimal or no performance gap



Heating test results (Centre for Built Environment, Leeds University)

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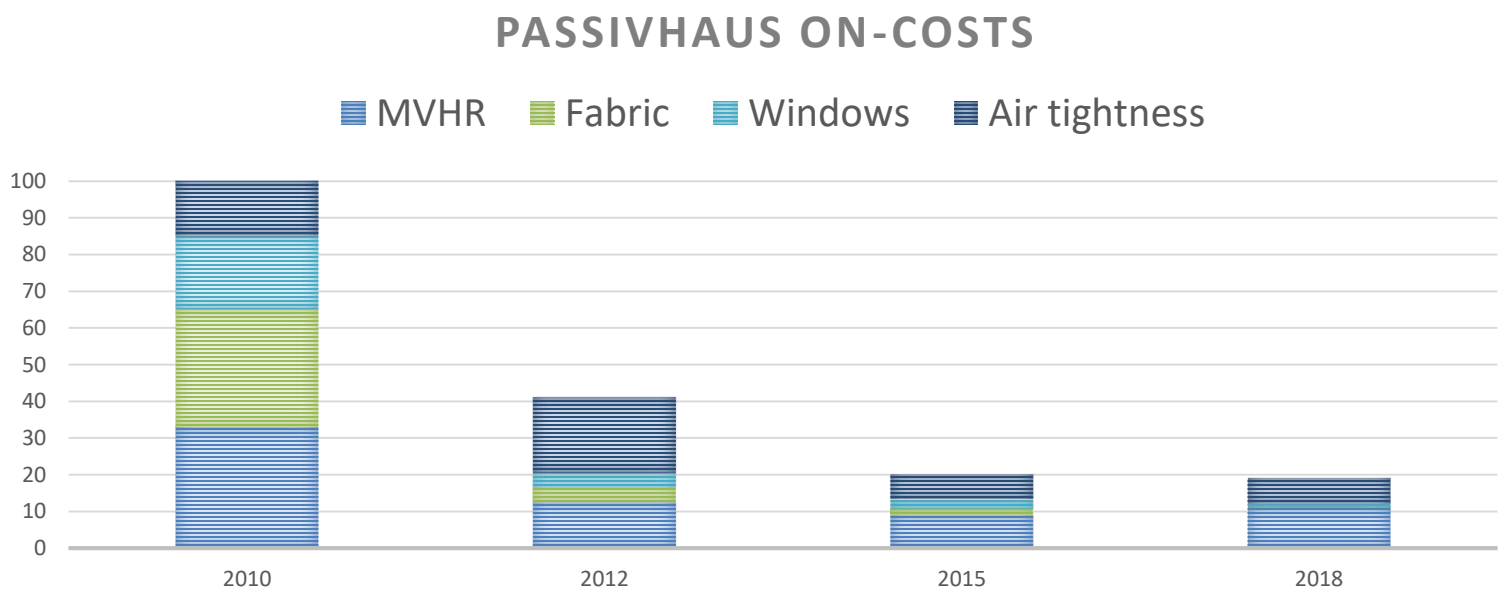
Cost effective



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Healthy Homes – What are the issues?

Main health issues in the UK

- Asthma - *£1.1 billion cost to the NHS*
- Cancer - *£18.3 billion cost to the NHS*
- Diabetes - *£23.7 billion cost to the NHS*
- Mental health disorder - *£70 billion cost to the NHS*
  - £2.6 billion to the UK employers alone

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Healthy Homes – Why bother?

"There are around 100,000 potentially neurotoxic substances in commercial use, with **2,300 new ones every year**. There is no way for research into their impacts to keep up; **all they look for is the lethal dose"**

Dr Sarah Mackenzie Ross

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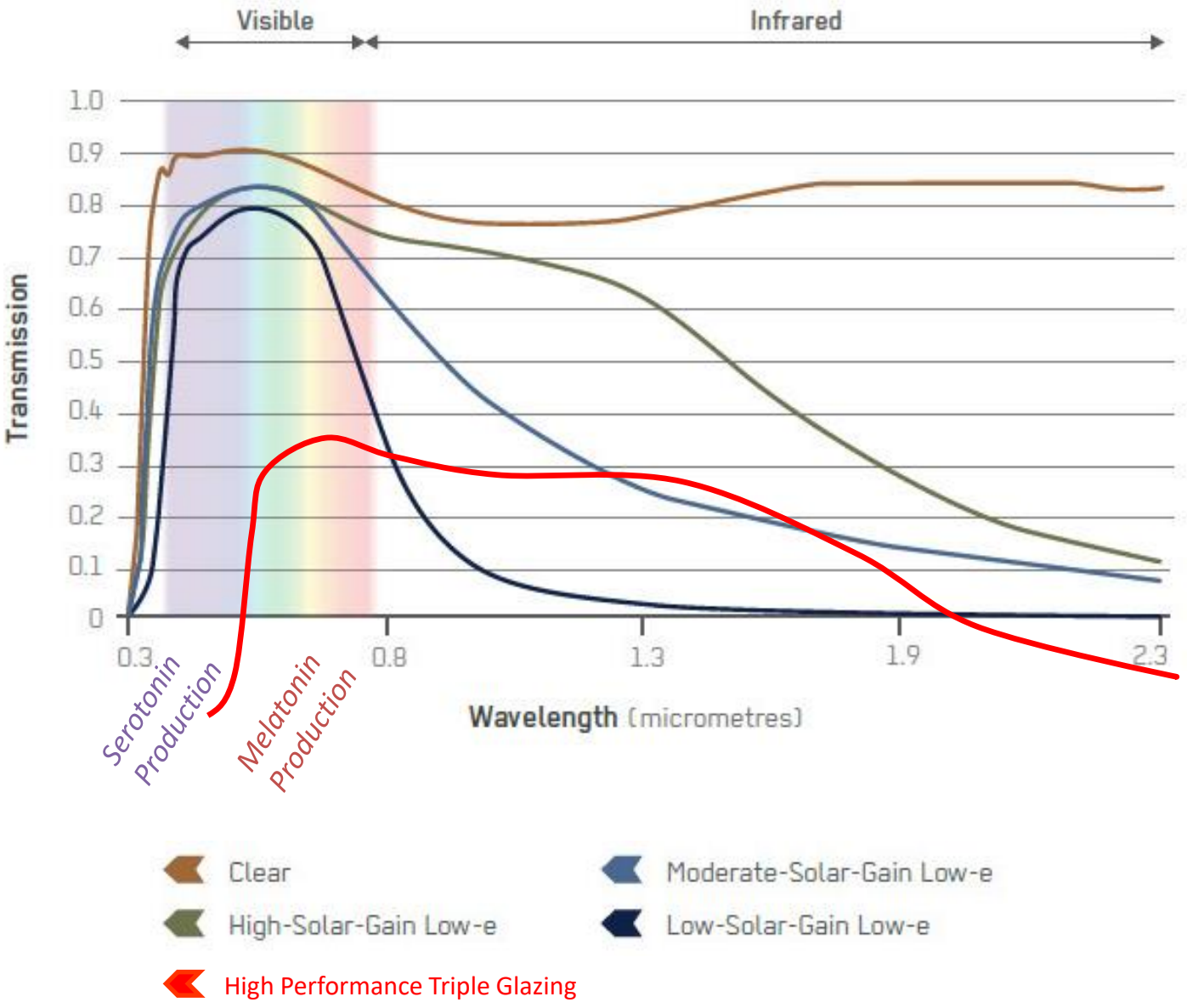
Healthy Homes

- Role of ventilation (Air Quality)
- Role of materials (Air Quality)
- Daylight……



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- Sleep

Electro statics

Bacteria

Mould

VOC

Odour

Daylight

Comfort

Humidity

Dust

Hygiene

Acoustic

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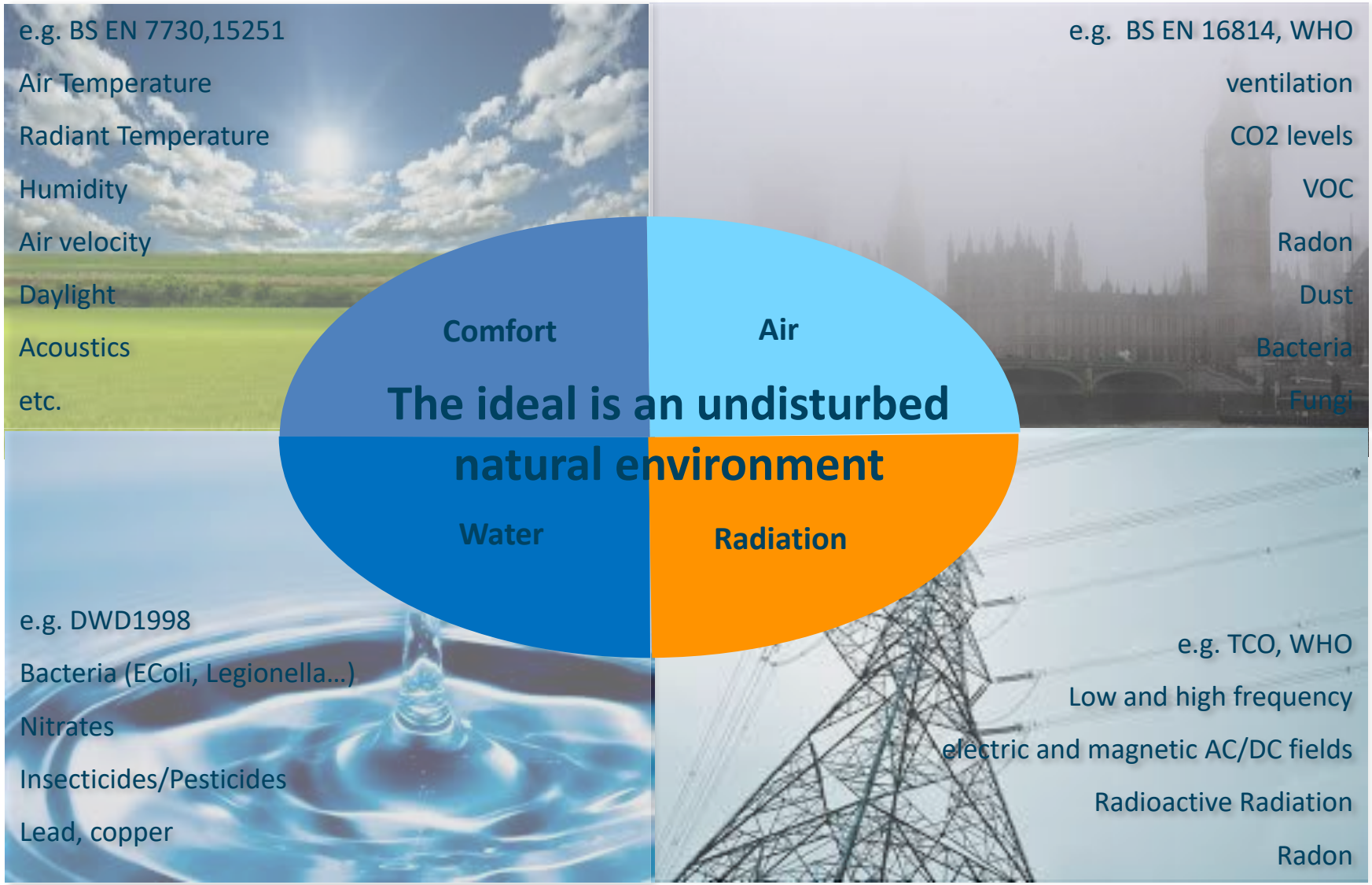
Bau Biology

Risks are identified and assessed based on the 'Standard of Building Biology Testing Methods' (SBM 2015)



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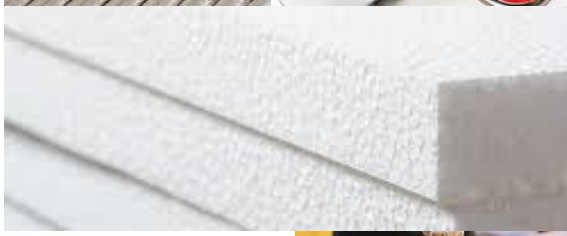
Healthy Design – SBM2015

Clearly defined, scientific, measurable targets for air quality, indoor climate, lighting and day light, radiation








B INDOOR TOXINS, POLLUTANTS, INDOOR CLIMATE

1 FORMALDEHYDE and other Toxic Gases

Formaldehyde in microgram per cubic meter	**µg/m³**	**< 20**	**20 - 50**	**50 - 100**	**> 100**

MAK: 370 µg/m³, BGA: 120 µg/m³; WHO: 100 µg/m³; AGÖF reference value 'normal': 30 µg/m³; VDI: 25 µg/m³; irritation of mucous membranes and eyes: 50 µg/m³; odor detection threshold: 60 µg/m³; immediate danger to life: 30.000 µg/m³; nature < 2 µg/m³; 100 µg/m³ = 0.083 ppm

3 PESTICIDES and other Semi-Volatile Organic Compounds (SVOV)

Pesticides	air	**ng/m³**	**< 5**	**5 - 25**	**25 - 100**	**> 100**
e.g. PCP, lindane, permethrin, chlorpyrifos, DDT, dichlofluanid...	wood, material	**mg/kg**	**< 1**	**1 - 10**	**10 - 100**	**> 100**
	dust	**mg/kg**	**< 0.5**	**0.5 - 2**	**2 - 10**	**> 10**
	material with skin contact	**mg/kg**	**< 0.5**	**0.5 - 2**	**2 - 10**	**> 10**
PCB	dust	**mg/kg**	**< 0.5**	**0.5 - 2**	**2 - 5**	**> 5**
Fire Retardants chlorinated	dust	**mg/kg**	**< 0.5**	**0.5 - 2**	**2 - 10**	**> 10**
halogen-free	dust	**mg/kg**	**< 5**	**5 - 50**	**50 - 200**	**> 200**
PAH	dust	**mg/kg**	**< 0.5**	**0.5 - 2**	**2 - 20**	**> 20**
Plasticizers	dust	**mg/kg**	**< 100**	**100 - 250**	**250 - 1000**	**> 1000**

Sum total values in nanogram per cubic meter (air) and in milligram per kilogram (material, wood, dust), respectively.

Values for dust apply to typical mixtures of substances. Values for adsorbed plasticizers in dust (sum total: x 2); PCB according to LAGA. PAH according to EPA.

5 PARTICLES and FIBERS (Fine Particulate Matter, Nanoparticles, Asbestos, Mineral Fibers...)

Indoor concentrations of particulate matter, fibers or dust should be below the common, uncontaminated outdoor concentrations. Asbestos should not at all be detectable in indoor air, house dust and on indoor surfaces.

Former building biology reference values for asbestos fibers, SBM-2000: < 100 no, 100-200 slight, 200-500 strong, > 500/m³ extreme anomaly

Asbestos fibers in air - BGA: 500-1000/m³; TRGS target: 500/m³; EU: 400/m³; WHO: 200/m³; outdoor air: 50-150/m³; clean air region: 20/m³; Particulate matter in air (annual avg.) - BImSchV: 40 µg/m³; EU: 50 µg/m³ (< 10 µm); EPA: 25 µg/m³ (< 2.5 µm); VDI: 75 µg/m³; TA: 150 µg/m³; Alps 3000 m: 5-10 µg/m³; rural: 20-30 µg/m³; urban: 30-100 µg/m³; indoor with tobacco smoke: 10 000 µg/m³; smog warning: 800 µg/m³

6 INDOOR CLIMATE (Temperature, Humidity, Carbon Dioxide, Air Ions, Air Changes, Odors...)

Relative humidity in percent	**% r.h.**	**40 - 60**	**< 40 / > 60**	**< 30 / > 70**	**< 20 / > 80**
Carbon dioxide in parts per million	**ppm**	**< 600**	**600 - 1000**	**1000 - 1500**	**> 1500**

MAK: 5000 ppm; DIN: 1500 ppm; VDI: 1000 ppm; USA (occupational/classrooms): 1000 ppm; unventilated bedroom after one night or classroom after a one-hour lesson: 2000-4000 ppm; nature in 2008: 380 ppm, in 1985: 330 ppm; annual increase: 1-2 ppm

Small air ions per cubic centimeter air	**/cm³**	**> 500**	**200 - 500**	**100 - 200**	**< 100**

Nature by the sea: > 2000/cm³; clean outdoor air: 1000/cm³; rural: < 800/cm³; urban: < 700/cm³; industrial areas/traffic: < 500 /cm³; indoor with static electricity: < 300/cm³; indoor with tobacco smoke: < 200/cm³; smog < 50/cm³; continuous decrease of air ions over past years/decades

Air electricity in volt per meter	**V/m**	**< 100**	**100 - 500**	**500 - 2000**	**> 2000**

DIN/VDE: occupational 40 000 V/m, general 10 000 V/m; nature: ca. 50-200 V/m, foehn: ca. 1000-2000 V/m, thunderstorm: 5000-10 000 V/m

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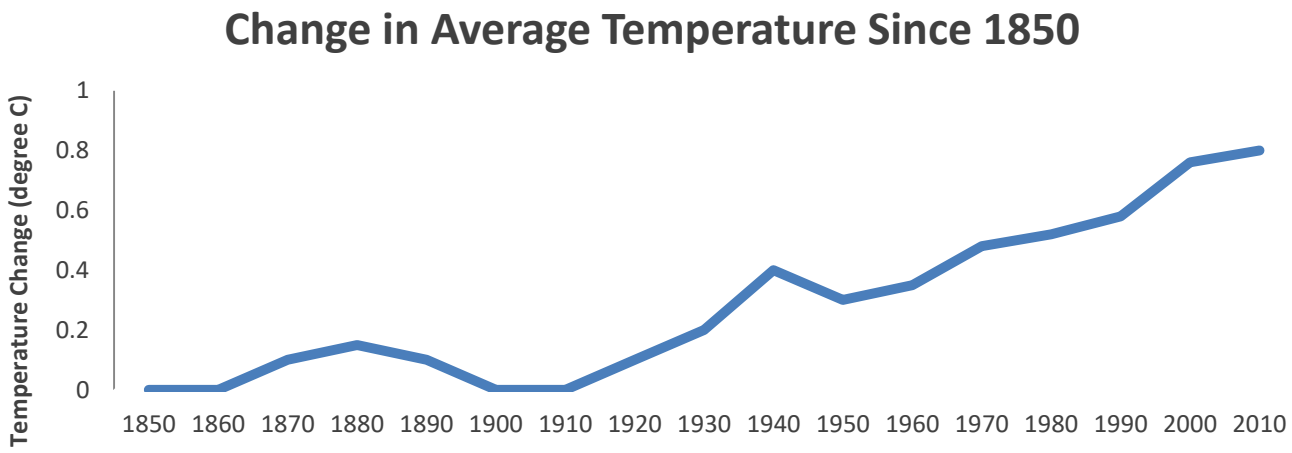
Climate Ready Design

- Since 1960's the average temperature in UK has risen
- Average summer temperature increase of 4-6 degree by 2100
- Increase in UV radiation
- Events of extreme rainfall and flooding have become more frequent and this trend is predicted to increase



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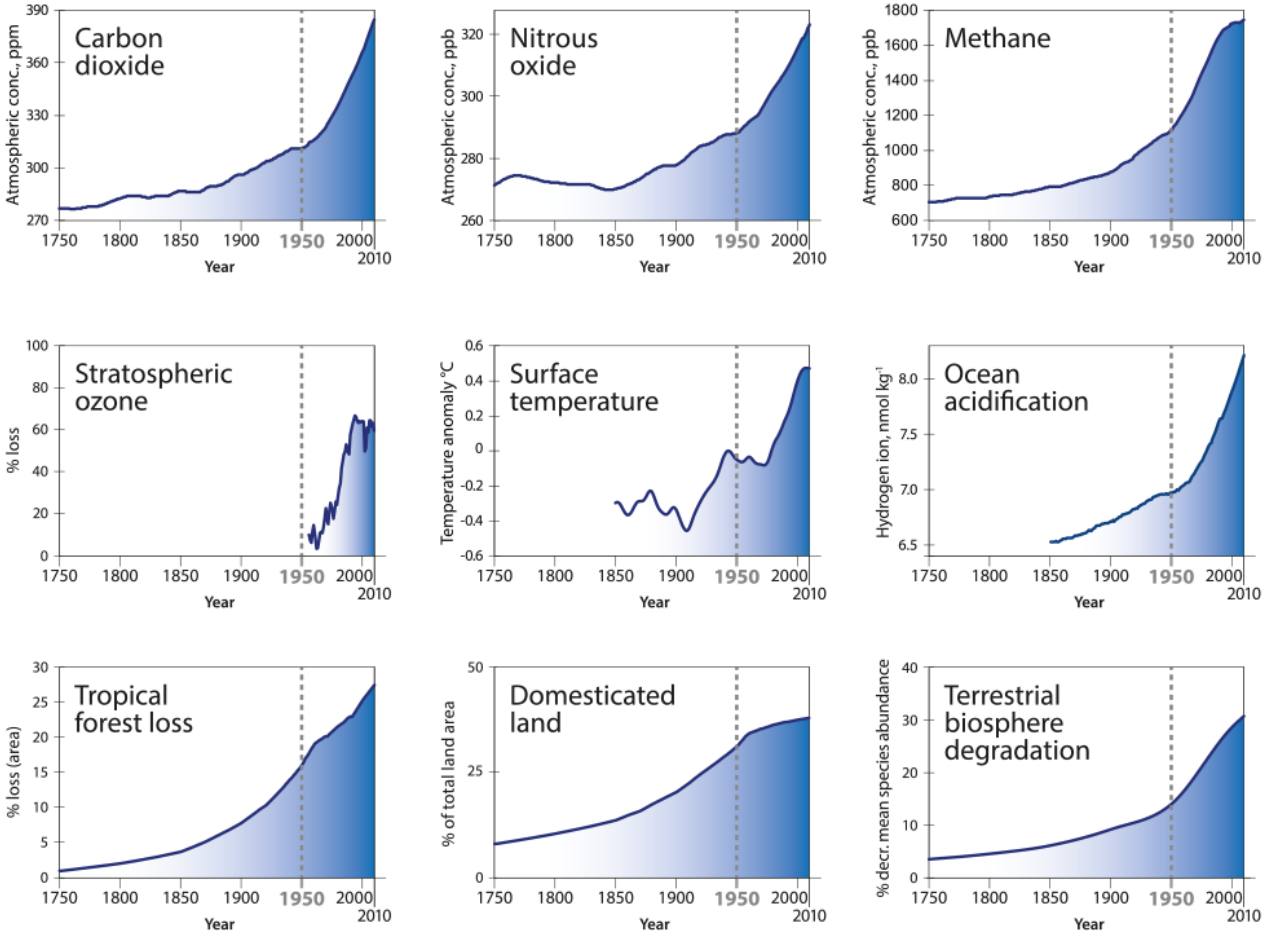
Climate Change



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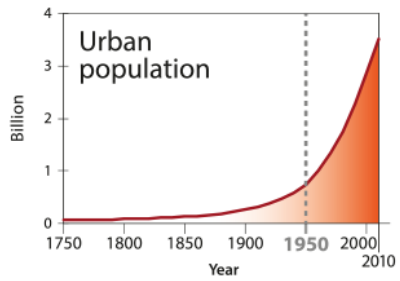
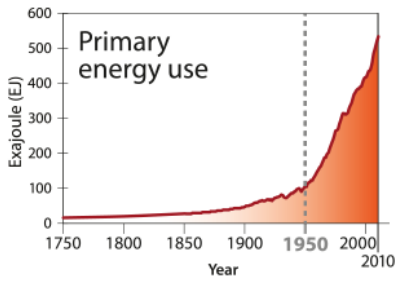
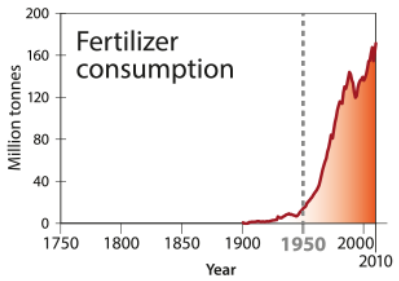
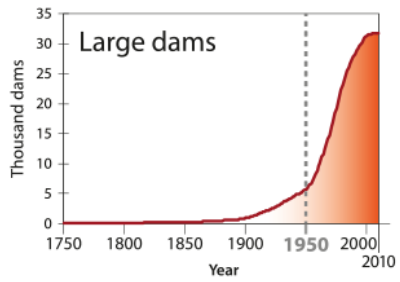
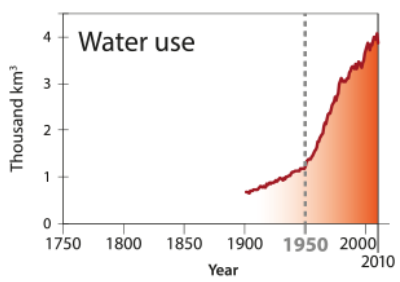
Climate Change

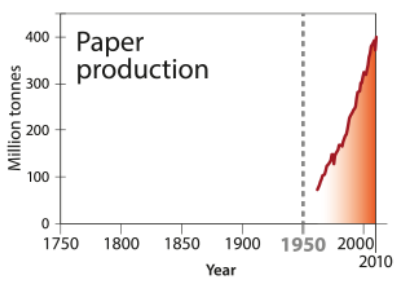


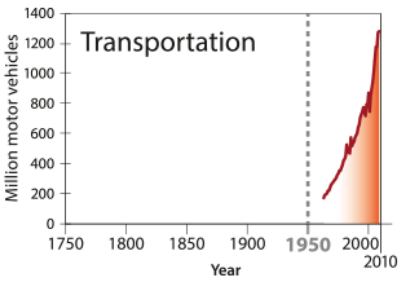


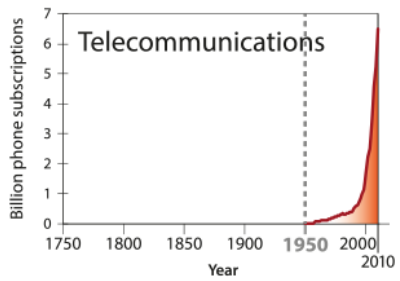


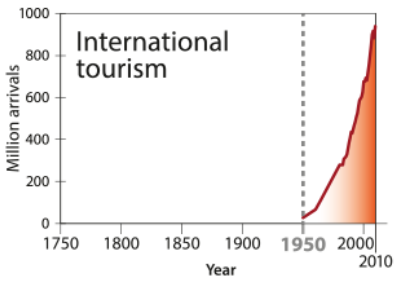












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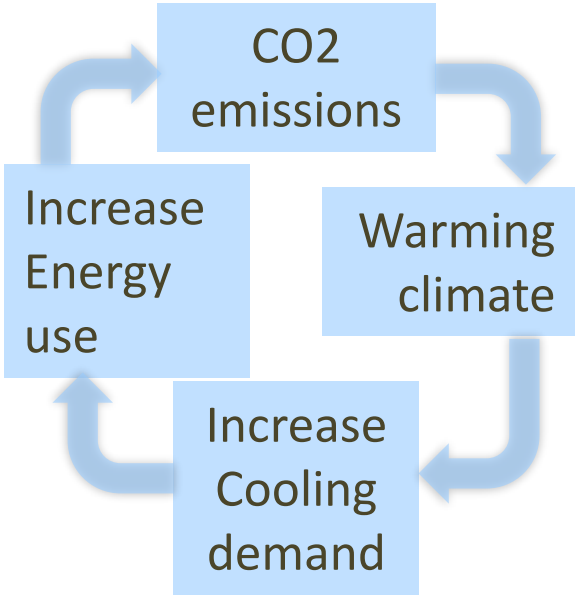
Climate Change?
What is the impact?

- Good news: ‘Energy used for heating buildings will fall by 30% over the next 15 years.’ (EU)

- If it gets hot? –
-
- Artificial cold is a recent phenomenon: the first domestic air-conditioning unit appeared in 1914, the first home fridges in 1930. As late as 1965, only a third of UK homes had one.

- Today air conditioning and refrigeration account for almost 20% of total electricity use in the UK

- Over the next 15 years the energy used to cool buildings is likely to increase by 72% (in the EU)



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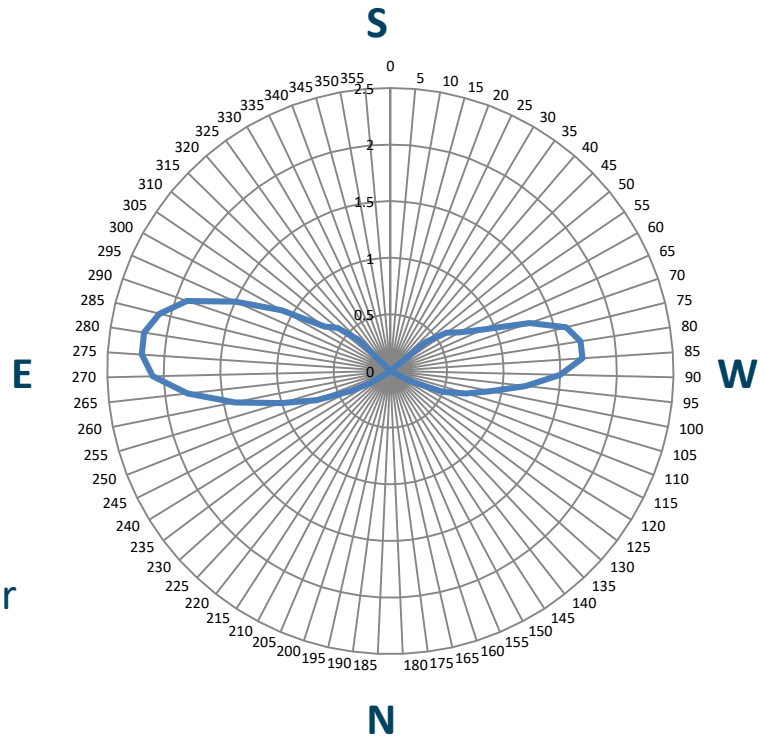
Overheating

To limit overheating it is recommended to include the following in the designs:

- Shading - shading devices and overhangs are effective strategies to reduce excessive solar gains
- Thermal mass - at least half of all space enclosing elements should be of high mass construction
- Ventilation - buildings should be detailed to allow for secure cross ventilation via opening windows on both sides of the building and via the roof lights

Contribution to Overheating (% hrs>25) Depending on Orientation



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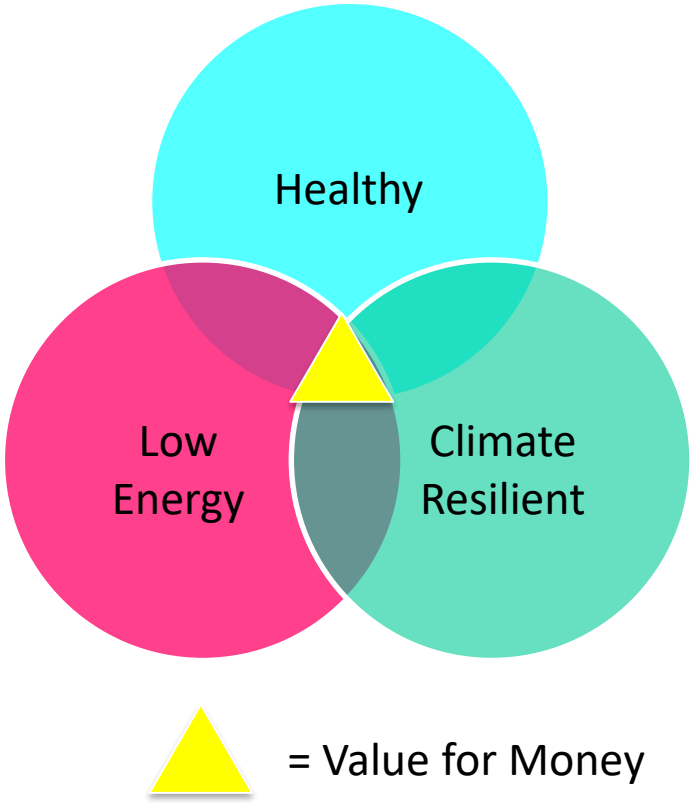
Putting theory into practice…



Development	Nos	Year
Rowan House	3	2009
Knights Place	18	2010
Silverberry Close	8	2015
Barberry Close	8	2015
Reed Walk	6	2015
Chester Long Court	21	2018
St Loyes Extra Care	53	2019/20
Total	**117**	

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Rowan House

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Knights Place

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Silverberry Close

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Barberry Close

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Reed Walk

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Chester Long Court

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ExtraCare

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St Sidwell's Point

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Pushing sustainable boundaries – the future

Exeter City Living Ltd – public / private sector development

- Year 1 – 43 market sale homes
- Year 2 – 100+
- Year 3 – 200 +

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Any questions?

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