

Zero Carbon Homes

Why? How? When?

Neil May

Natural Building Technologies

The Good Homes Alliance

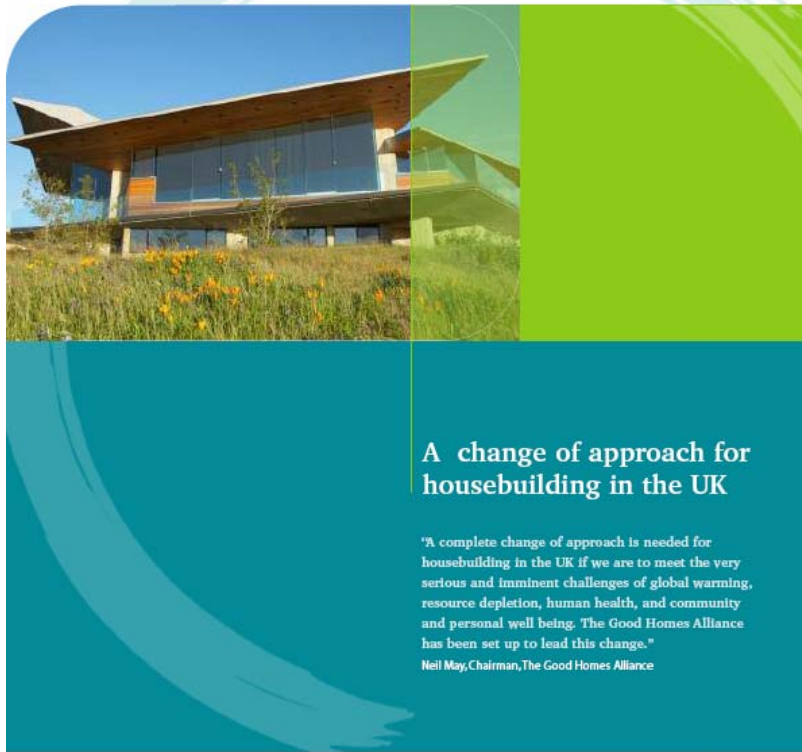


Natural Building Technologies

The Good Homes Alliance



An alliance of developers, building professionals and charities set up to deliver properly sustainable housing in the mainstream in the UK, and to prove the case



Sustainability's Triple Bottom Line

- Environmental
- Social
- Economic

What are the consequences of zero carbon policy?



UK Construction

**What is the
problem?**

The Big Issues

Environmental Impact

Human Health

Building Durability

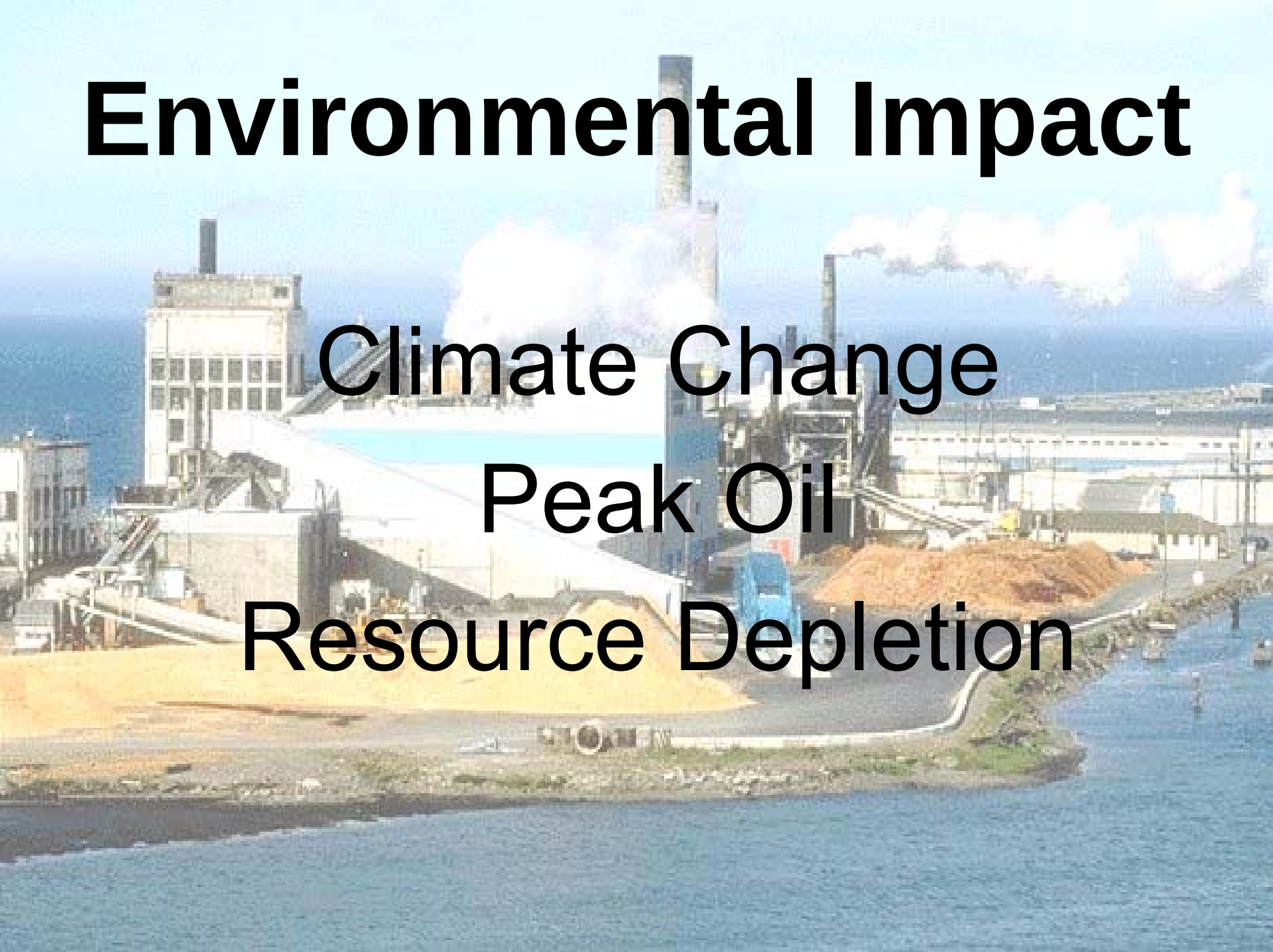
People in construction

Environmental Impact

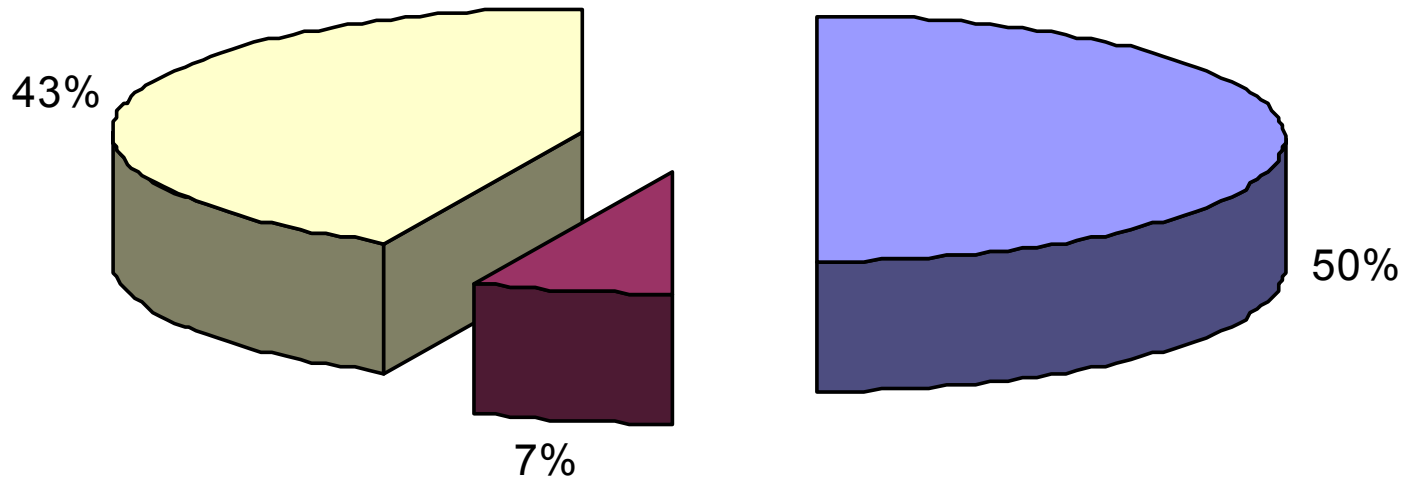
Climate Change

Peak Oil

Resource Depletion

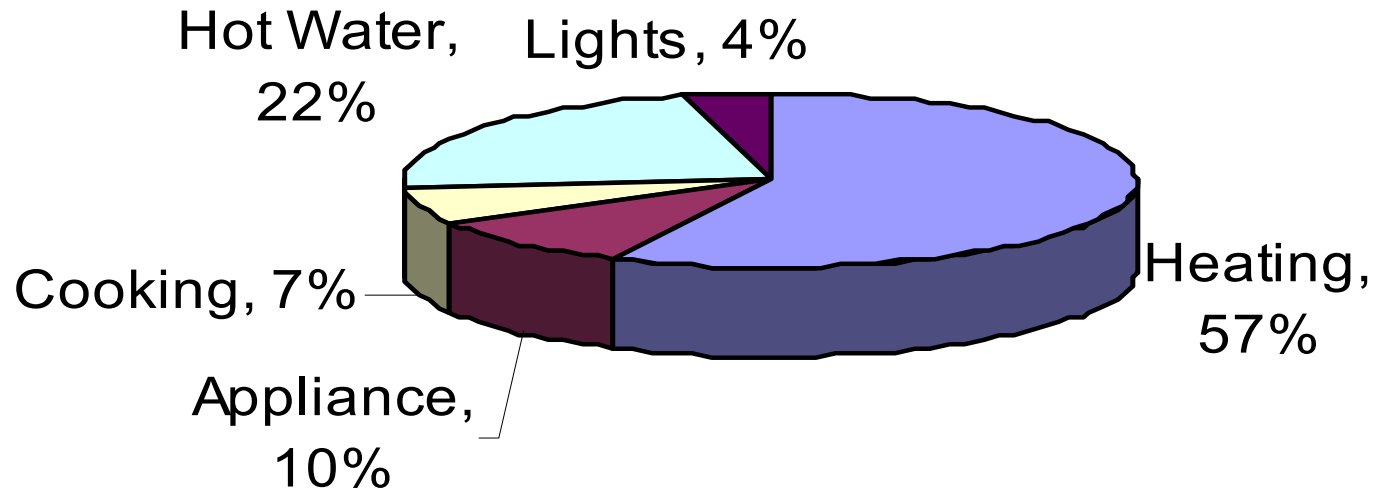


UK Buildings Energy Use



■ Buildings Use ■ Construction Materials ■ Other

Energy Use in Domestic Buildings



■ Heating ■ Appliance ■ Cooking ■ Hot Water ■ Lights

Some Shocking Facts

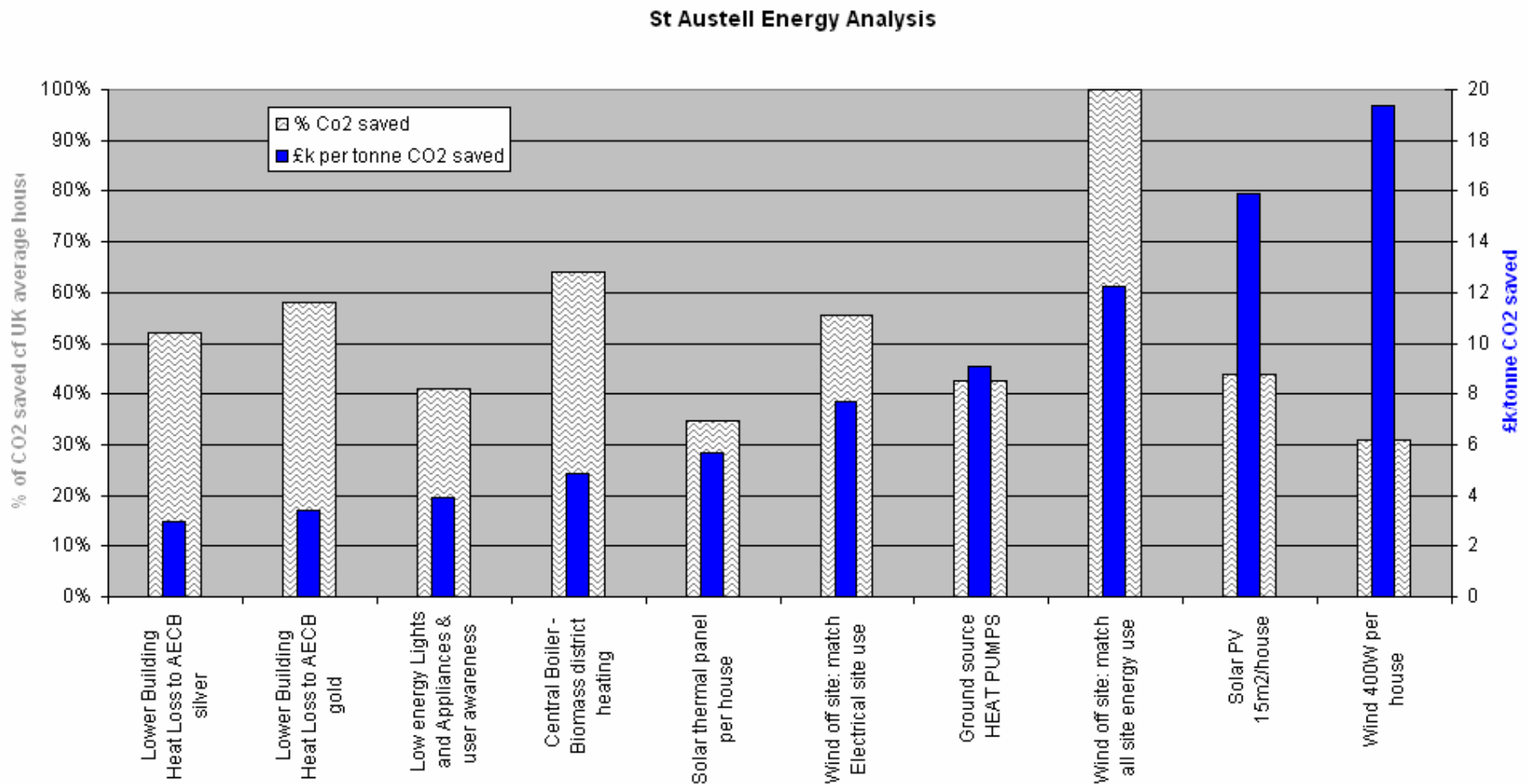
- Energy in building use has gone up by over 30% in the last 30 years
- Many designed U values fail by over 50% in design terms
- Buildings are not built airtight and are 30- 50% worse after 4 years
- Cooling forecast to be 25% of energy use by 2020
- Many building systems and products don't work
- Many architects haven't a clue
- Many builders don't build properly

The German Experience

- Passiv Haus development – 20 years
- Passiv Haus is not zero carbon
- Now 1% of new builds
- Financial incentives
- Supply chain development
- Cultural considerations
- 10 years minimum for 100% Passiv Haus
- Winning the world cup

Another Shocking Fact

- Micro Generation is not a simple answer

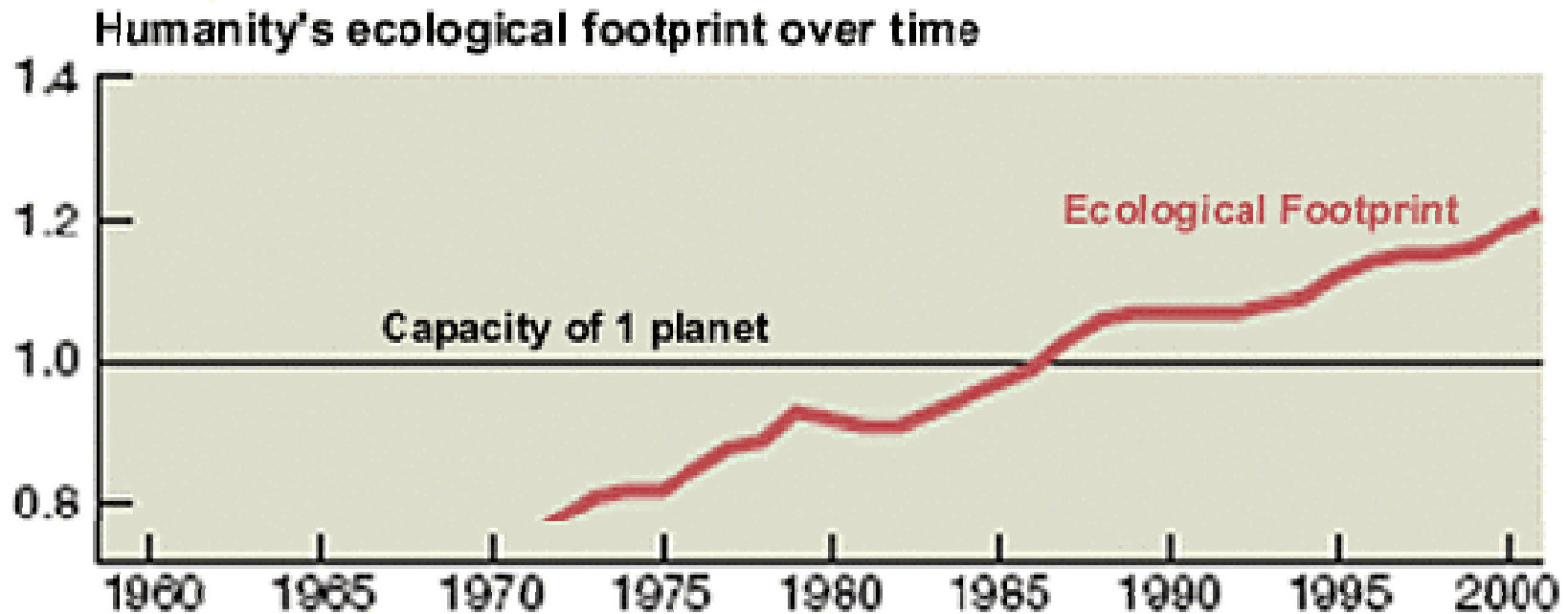


The Solution

- Really energy efficient building envelope (insulation, airtightness, and overheating control)
- Low energy appliances
- User awareness
- Monitoring
- Simple on site renewables
- Large scale offsite renewables

Resource Depletion

© WWF



Other environmental issues:

Waste

Pollution

Habitat Destruction



The Solution

- **Reduce consumption**
- Use renewable/ sustainable resources
- Re-use, recycle environmentally
- Build buildings that endure

Human Health

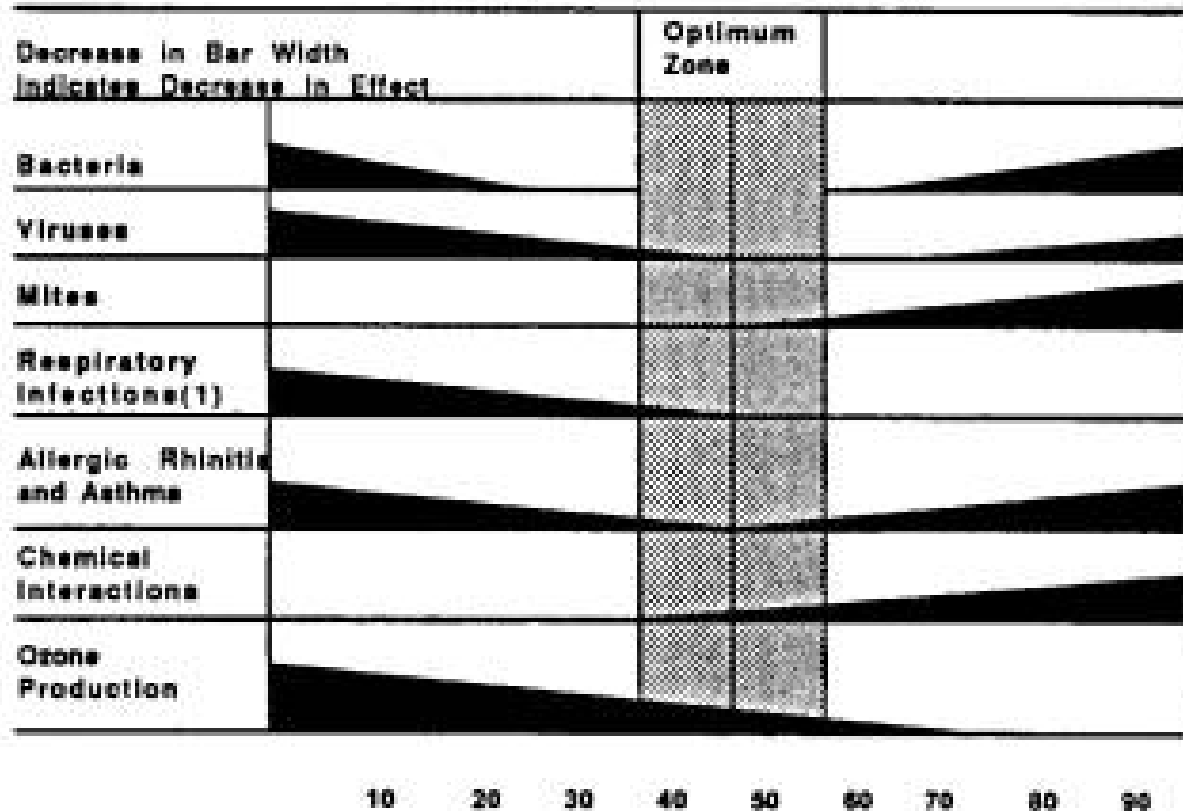
- Physical Health
- Well being



Asthma and Buildings

- In the UK 1 in 6 people has asthma
- Almost 2000 deaths per annum
- 75,000 hospital admissions
- Cost to state runs into £billions
- Directly linked to dustmite faeces
- Which are directly linked to RH in houses
- Other moulds, bacteria and diseases also linked

Health and Relative Humidity



(1) INSUFFICIENT DATA ABOVE 50% R.H.

SOURCE: Sterling (1984) ASHRAE Transactions V.90, Part 2

The Solution

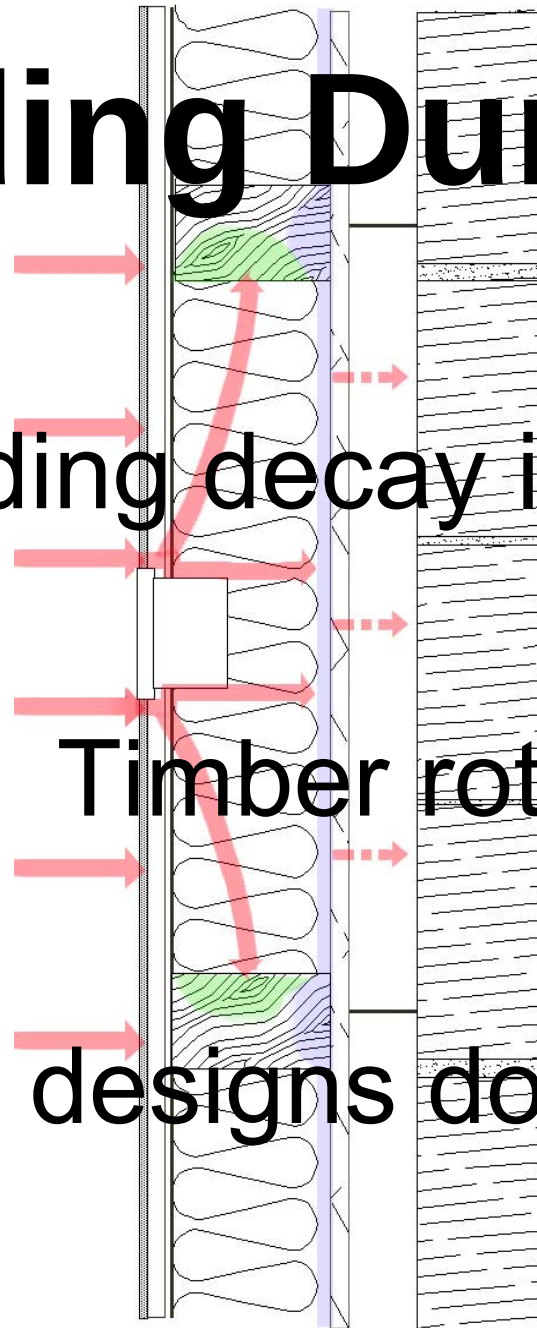
- Ventilation
- Moisture control in the fabric
- Non toxic materials
- Filters?

Building Durability

75% of building decay is due to water

Timber rots

Many designs don't work



The Solution

- Good design
- Good site practice
- Breathing buildings

Why is Breathability important?

- **Health of Building Fabric:** reduced moisture related fabric decay because of simpler build processes and more failsafe designs (vapour open structures)
- **Health of Building Occupants:** reduced moisture related illnesses because of healthy fabric and through the hygroscopic buffering of internal RH

Breathability comparison of some common materials

Material	Vapour Permeability r	Hygroscopic potential (increase in EMC: 50% to 85% RH)	Hygroscopic capacity (density x potential – in kg/m³)	Speed of hygroscopic take up	Capillarity w kg/m²h^{0.5}
Dense Concrete	500	2%?	40?	Slow	1.8
Fired Clay Brick	50	0.1%	1.7	Medium	25.1
Unfired Clay Brick	40	3%	52	Very Fast	2
Mineral wool insulation	5	1%	0.1	Medium	0.1?
Expanded polystyrene insulation	150	0%	0	N/A	0.2?
PU/ PI Insulation with foil	>10,000	0%	0	N/A	0
Woodfibre insulation	25	9%	18	Fast	0.5 – 2
Cellulose insulation	25	9%	4	Fast	>10
Flax/ hemp/ sheepswool insulation	5	9%	2.25	Fast	1 - 2

In terms of performance green
materials are just materials

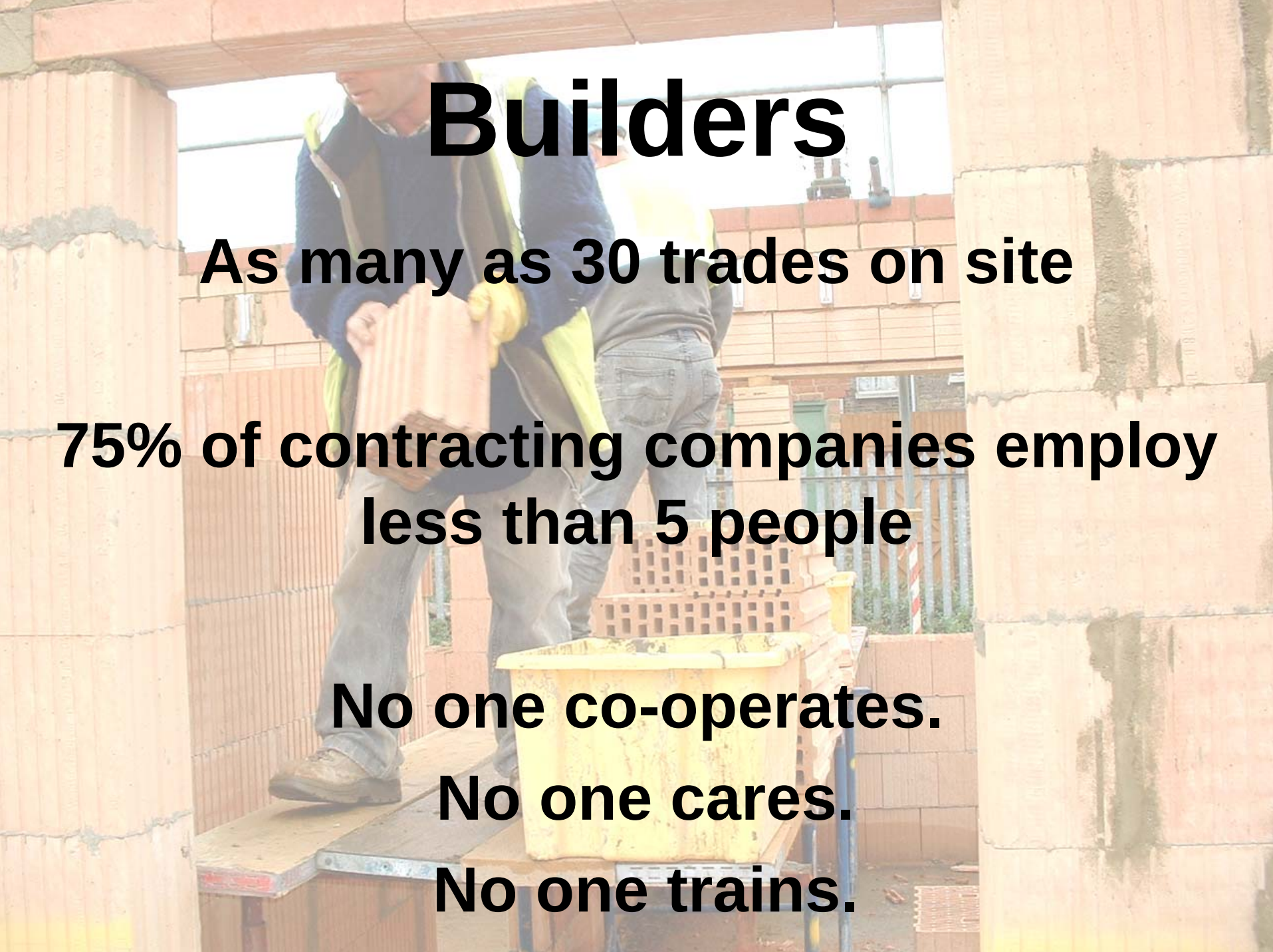
The changing purpose of the building shell

- 1. From keeping the weather out to keeping heat in**
- 2. From thermal insulation to airtightness**
- 3. From building physics to building biology**

The big issue

How to make buildings more energy efficient, robust and healthy at the same time?

In particular: What on earth do we do about the existing building stock?

A construction worker in a blue jacket and yellow safety vest is carrying a large brick on a construction site. The worker is standing on a wooden platform, and a yellow plastic bin is visible in the foreground. The background shows a brick wall and some construction equipment.

Builders

As many as 30 trades on site

75% of contracting companies employ less than 5 people

No one co-operates.

No one cares.

No one trains.

Others in construction

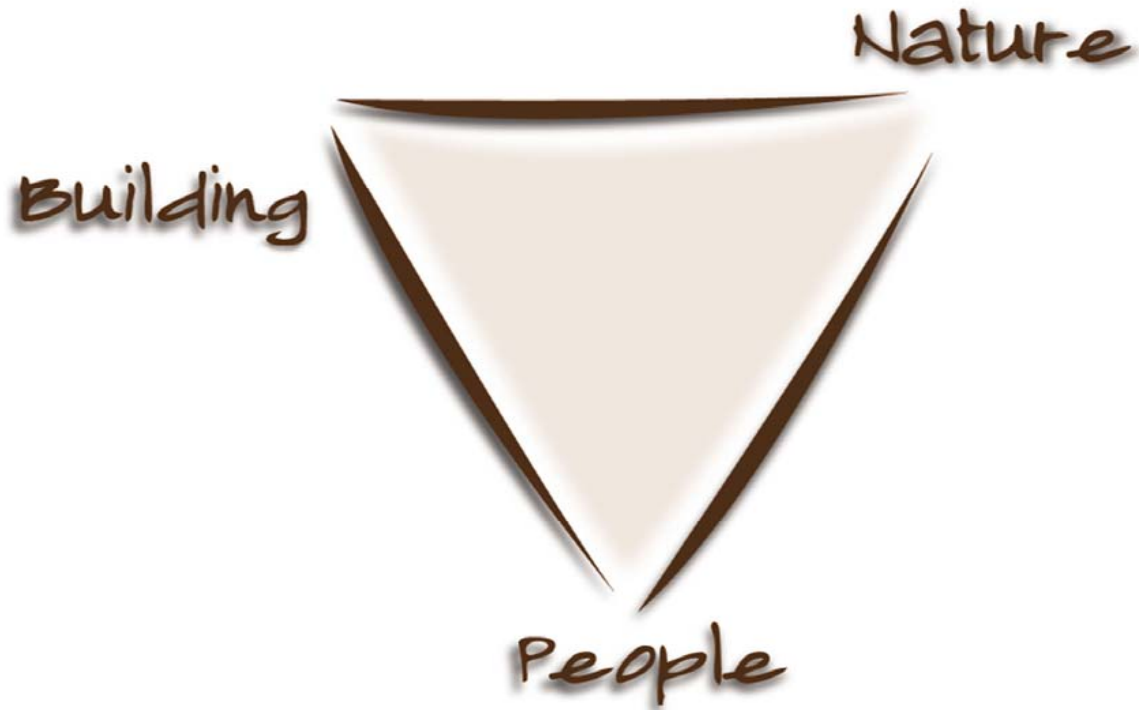
**How good are
Architects,
Quantity Surveyors,
Suppliers,
Distributors,
Clients?**

The Solution

- Reduce trades by simplified building systems
- Train people to become shell builders
- Join up the supply chain
- Educate everyone

From liability to responsibility

The whole solution has to be holistic



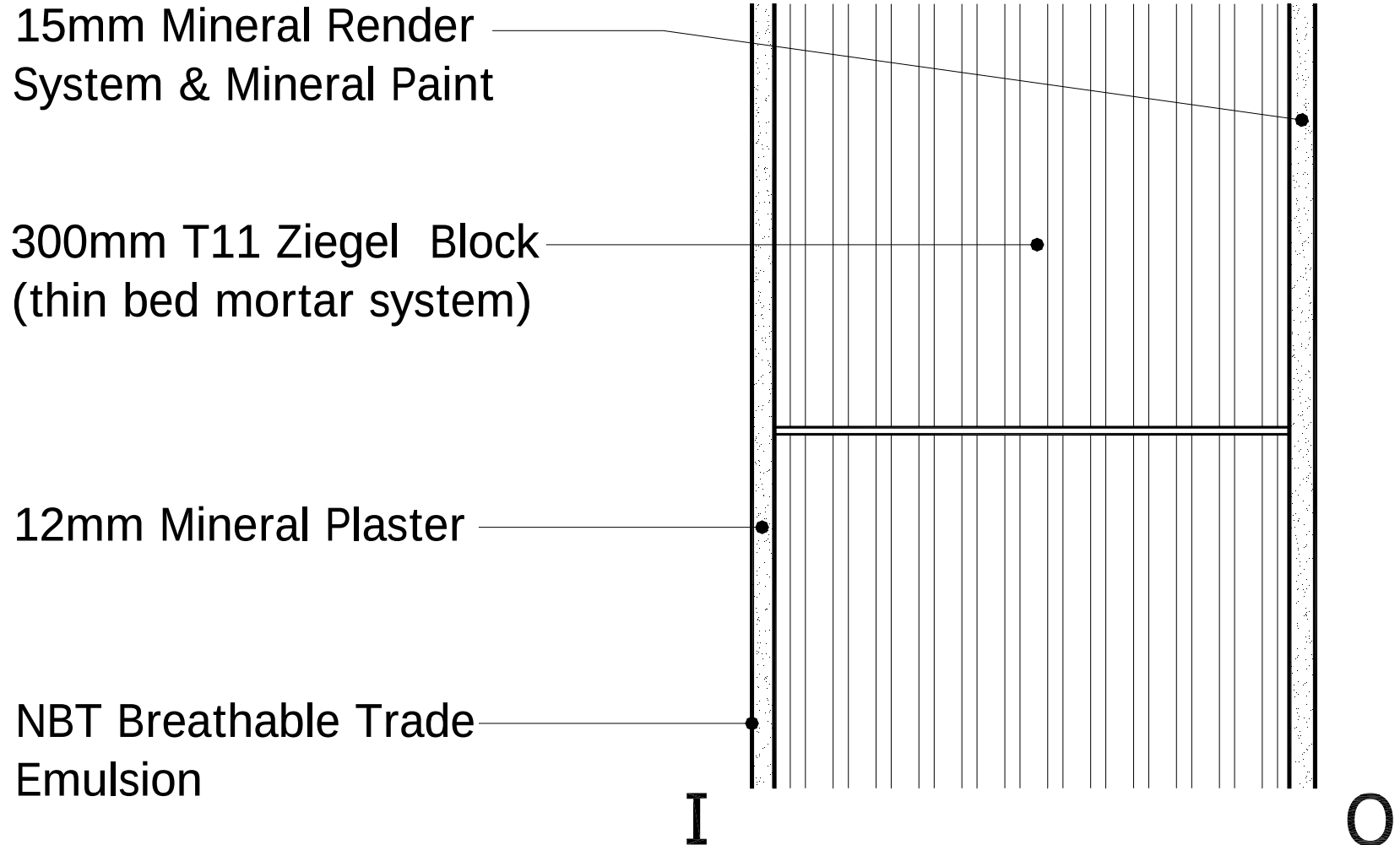
Building Solutions wanted now

- Effective simple building envelopes
- Sustainable resources
 - Robust ventilation
 - Breathing structures
 - Non toxic materials
- Cost effective systems



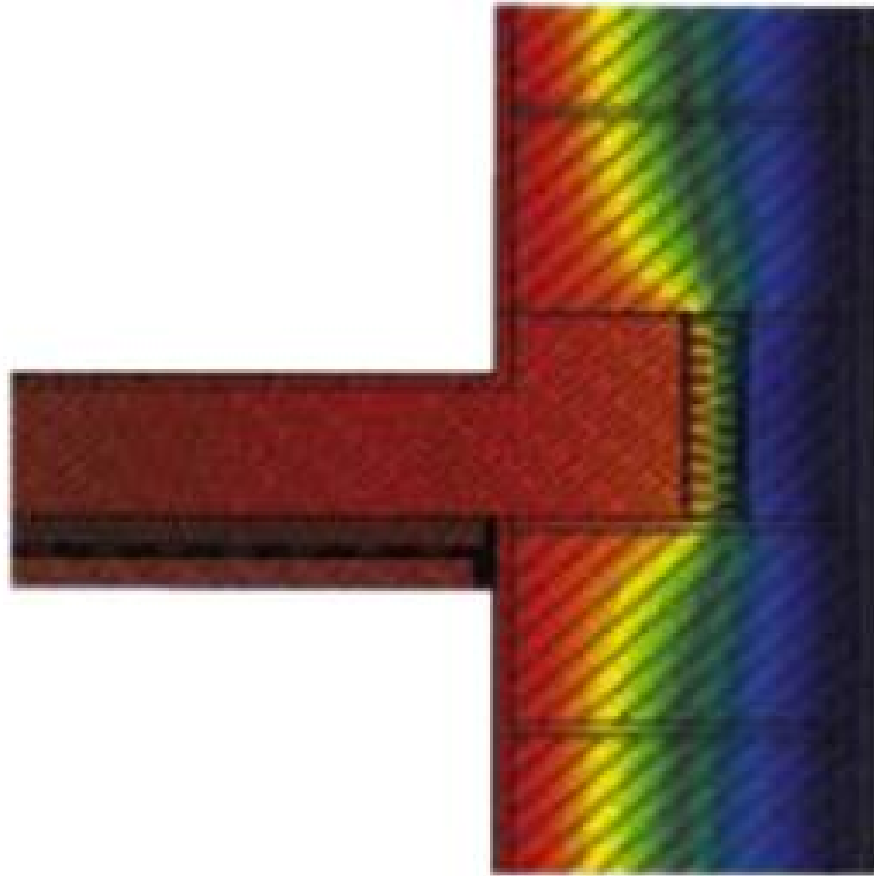
Fired Clay Solid Walls

NBT Thermoplan



- 
- A high-angle photograph of a construction site on a rooftop or elevated platform. Numerous stacks of red bricks are arranged across the surface. Several construction workers wearing hard hats and work clothes are visible, some standing near the brick stacks and others further back. Scaffolding and construction equipment are also present. The background shows greenery and residential buildings.
- **Simplicity**
 - **Speed**
 - **Energy Performance**
 - **Breathability**
 - **Non Toxicity**
 - **Low embodied carbon**

Ψ values, y values and CSH





18



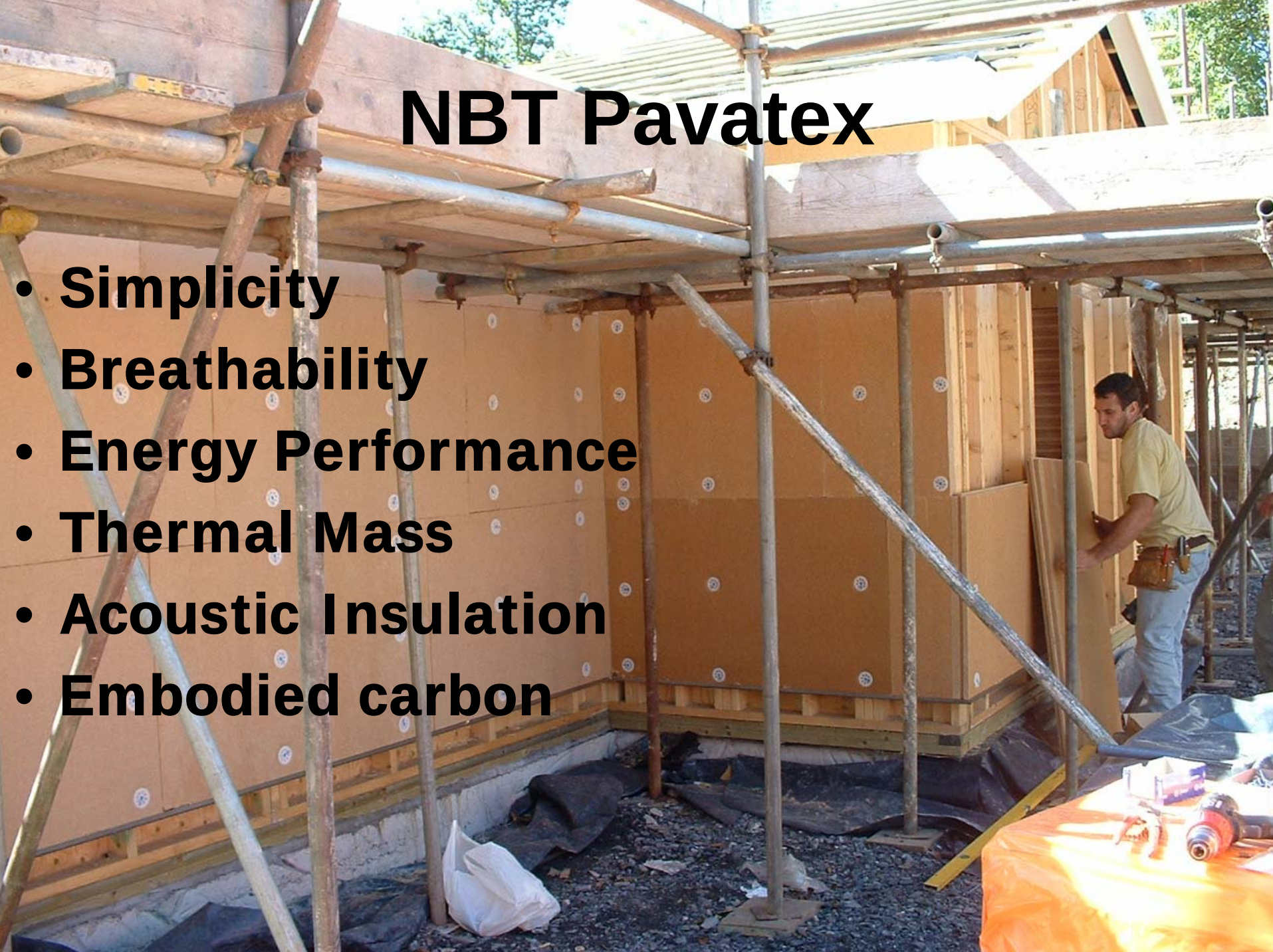




Woodfibre Systems

NBT Pavatex

- **Simplicity**
- **Breathability**
- **Energy Performance**
- **Thermal Mass**
- **Acoustic Insulation**
- **Embodied carbon**



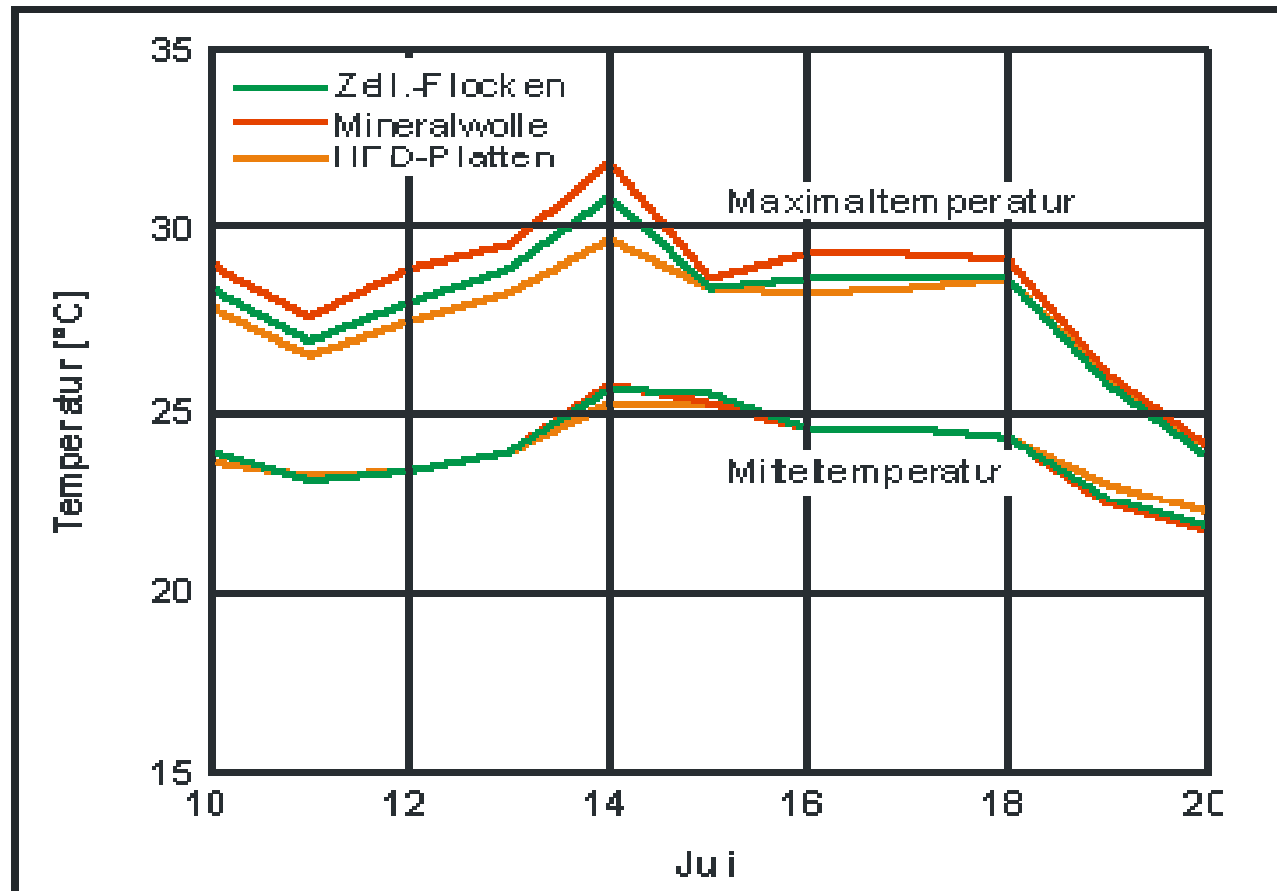
Thermal Mass = Density x SHC

Material	Density: kg/m ³	Specific Heat Capacity: J/kgK	Thermal Mass: J/m ³ K
Mineral Wool	10	800	8000
EPS	20	1400	28000
Cellulose	45	1400	63,000
Woodfibre	200	2100	420,000 (52.5 x mw)

Wood Fibre Roofs



The effect of different roof insulations on internal temperature





Mixed Development Oxford



30 11:49

**Non-toxic, renewable, breathable
insulation**



Non-toxic, low carbon paints



When and how much?

- What should be our aims in terms of sustainable construction?
- What time scales should be set?
- What cost should we be prepared to pay?

Government Agenda(s)

- New Part L (2006)
- Code For Sustainable Homes
- HIPs
- Regional variations – Merton rule etc
- Future carbon taxes/ incentives etc
- Other environmental legislation

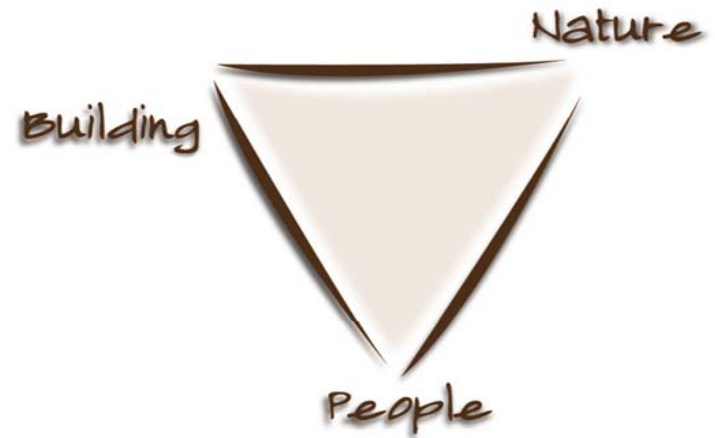
Do Government understand what they are doing?

The danger of partial solutions

- Low carbon buildings could be worse for the environment in terms of carbon – **the carbon waltz**
- Environmental buildings could damage human health and social fabric – **unintended consequences and cost opportunity**
- Less haste, more speed – **mind the gap**

Sustainability's Triple Bottom Line

- Environmental
- Social
- Economic



Is this enough? Do we really care?



What is it all about anyway?