

ZERO CARBON BUILDINGS




Prof. David Strong
Chief Executive, Inbuilt Ltd.
Sustainability/live! 2009
NEC Birmingham
21st May 2009



TUESDAY
NEWS EXTRA

**VICAR
FIGHTS
BROTHEL
CLOSURE**

 **Evening Standard**
KNOW WHAT LONDON'S THINKING



WEDNESDAY
NEWS EXTRA

**ZERO-CARBON
AGENDA CAN
RESULT IN
PERVERSE
OUTCOMES**

EVENING STANDARD



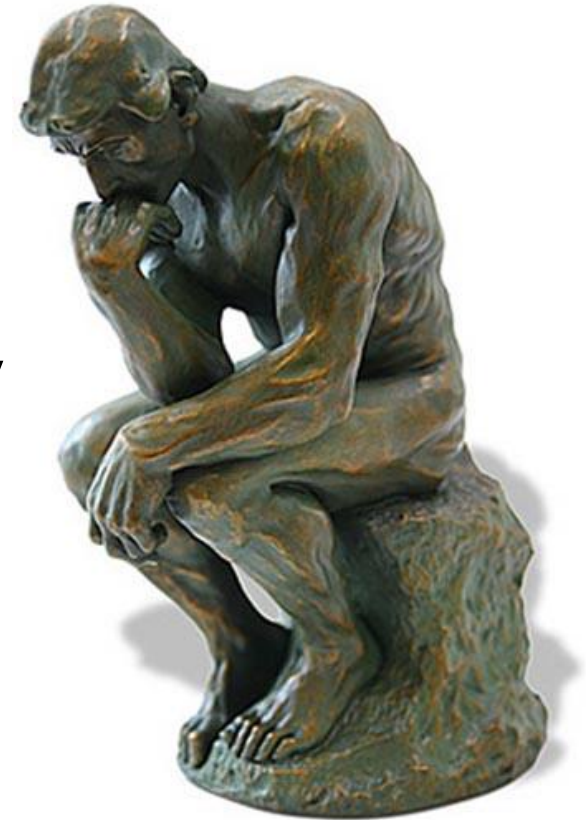
WEDNESDAY
NEWS EXTRA

**ZERO-CAP
AG
COUNTER-INTUITIVE?
SET IN
PERVERSE
OUTCOMES**

EVENING STANDARD

Time to reflect

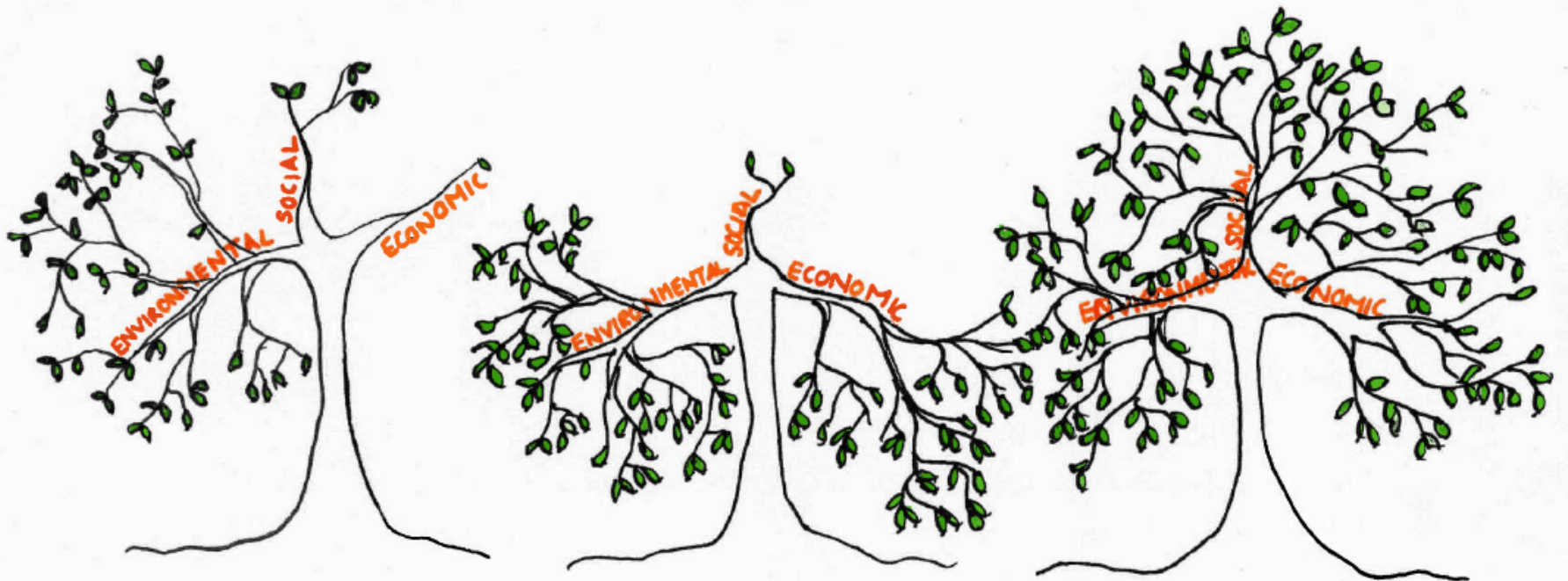
- Is the zero-carbon building our highest ambition?
- Is there more to delivering genuinely sustainable buildings than zero-carbon?
- What are the dangers and pitfalls?



Major concern in the UK that the Zero-Carbon Agenda could lead to:



- Imbalance
- Missed opportunities
- Highly perverse outcomes





Firstly, what do we mean by net-zero Carbon and is it an illusion anyway?

Terminology and definition are currently very confusing. Over the past year, different government departments/agencies have used at least three different definitions:-

Zero Carbon: no carbon-emitting fuels are burnt on site and no electricity is imported from the grid.

Net Zero Carbon: carbon emitting fuels are burnt on site, but locally generated renewable energy is exported to the grid to make up for this.

Carbon Neutral: offsite generated renewable energy is imported from the grid via private wires.

What is a renewable or low carbon technology?



- There is no standard definition of what constitutes a “renewable” technology or low carbon technology, different government departments, agencies and programmes recognise various systems, technologies and energy sources as “renewables”.
- “Active” renewable options include:-
 - Biomass/biofuels/biogas
 - Photovoltaics
 - Solar Thermal
 - Heat Pumps
 - Wind Turbine
 - Micro-chp
 - Hydro (including wave/tidal)
 - Energy from waste
 - Hydrogen Fuel Cells?



Some technologies don't even feature in any government list of renewable technology but are (arguably) the most effective!



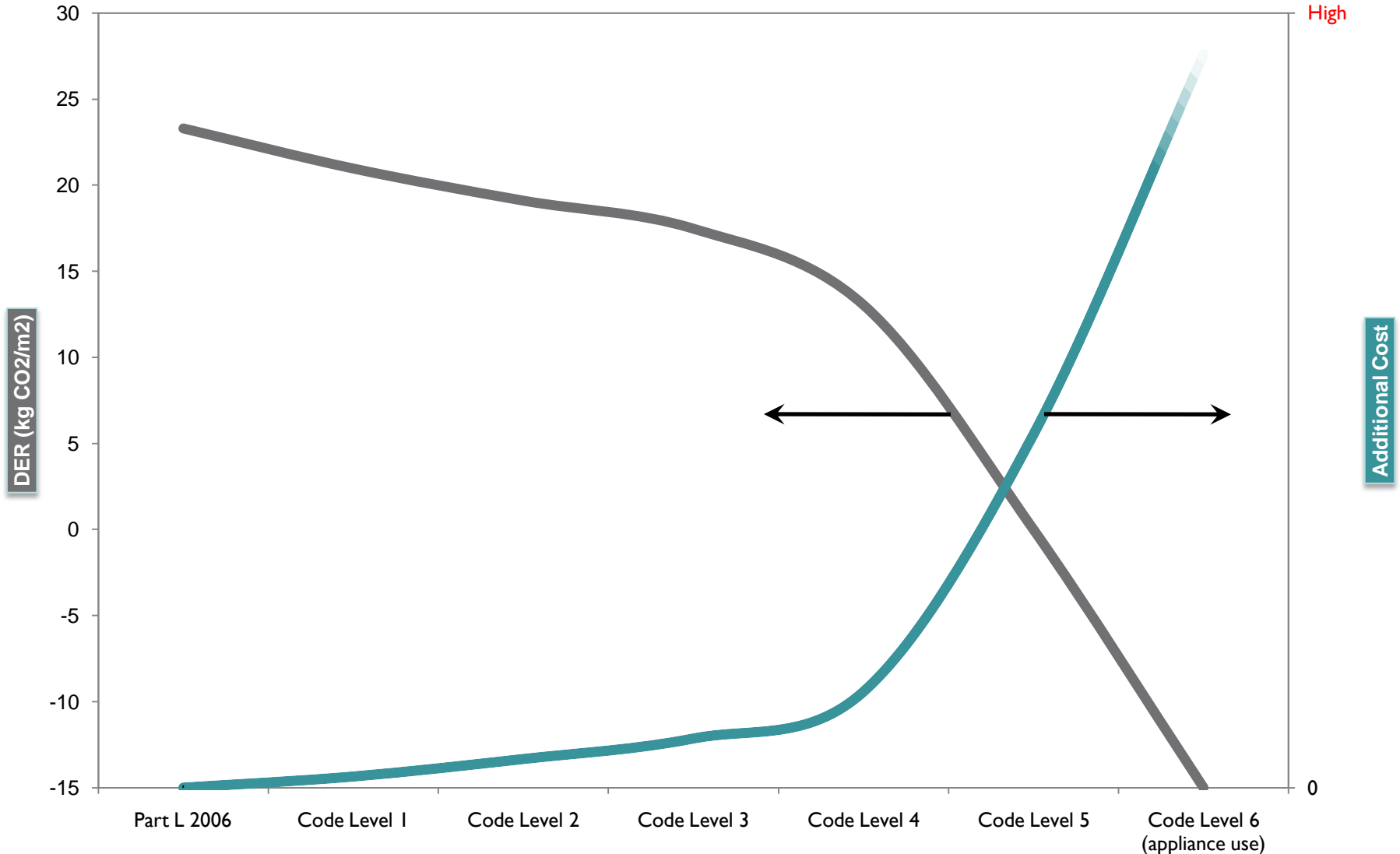
Advanced wind powered solar assisted renewable low carbon drying system



What are the risks from the zero-carbon agenda?

- Law of Diminishing Returns
- Law of Unintended Consequences
- Murphy's Law

Carbon emissions vs. Code Level –the law of diminishing returns!



- Based on an 80m² semi-detached house



Beware the law of unintended consequences

- Summertime overheating
- Flood resilience
- Transport
- Security
- Acoustic performance
- Indoor air quality/Health problems
 - No IAQ regulations
 - c1900 about 50 materials (mostly natural)
 - Now over 50,000 compounds and chemicals



Murphy's Law



Over-reliance on complex / unproven technologies

- As a general rule, simple building technologies work, complex ones can prove problematic!
- Mis-selling/misspecification of technologies could have hugely damaging consequences
 - Micro-wind turbines in the urban environment
 - Air source heat pumps
 - are they appropriate for the UK climate?





Is there a way which avoids these perverse outcomes?

- Genuine sustainability requires a “whole-system” approach
 - Focusing on zero-carbon is not enough!
 - There are no technology ‘magic bullets’
 - Vital that social and economic factors are also considered
- It’s **much more** than just ticking the BREEAM / LEED / CSH box!



Our Approach

- Inbuilt has adapted and applied the proven principles of The Natural Step to the built environment
- Enables **Economic** and **Social** sustainability to be considered as well as Environmental
- Technical solutions based on **elegant simplicity**

The Inbuilt Framework for Sustainable Development



Genuine Sustainability:

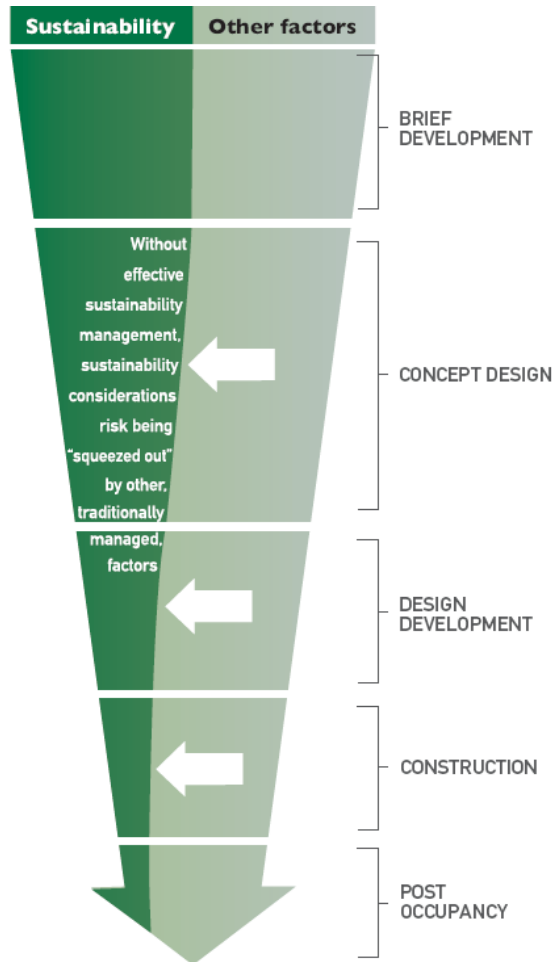
- Requires a **clear vision** and **shared definition of project success**
- Is **unique** for every project
- **Cannot** be addressed through a ‘**broad brush**’ or **single issue approach**
- Can only be fully realised through **collaborative engagement**
- Helps **manage risk** and **adds value**
- Is based on **whole-systems thinking**



SUSTAINABILITY



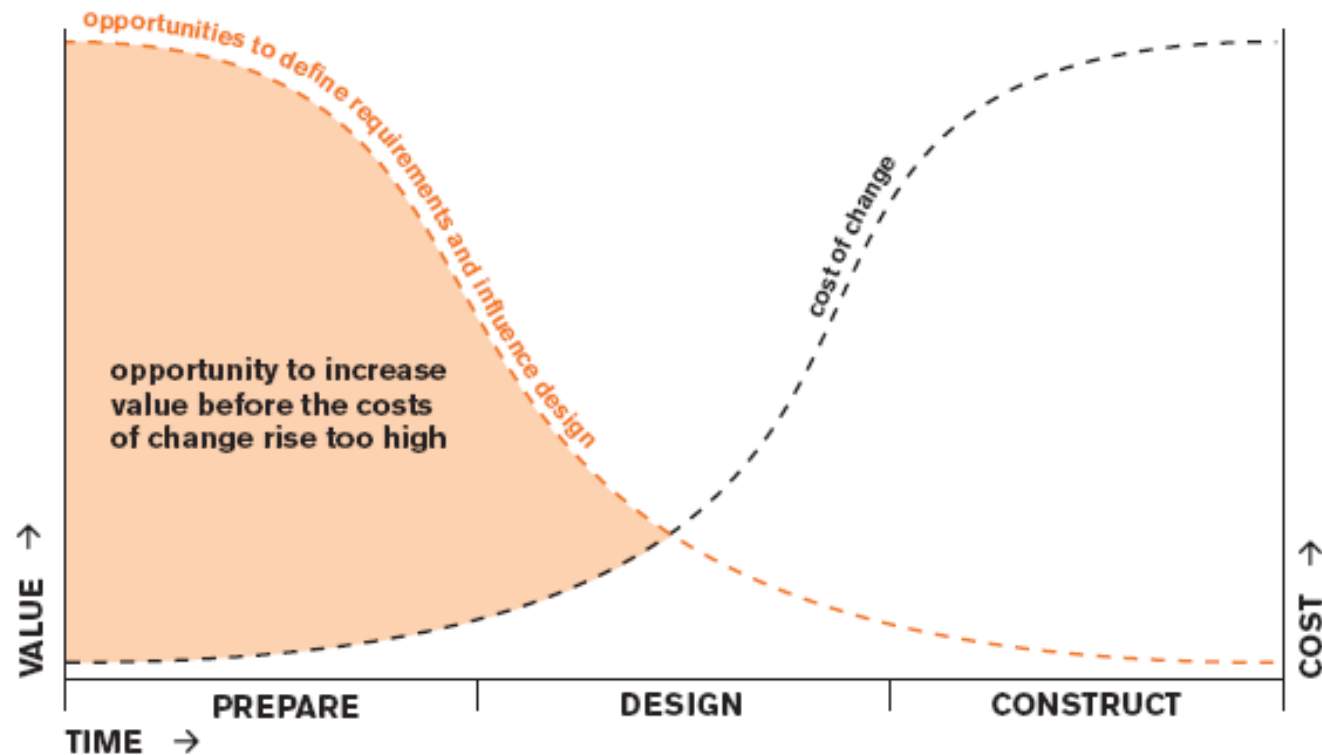
Conventional Design and Construction Process



Sustainability is challenged by:

- Insufficient stakeholder engagement
- Lack of clarity in the initial brief
- Value engineering changes with an uncoordinated reappraisal of design
- Lack of monitoring during construction and commissioning
- Incorrect operation and management of the building

Opportunities to exploit whole system thinking



In conventional design ‘all the really important mistakes are made on the first day.’ Source: Amory Lovins



Jones Lang LaSalle: 2007 Global Survey

on **point**



JONES LANG
LASALLE



Global Trends in Sustainable Real Estate: An Occupiers Perspective

2007 represented a tipping point in occupier attitudes towards sustainability. Momentum will gather further and faster in 2008.

A Jones Lang LaSalle / CoreNet Global survey of over 400 occupiers globally, identified that there is clear occupier demand for sustainable real estate solutions.

Occupiers are prepared to pay a premium to secure sustainable real estate but the ability of the supply side to provide sustainable solutions is currently viewed by occupiers as sporadic.



Table 2: How much more occupiers are willing to pay for sustainable real estate solutions, by region.

Premium	EMEA	North America	Asia-Pacific	Australasia
Same or less	34	23	36	32
1-10%	64	74	48	61
>10%	2	3	16	7

In Europe two thirds of all occupier respondents were prepared to pay a premium for sustainable real estate solutions.



Great buildings that consume huge portions

3 October, 2008
By Michael Willoughby

Some of the most iconic buildings are the hungriest

Display Energy Certificate

How efficiently is this building being used?

HM Government

A Government Dept
12th & 13th Floor
Jubilee House
High Street
Anytown
AT 2CD

Certificate Reference Number:
1234-1234-1234-1234

This certificate indicates how much energy is being used to operate the building. The Operational Rating is based on meter readings of all the energy actually used in the building. It is compared to a benchmark that represents performance indicative of all buildings of this type. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/epcr.

Energy Performance Operational Rating

This tells you how efficiently energy has been used in the building. The numbers do not represent actual units of energy consumed; they represent comparative energy efficiency. 100 would be typical for this kind of building.

More energy efficient

- A 0-25
- B 26-50
- C 51-75
- D 76-100
- E 101-125** < 108
- F 126-150
- G Over 150

Less energy efficient

100 would be typical

Total CO₂ Emissions

This tells you how much carbon dioxide the building emits. It shows tonnes per year of CO₂.

Previous Operational Ratings

This tells you how efficiently energy has been used in the building over the last three accounting periods.

Technical information

This tells you technical information about how energy is used in the building. Consumption data based on actual readings.

Main heating fuel: Gas
Building Envelope: Air Cooled
Total useful floor area (m²): 2927
Asset Rating: 92

	Heating	Electric
Annual Energy Use (kWh/m ² /year)	120	129
Typical Energy Use (kWh/m ² /year)	120	95
Energy from renewables	0%	20%

Administrative information

This is a Display Energy Certificate as defined in Regulation 6 of the Energy Act 2007.

Assessment Software: CR v1
Property Reference: 89152973632
Assessor Name: John Smith
Assessor Number: ABC12345
Accreditation Scheme: AEC Accreditation Ltd
Employer/Trading Name: EnergyPlus Ltd
Employer/Trading Address: Alpha House, New Way, Birmingham, B2 1AA
Issue Date: 12 May 2007
Nomination Date: 05 Apr 2007
Valid Until: 31 Mar 2009
Related Party Disclosure: EnergyPlus has contracted an energy manager to manage the building. Recommendations for improving the energy efficiency of the building are contained in Report Reference Number 1234-1234-1234-1234.

bd
London mayor's Sustainable City Hall is missing energy consumption targets by 50%
Ken's gas guzzler
Sunny outlook for legal teams
Per legal teams the holiday season would hit 1.17



90 kWh/m²/yr

STRATEGY BRIEF FEASIBILITY DESIGN CONSTRUCTION OCCUPATION



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bd building design

London mayor's Sustainable City Hall is missing energy consumption targets by 50%

Ken's gas guzzler

City Hall energy use

City Hall energy use

City Hall energy use



450 kWh/m²/yr

STRATEGY BRIEF FEASIBILITY DESIGN CONSTRUCTION OCCUPATION



What is the best way of delivering an ultra-low energy requirement building (whilst also avoiding perverse outcomes)?

Passivhaus – an intelligent “whole-building” energy performance standard

- Space heating <math><15\text{ kWh/m}^2\text{/year}</math>
- Primary energy (heating, lighting, domestic hot water, appliances) <math><120\text{ kWh/m}^2\text{/year}</math>
- Air tightness of 0.6 ach @ 50Pa
- Modelled using the Passivhaus Planning Package (PHPP)

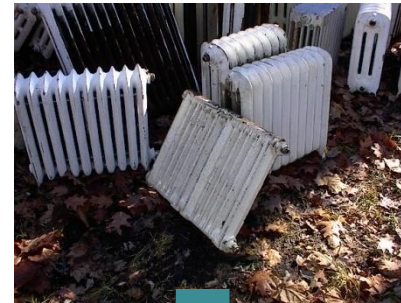


▶ Things that you ‘save’: reduce the build cost

Meet carbon targets without excessive renewables and “eco-bling”

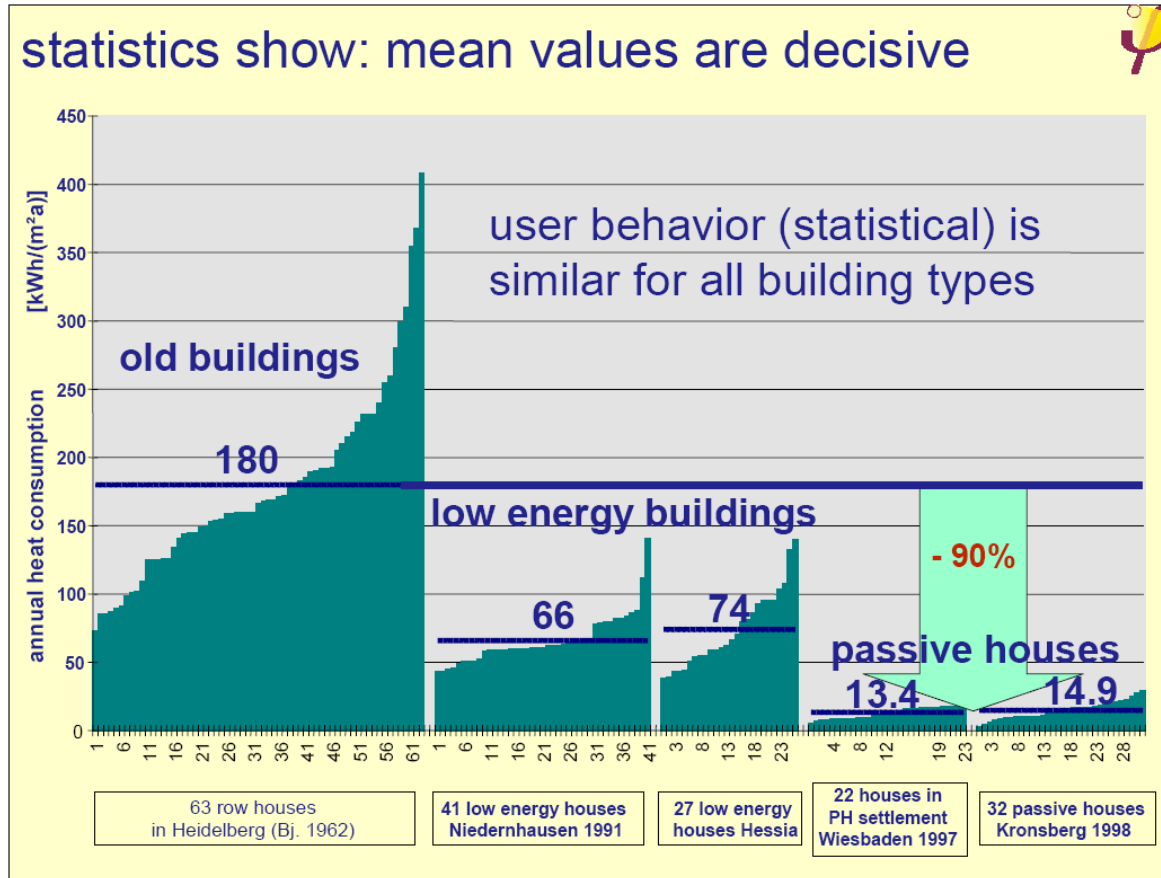


Downsize or remove the wet heating system





It's proven to work



Recorded and demonstrable performance in 8,000+ buildings in Austria and Germany.

Delivering Genuine Sustainability



- Sustainability is a complex web of interrelated issues
- **a whole systems approach is essential**
 - Cannot be addressed through a “broad-brush” or single issue approach
- Collaborative, integrated multi-disciplinary team working
- “designing-out” technical complexity and cost by rethinking, challenging and improving





Summary

- Beware!
 - The Law of Diminishing Returns
 - The Law of Unintended Consequences
 - Murphy's Law
- Genuinely sustainable buildings are based on elegant simplicity
 - Passivhaus principles help achieve this

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www.inbuilt.co.uk

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