

Delivering genuinely sustainable university buildings at an economic cost



Prof. David Strong
Chief Executive, Inbuilt Ltd.
Universities and the Built Estate Conference
America Square Conference Centre
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What does a genuinely sustainable building look like?



Hopefully, not like this!



Or like this?



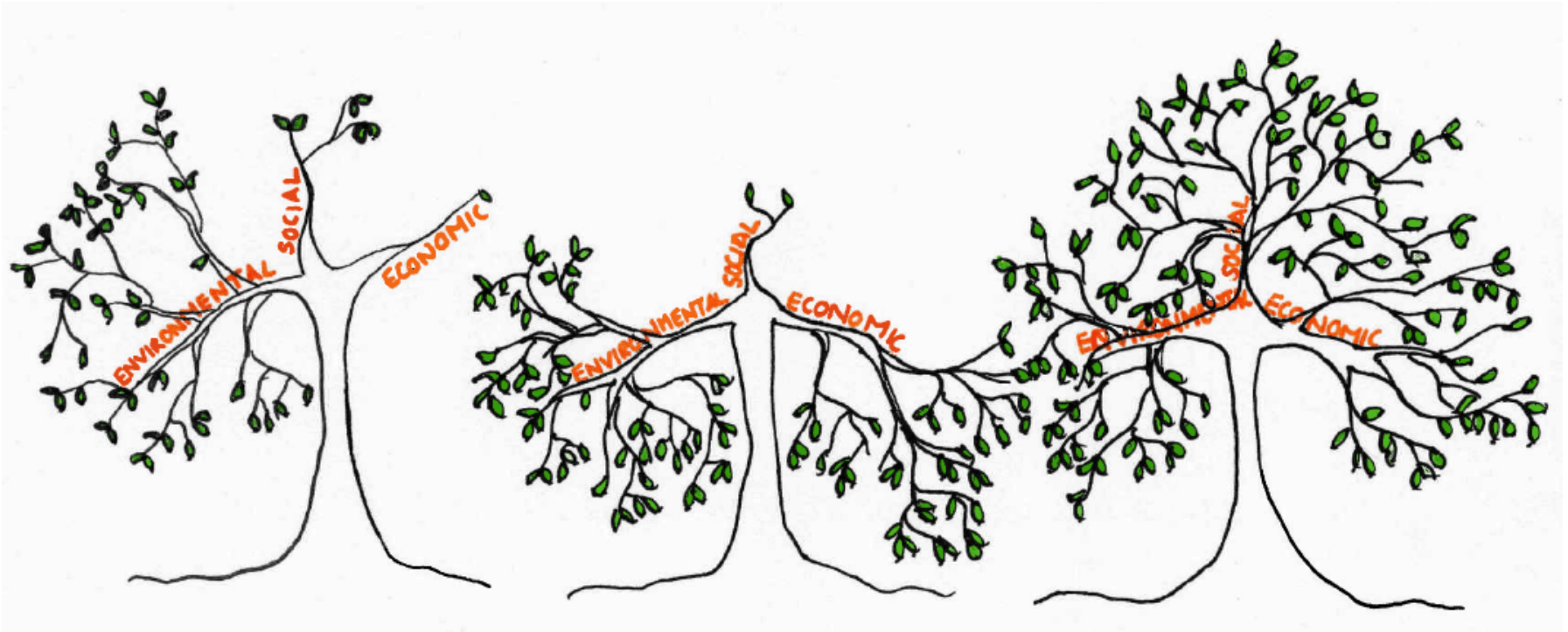
Or this?





Major concern that the current focus on BREEAM and the zero-carbon agenda could lead to:

- Imbalance
- Missed opportunities
- Highly perverse outcomes



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?

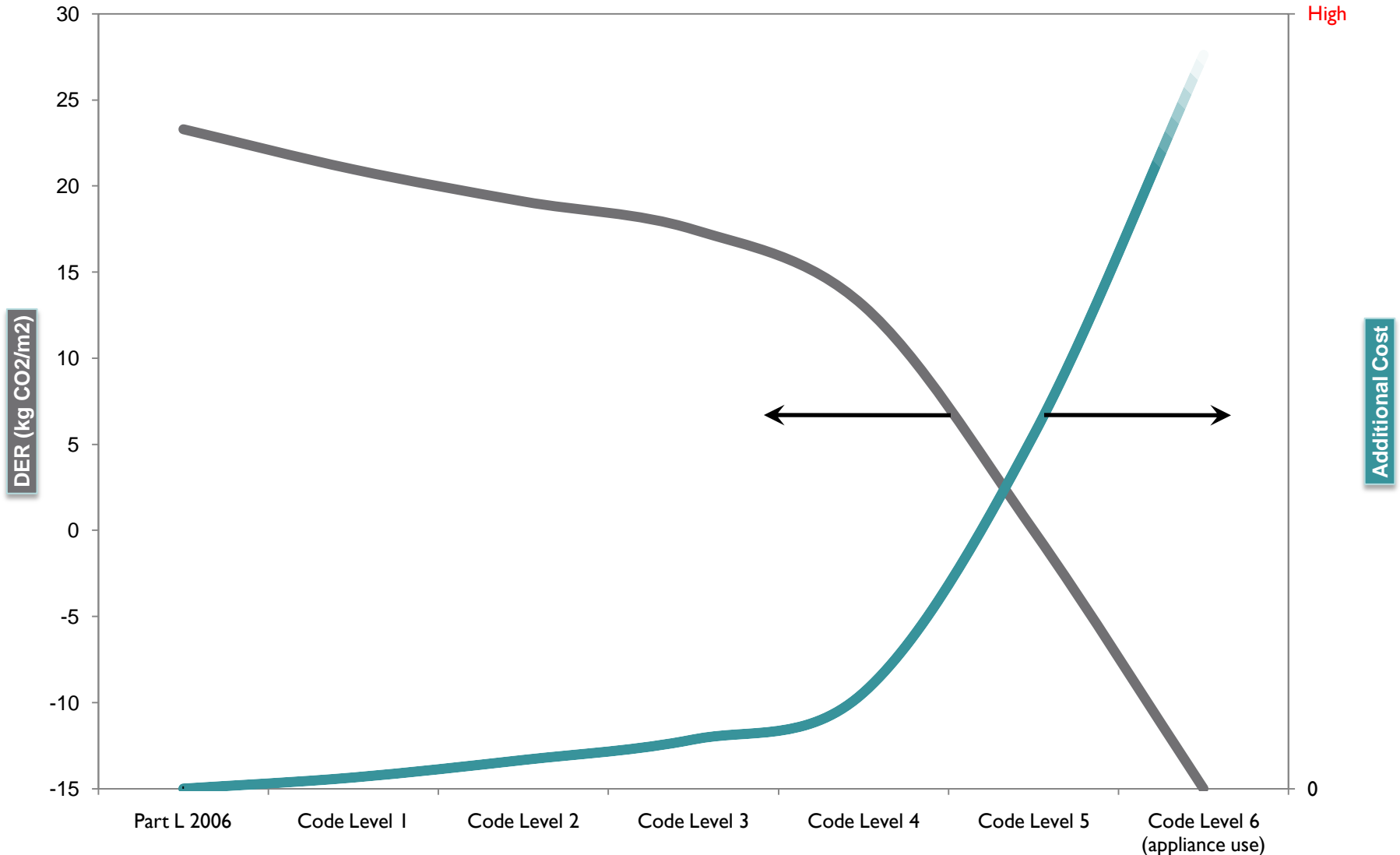




What are the risks from the zero-carbon agenda?

- 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?





Great buildings that consume huge portions

3 October, 2008
By Michael Willoughby

Some of the most iconic buildings are the hungriest



90 kWh/m²/yr

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.

Period	CO ₂ Emissions (tonnes/year)
Mar 2007	228
Apr 2008	229
Apr 2007	153

Previous Operational Ratings

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

Period	Operational Rating
Apr 2007	126
Apr 2008	129
Mar 2007	153

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 (m ²):	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 Efficiency (Buildings) Regulations 2007.

Assessment Software: CR v1
Property Reference: 891529736432
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.

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

Ken's gas guzzler

City Hall energy use

STRATEGY BRIEF FEASIBILITY DESIGN CONSTRUCTION OCCUPATION



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Ken's gas guzzler

London Mayor Ken Livingstone's Sustainable City Hall is missing energy consumption targets by 50%

Sunny outlook for budget because the building team would not.

City Hall energy use



450 kWh/m²/yr



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**

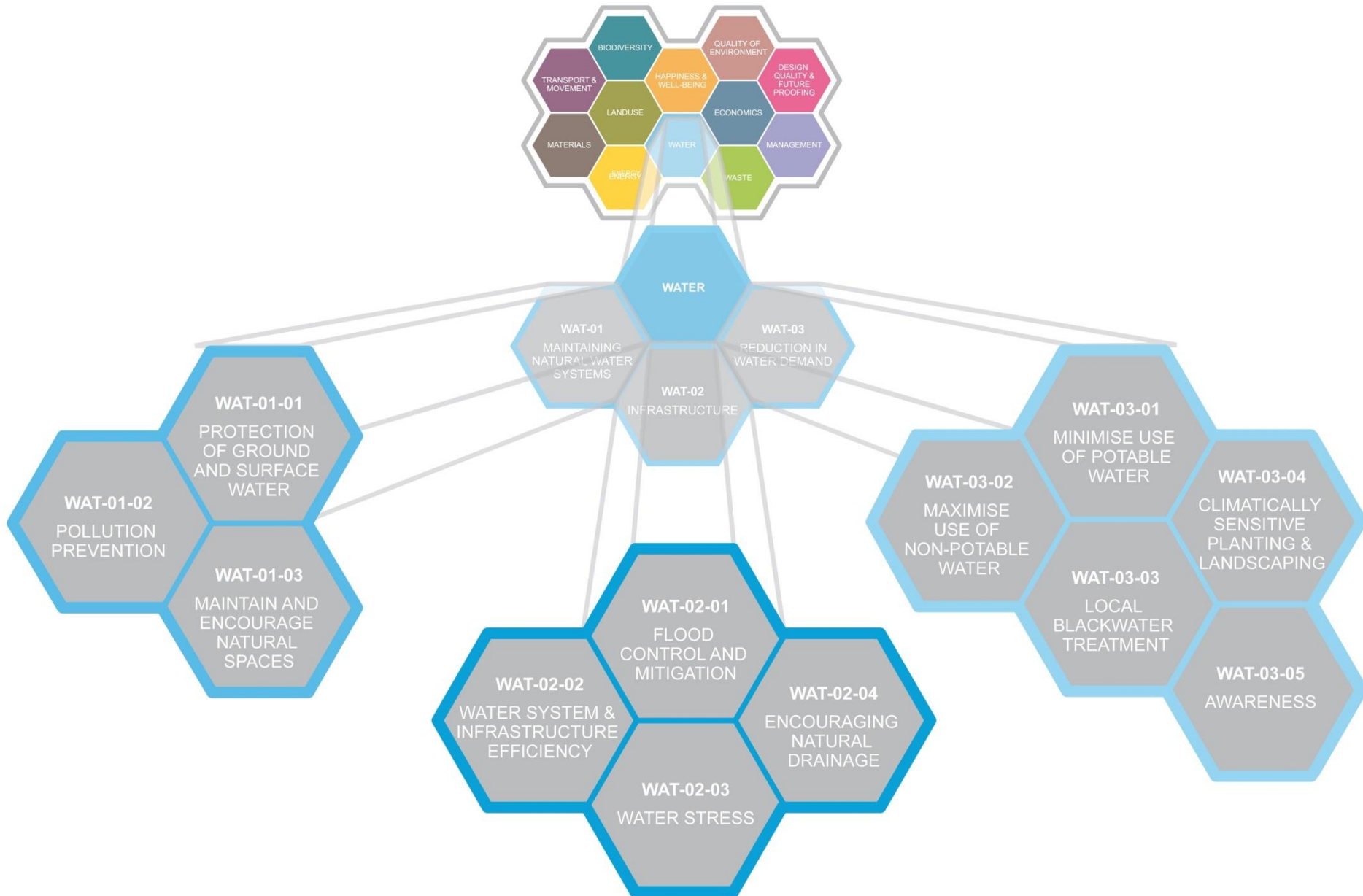
The Inbuilt Framework for Sustainable Development



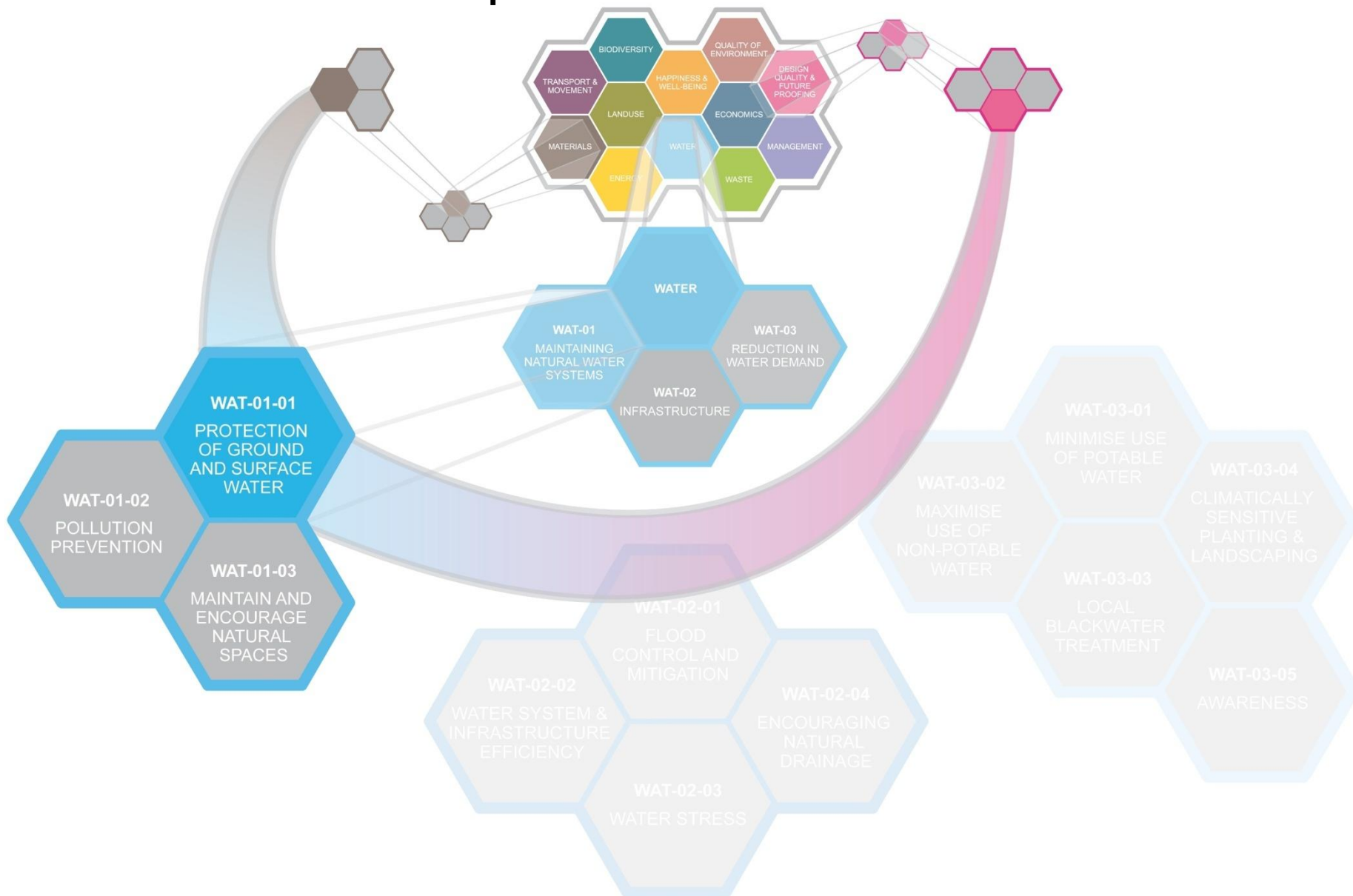
IFSD 12 Dimensions



Within each Dimension there are Aspects



Important to recognise the cross-linkages between Dimensions and Aspects





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)

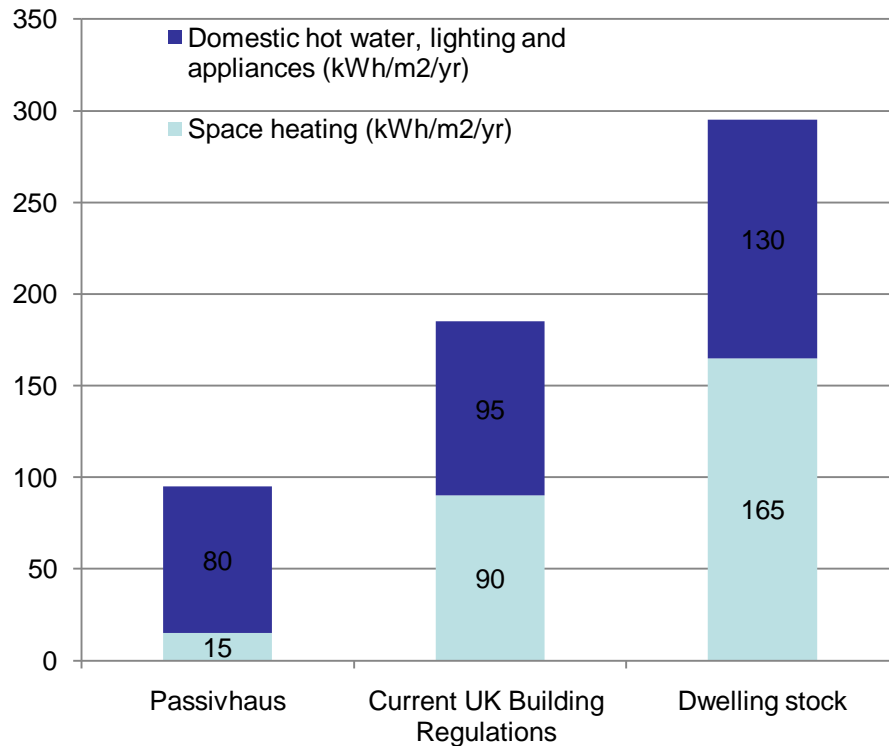




What do the targets mean?

Space heating (read gas use) reduced by 90% compared to the existing stock, and 80% compared to new build.

Primary energy savings through best practice efficiency measures.





1st Passivhaus, Housing, Darmstadt, Germany



Student residence refurbishment – Neue Bourse, University of Wuppertal, Germany



Detached Passivhaus, Samerburg, Germany



(c) 2005 www.passivhausprojekte.de

Fire station - Heidelberg (Baden-Württemberg)



Terraced houses, Hannover



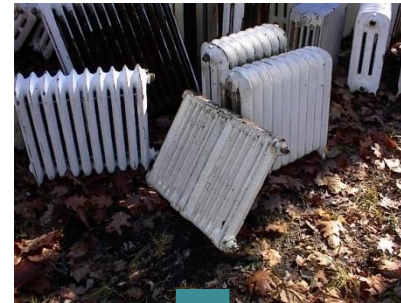
Offices, Germany, Architect Hermann Kaufmann

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

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

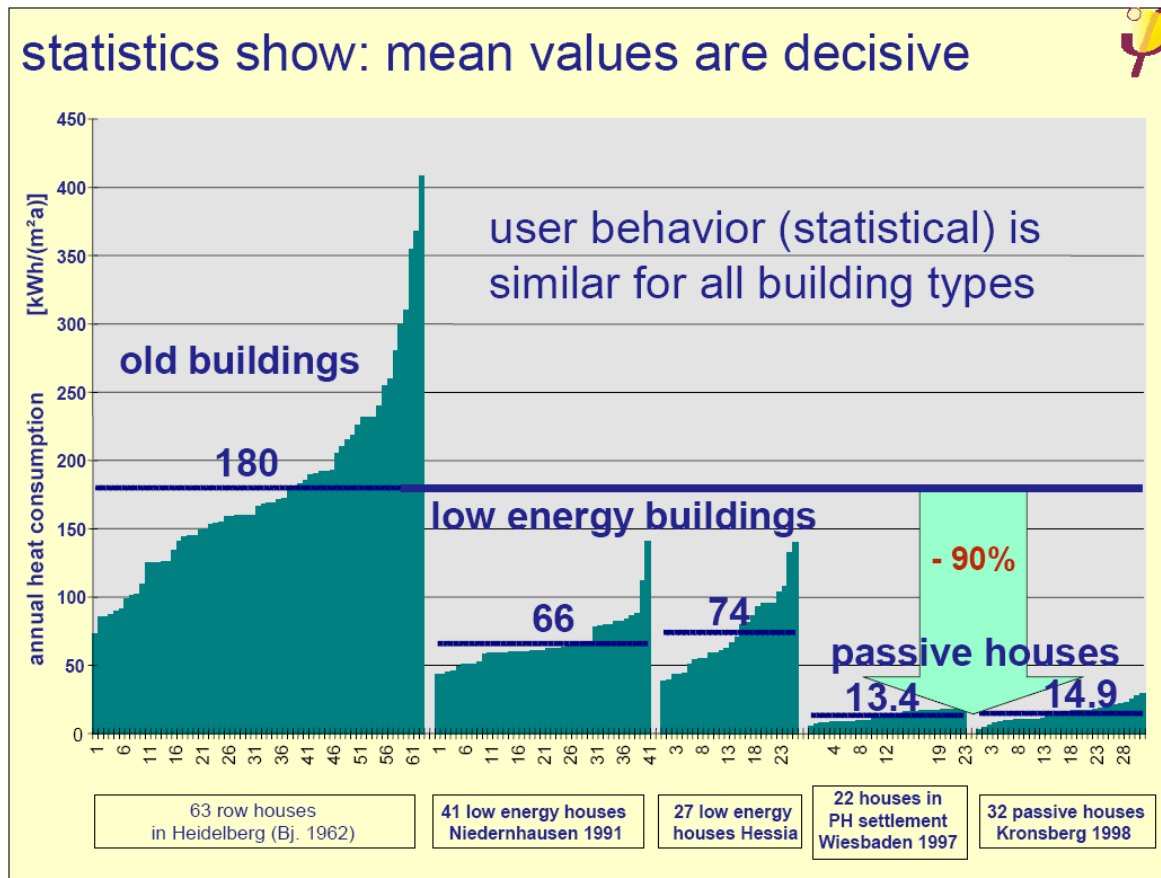


Downsize or remove the wet heating system



It's proven to work

Yes, but behaviour still plays its part.



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



- There is no “one size fits all” approach to delivering genuine sustainability
- Success requires a clear (and shared) definition of targets and objectives
 - Our IFSD helps achieve this
- There is much more to achieving genuine sustainability than BREEAM / CSH, or the zero-carbon agenda
 - Vital to decarbonise the electricity grid and utilise low-carbon space heating & cooling
- Beware!
 - The Law of Diminishing Returns
 - The Law of Unintended Consequences
 - Murphy’s Law
- Genuinely sustainable buildings are based on elegant simplicity

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