Delivering genuinely sustainable university buildings at an economic cost

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What does a genuinely sustainable building look like?

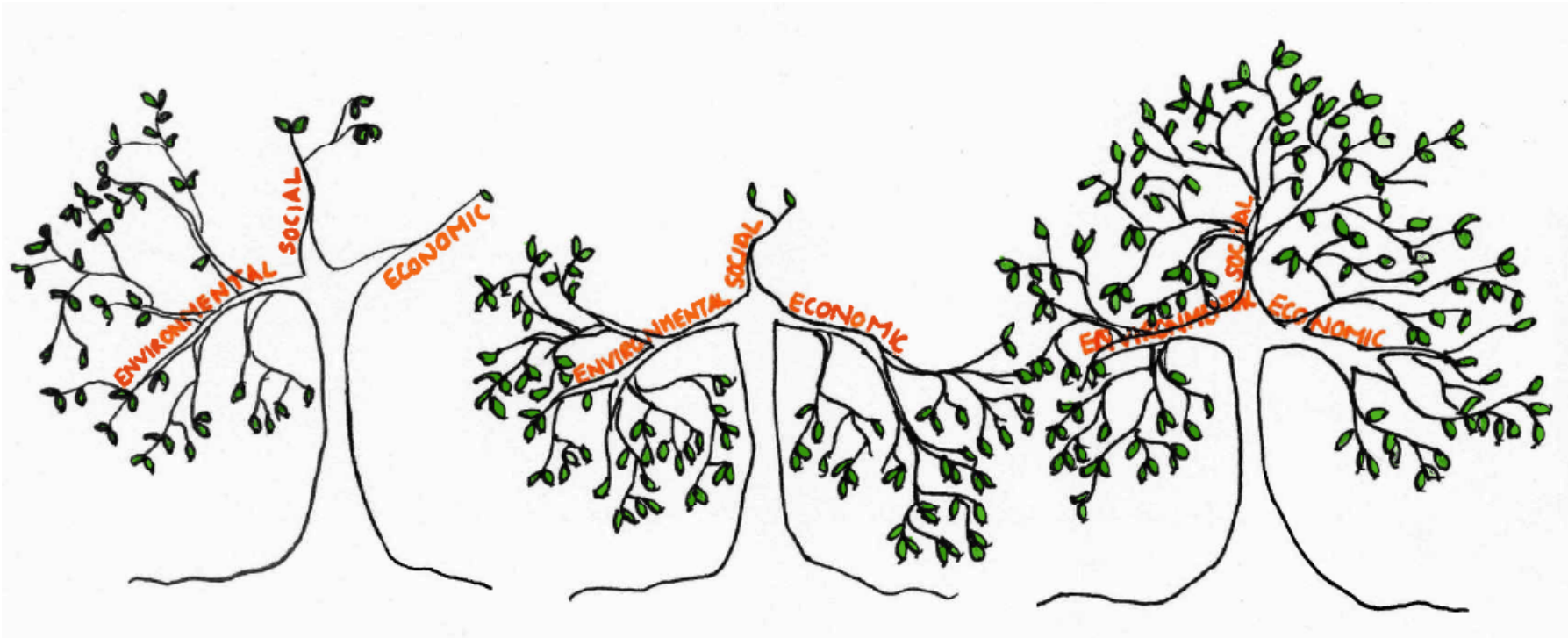
Hopefully, not like this!

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



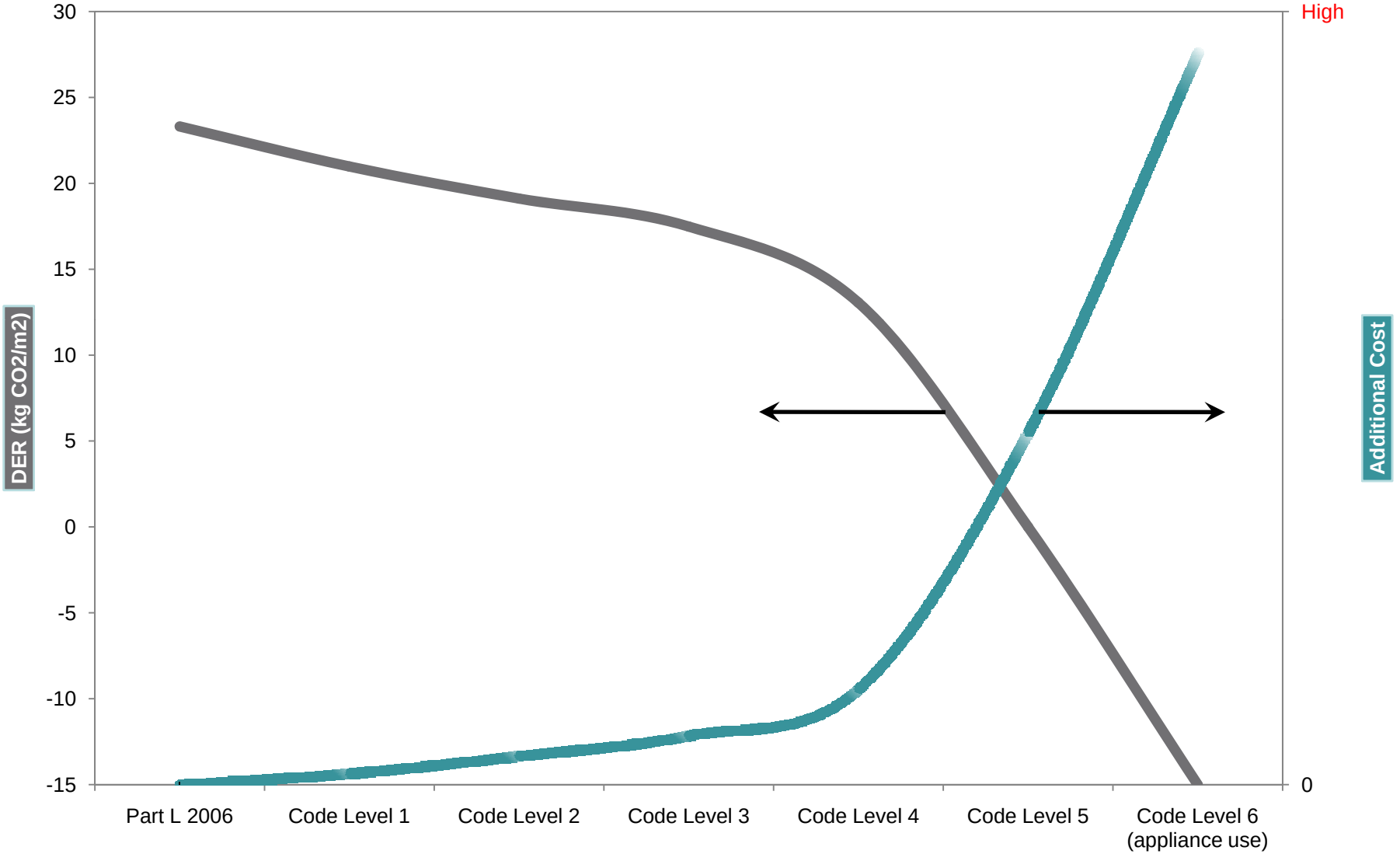
Time to reflect

- 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

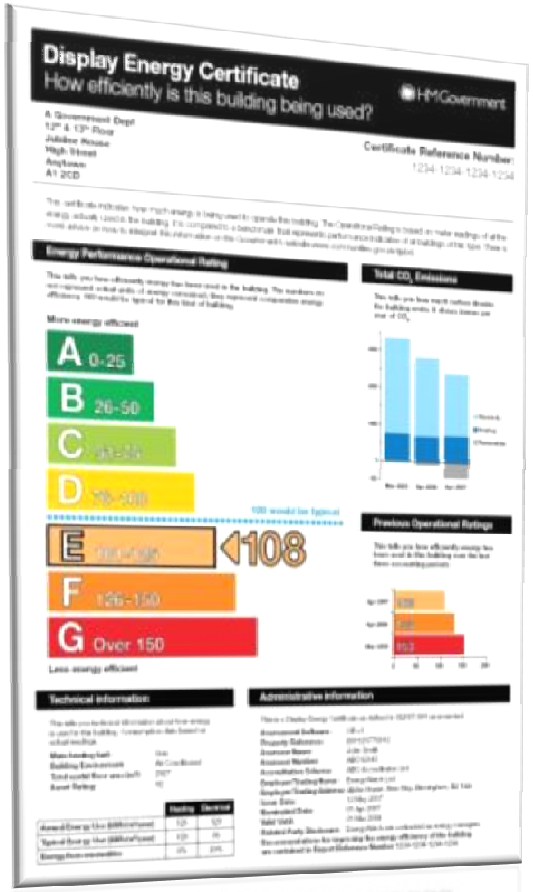
Beware the law of unintended consequences

- 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?



450 kWh/m²/yr

STRATEGY | BRIEF | FEASIBILITY | DESIGN | CONSTRUCTION | OCCUPATION

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!

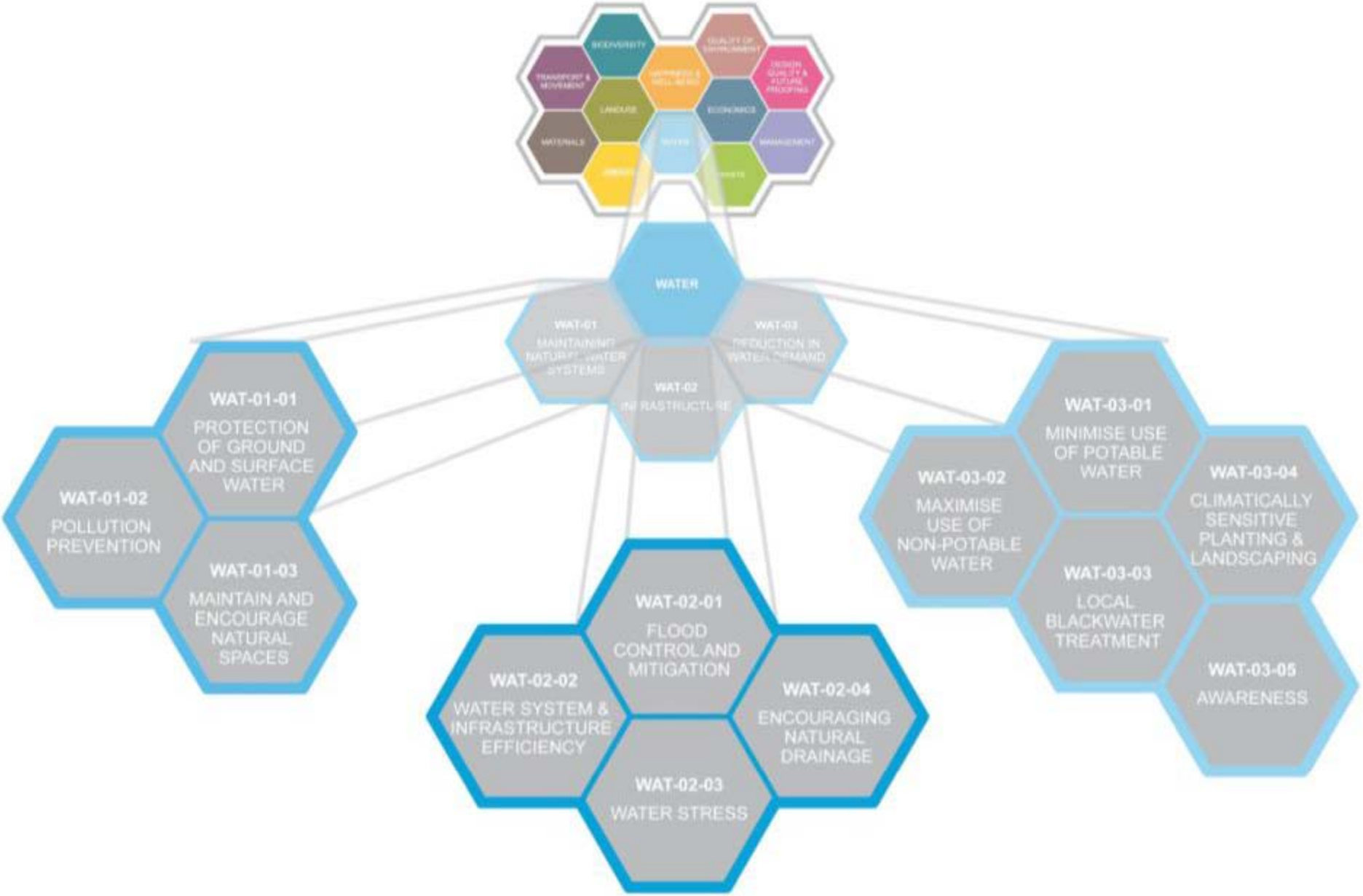
Our Approach

- 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**

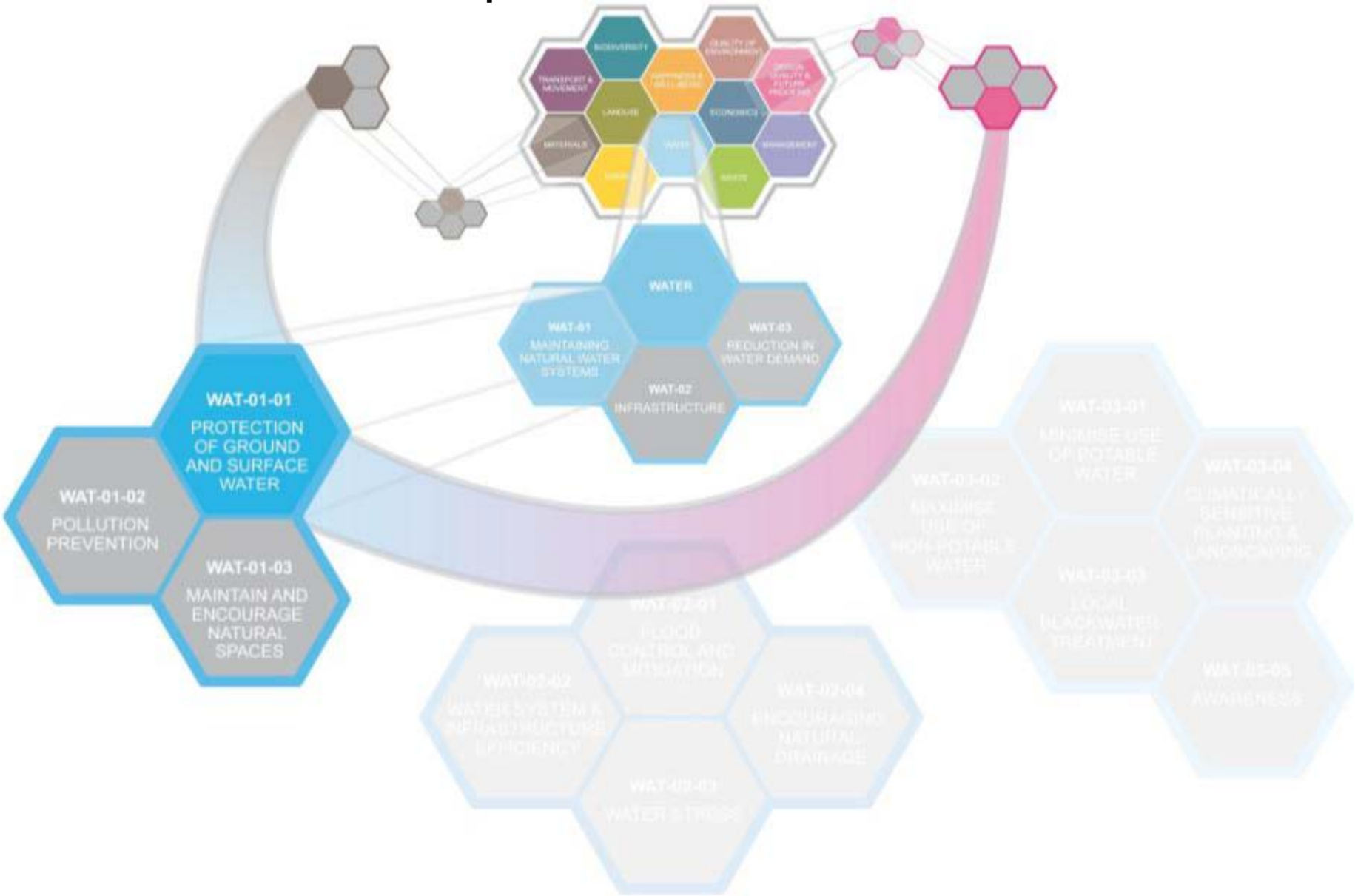
The Inbuilt Framework for Sustainable Development

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)?

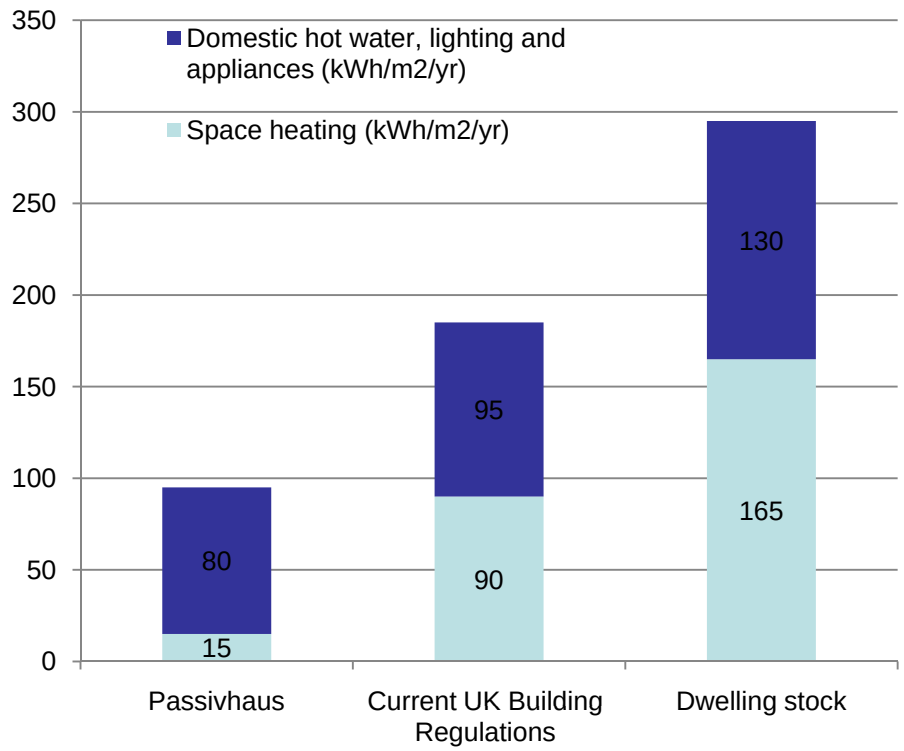
Passivhaus – an intelligent “whole-building” energy performance standard

- Space heating <15 kWh/m^2/year
- Primary energy (heating, lighting, domestic hot water, appliances) <120 kWh/m^2/year
- 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 Burse, University of Wuppertal, Germany

Detached Passivhaus, Samerburg, Germany

Fire station - Heidelberg (Baden-Württemberg)

Terraced houses, Hannover

Offices, Germany, Architect Hermann Kaufmann

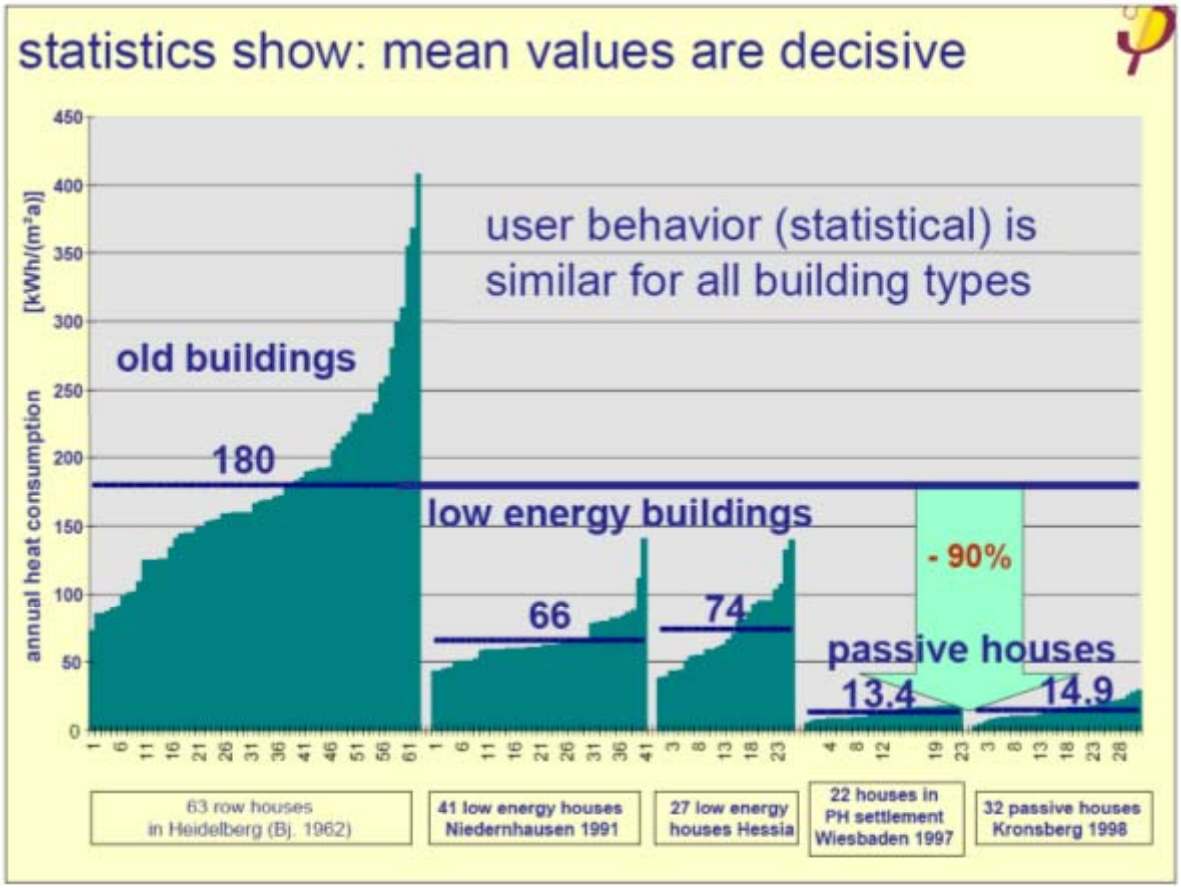
Things that you ‘save’: reduce the build cost

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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