

**Association of University Engineers conference
Manchester, 9 September 2010**

***Usable buildings 1970-2050:
Back to the future?***

Bill Bordass

***the* USABLE BUILDINGS TRUST**
www.usablebuildings.co.uk

Structure of the talk

- 1. Past, present and future**
 - 2. Where are we now?**
 - 3. Moving forward**
 - 4. Conclusions**
-

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**PAST, PRESENT
AND FUTURE**

Decade by decade (± 5 years): *Some context*

1960s	Expansion	<i>New Universities. Quinquennial funding. The Robbins report.</i>
1970s	Retrenchment	<i>Sudden constraints. Oil crisis. Three day week. IMF.</i>
1980s	Uncertainty	<i>With smaller scale opportunities. Bruntland sustainability report.</i>
1990s	Realignment	<i>Polytechnics merge. Rise of FM and MBA. BREEAM launched.</i>
2000s	Binge + bust	<i>Big scale. Outsourcing. PFI. Mortgaging the future. Carbon.</i>
2010s	Hangover	<i>Danger of implosion, commitments exceeding resources</i>
2020s on	Shipwreck or survival?	<i>Vicious or virtuous circles? The death of short-termism?</i>

Decade by decade (± 5 years):

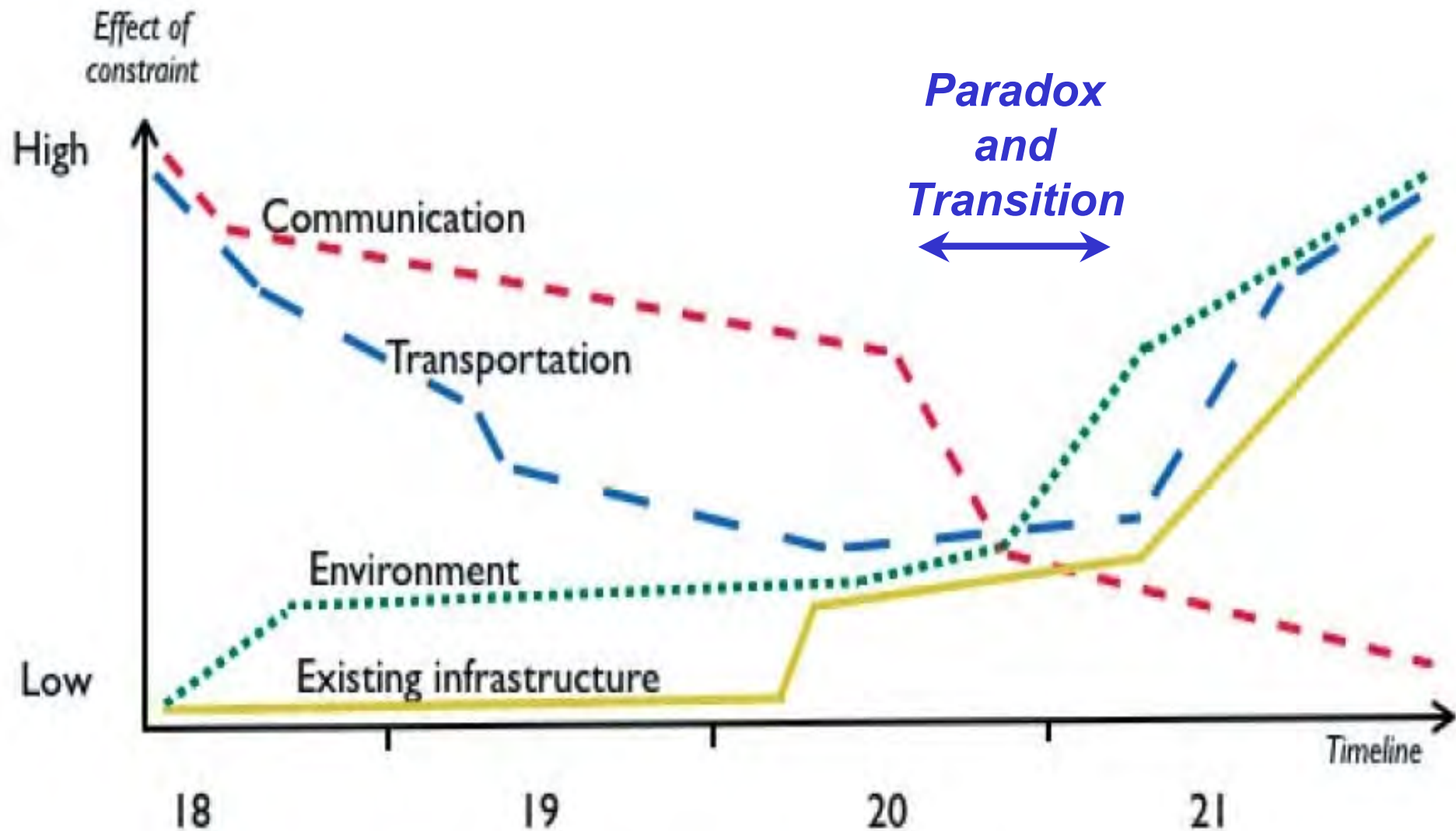
Energy and services

1960s	Expansion	<i>District heating services, with coal, oil (& nuclear suggested!).</i>
1970s	Retrenchment	<i>Oil crisis. Energy conservation. But North Sea gas and oil.</i>
1980s	Uncertainty	<i>Ayatollah. 25,000 therm limit. Shortage, then abundance.</i>
1990s	Realignment	<i>Fuel industry privatisation. Low prices undermine common sense</i>
2000s	Binge + bust	<i>More services, more regulation more complication, tick boxes.</i>
2010s	Hangover	<i>Cheaper or better? Will the tail wag the dog?</i>
2020s on	Shipwreck or survival?	<i>Simpler or more complicated? Centralised and/or dispersed?</i>

Vision 2000: *our crystal ball in the 90s:* **Paradox, Transition and Consequences**

- Undertaken for a UK utility in 1993-94.
- Examined social, economic and technical trends affecting building electricity use in 20 years' time.
- Suggested that we were in an ***Age of Paradox***, where the economy and our buildings were not taking proper account of the world in which they would find themselves.
- Predicted a ***Period of Transition***, which arrived more slowly than expected, but we now seem to be in; towards
- an ***Age of Consequences***, in which decisions would be much more strongly influenced by downstream effects.
- Convergence between business efficiency and sustainability, as are both ultimately about waste avoidance.

Paradox and transition: *adapting to changing constraints over time*



Buildings and services for the future: *things we had expected to see by 2010*

- Simple, robust, adaptable buildings to suit many purposes, with good passive design and mixed mode services.
- Complex, more highly serviced buildings would also be required, but should be kept to a necessary minimum. Scope for major improvements in their efficiency.
- Better design for usability, manageability and responsiveness; and seek to minimise downside risks.
- FMs much better informed and more involved in design.
- More understanding of performance in use by designers, builders and government, to focus efforts better.
- Major opportunities for improving controls.
- Large reductions in energy demands and other resource and environmental impacts. Effective waste avoidance.

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**WHERE ARE
WE NOW?**

Many designers and builders still don't know that much about actual performance in use

“in theory, theory and practice are the same, in practice they aren't”

SANTA FE INSTITUTE for research into complex systems

“designers seldom get feedback,

and only notice problems when asked to investigate a failure”

ALASTAIR BLYTH CRISP Commission 00/02, UK

“unlike medicine, the professions in construction

have not developed a tradition of practice-based user research ...

Plentiful data about design performance are out there, in the field ...

Our shame is that we don't make anything like enough use of it”

FRANK DUFFY Building Research & Information, 2008

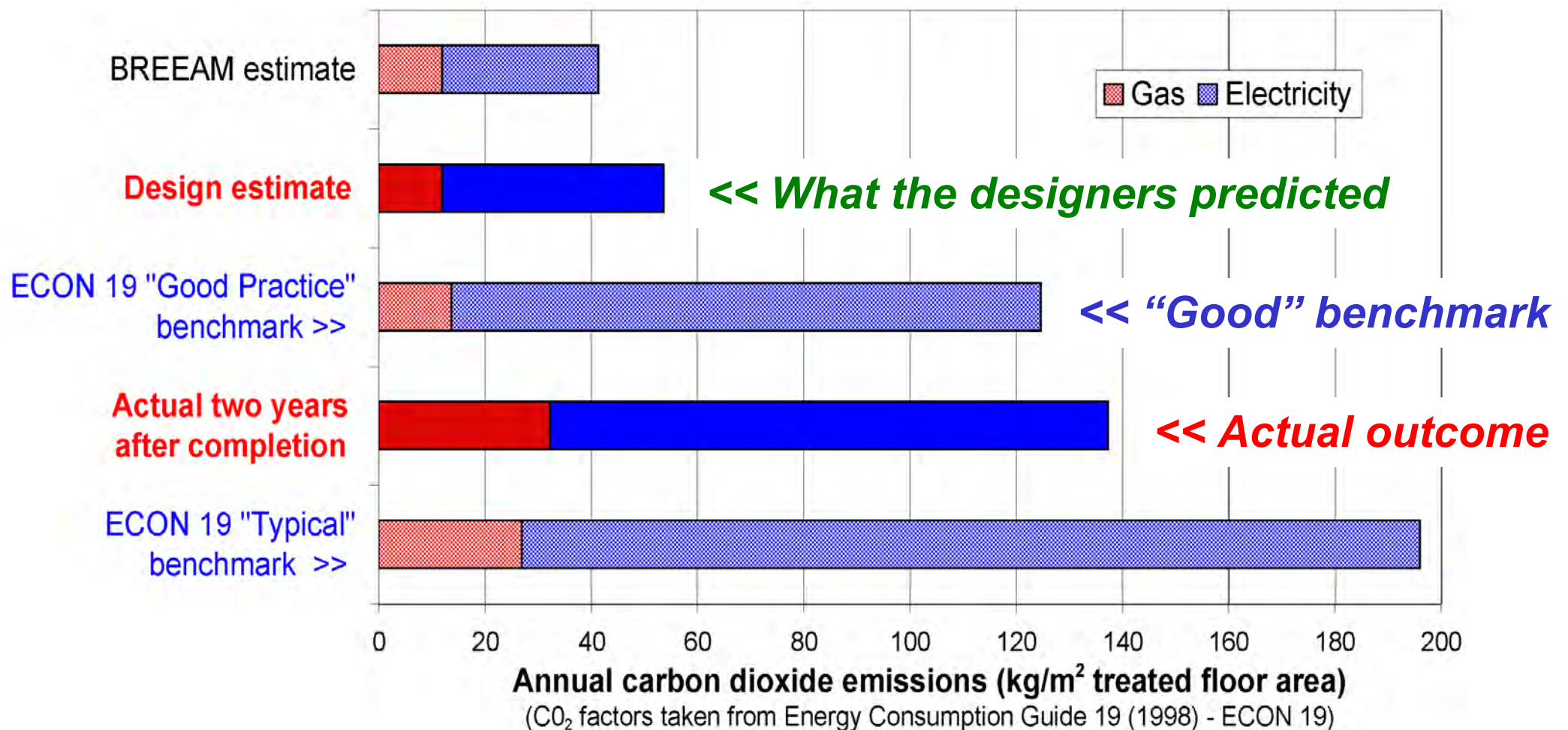
“I've seen many low-carbon designs,

but hardly any low-carbon buildings”


ANDY SHEPPARD Arup, 2009

The Credibility Gap: *We couldn't deliver low-energy and carbon performance reliably in the 1990s. We're still finding it difficult.*

Data from the winner of a Green Building of the Year Award




We've been trying to close the feedback loop at www.usablebuildings.co.uk



... for
feedback
and
strategy

... from the Usable Buildings Trust

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Usable Buildings is a free resource for practitioners, managers, building owners, developers, students and anyone else who wants to make buildings more suitable for the people who use them, less damaging to the natural environment and a better long-term investment. Usable Buildings is run by the Usable Buildings Trust.

The Usable Buildings Trust (UBT) is an independent charity, registered in the United Kingdom. UBT promotes better buildings through the more effective use of feedback on how they actually work. It spreads the results through its website, user groups, collaborative working and input to postgraduate courses. UBT is also a home for approaches which are not quite ready for widespread application and an incubator for their development. [Aims Background](#)

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Who we are and what we do: [Trustees' Report](#) summarises activities and plans. [What Do We Do?](#)

Website: Our website is text-based and designed primarily to deliver pdf files. [Website set-up](#).

Latest posted : [The Building Services Brief of the Future](#) | [89 Culford Road](#) | [Surpassing Expectations](#) | [Human Factors: the bottom line](#) | [Soft Landings](#) | [The Great Escape](#) |

Basics: [POE and Feedback: Getting Started](#) | [Probe 9](#) | [A Guide to Feedback and Post-Occupancy Evaluation](#) |

[Full Latest list](#) [Live \(real-time\) monitoring](#) **[Please send in more examples!]**

Latest one liners: "Who are you going to believe? Me, or your own eyes?" [Groucho Marx](#) | "If the choice is between cooking alive and wasting money unnecessarily I would rather waste some money, because long before we cook we are going to kill each other if we don't deal with climate change." [George Soros](#) | "The paradox of public transport is the better it does its job the less 'efficient' it may be." [Tony Judt](#) | "I got rid of the Ferrari: it was bad for my hamstrings." [Ryan Giggs](#) [More](#)

Hosting : We host the [Feedback Portfolio: Techniques](#) and the [Probe](#) archive.

Support : We support [Soft Landings](#).

Searching : Most of the material available here is in pdf files, about two-thirds of which are password protected. If you wish to search within files that are not password protected use the Google search syntax: "filetype:pdf site:www.usablebuildings.co.uk search term". Example: for articles on health type in the Google search area: "filetype:pdf site:www.usablebuildings.co.uk health" [Show example](#)

Thursday, March 18

Established in the late 1990s when the research and policy emphasis on Rethinking Construction largely ignored building performance in use. UK Registered charity from 2002.

New buildings:

What do we still tend to find?

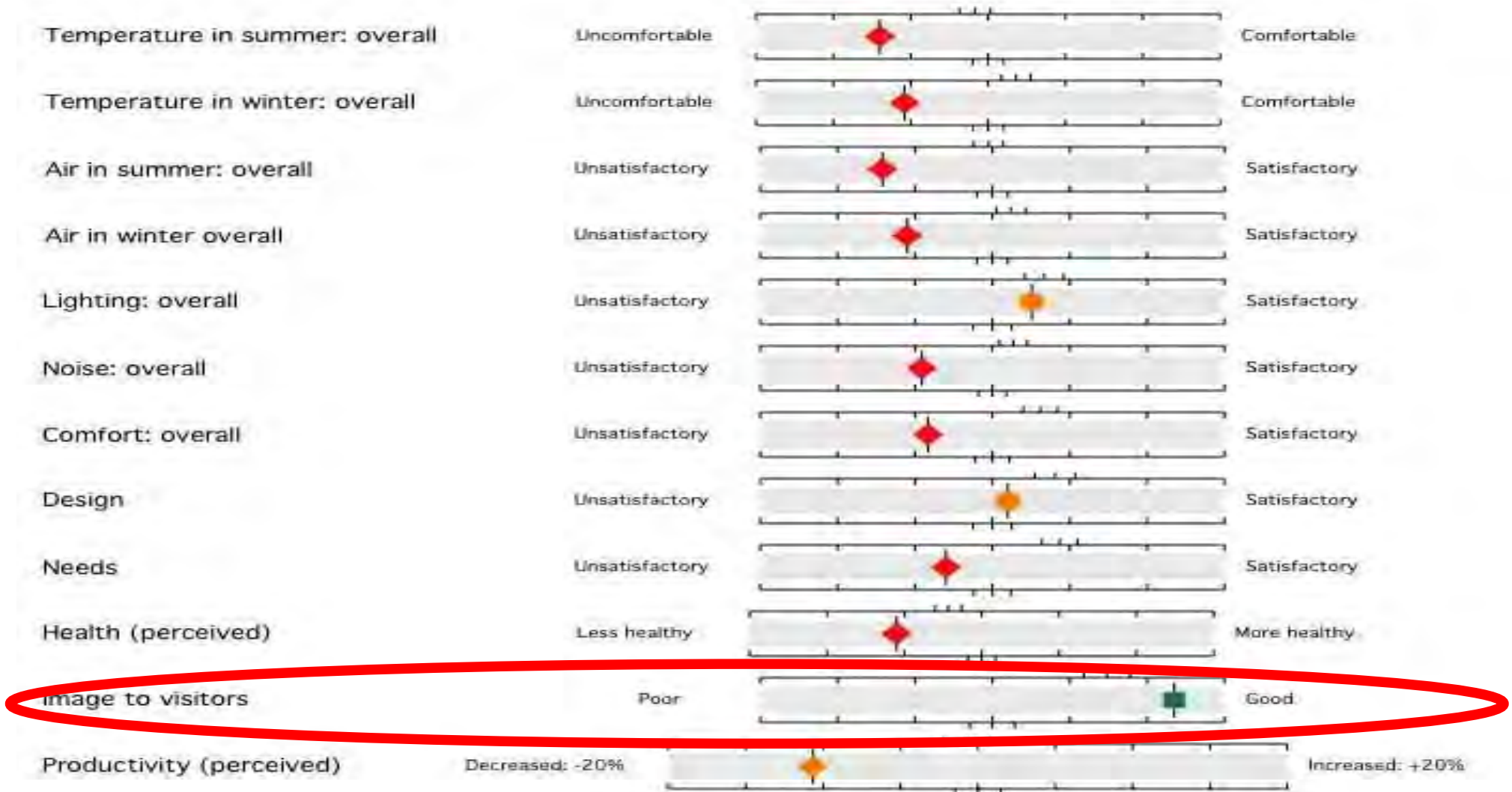
- Too often they perform much less well than anticipated, *especially for energy and carbon, often for occupants, and with high running costs.*
- Unmanageable complication is the enemy of good performance.
So why are we being forced to make buildings more complicated in the name of sustainability, when we don't get simple things right?
- Buildings are seldom tuned-up properly.
So if we have more to do, what chance do we have?
- Design intent is seldom communicated well to users.
Designers and builders tend to go away at handover.
- Good environmental performance and occupant satisfaction can go hand in hand, *but only where committed people have made it do so.*
- Modern procurement systems make it difficult to pay attention to critical detail. *Not a good idea when promoting innovation.*
- Are we **sparing no expense to get something on the cheap?** *

**KEEP IT SIMPLE, DO IT WELL,
FOLLOW IT THROUGH, TUNE IT UP**

* *The British spare no expense to get something on the cheap ... NIKOLAUS PEVSNER, Architectural historian*

Credibility gaps: Occupant satisfaction

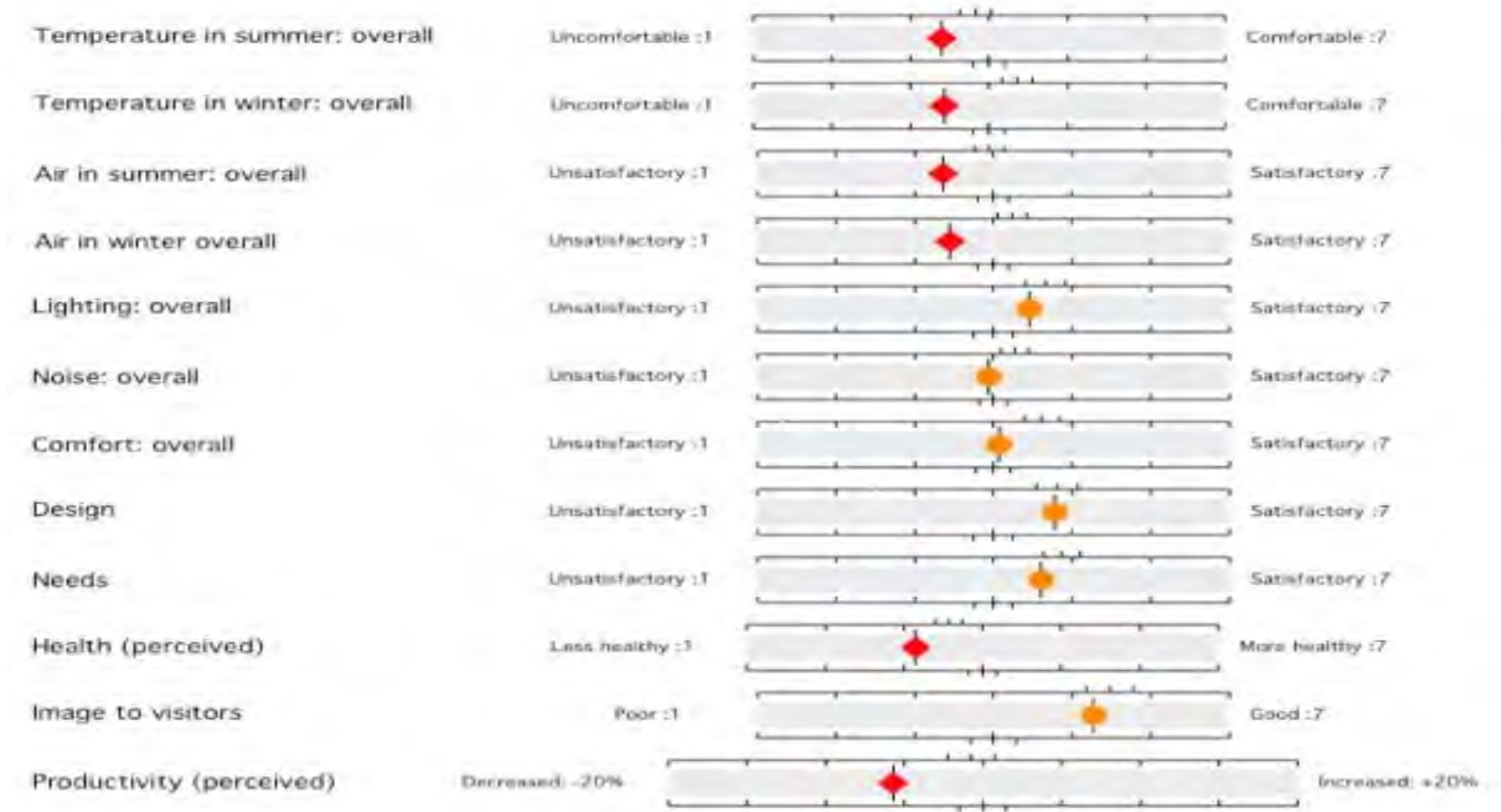
Occupant survey, award-winning educational building, 2009



What impresses the judges may not impress the users!

Credibility gaps: Occupant satisfaction

Occupant survey, five year old offices, 2010



Do pilot projects of improvements where you can.

The image shows a large, modern university building interior. The space is characterized by its multi-level design, with numerous balconies and walkways. A prominent feature is a large, white, cylindrical pillar that runs vertically through the center of the atrium. The balconies are enclosed with glass railings, and the building's structure is made of dark metal. In the foreground, there is a curved, light-colored reception desk. The lighting is a mix of natural light from above and artificial lights, creating a bright and open atmosphere. The text "Why are these lights on in a new university building?" is overlaid at the bottom of the image.

Why are these lights on
in a new university building?

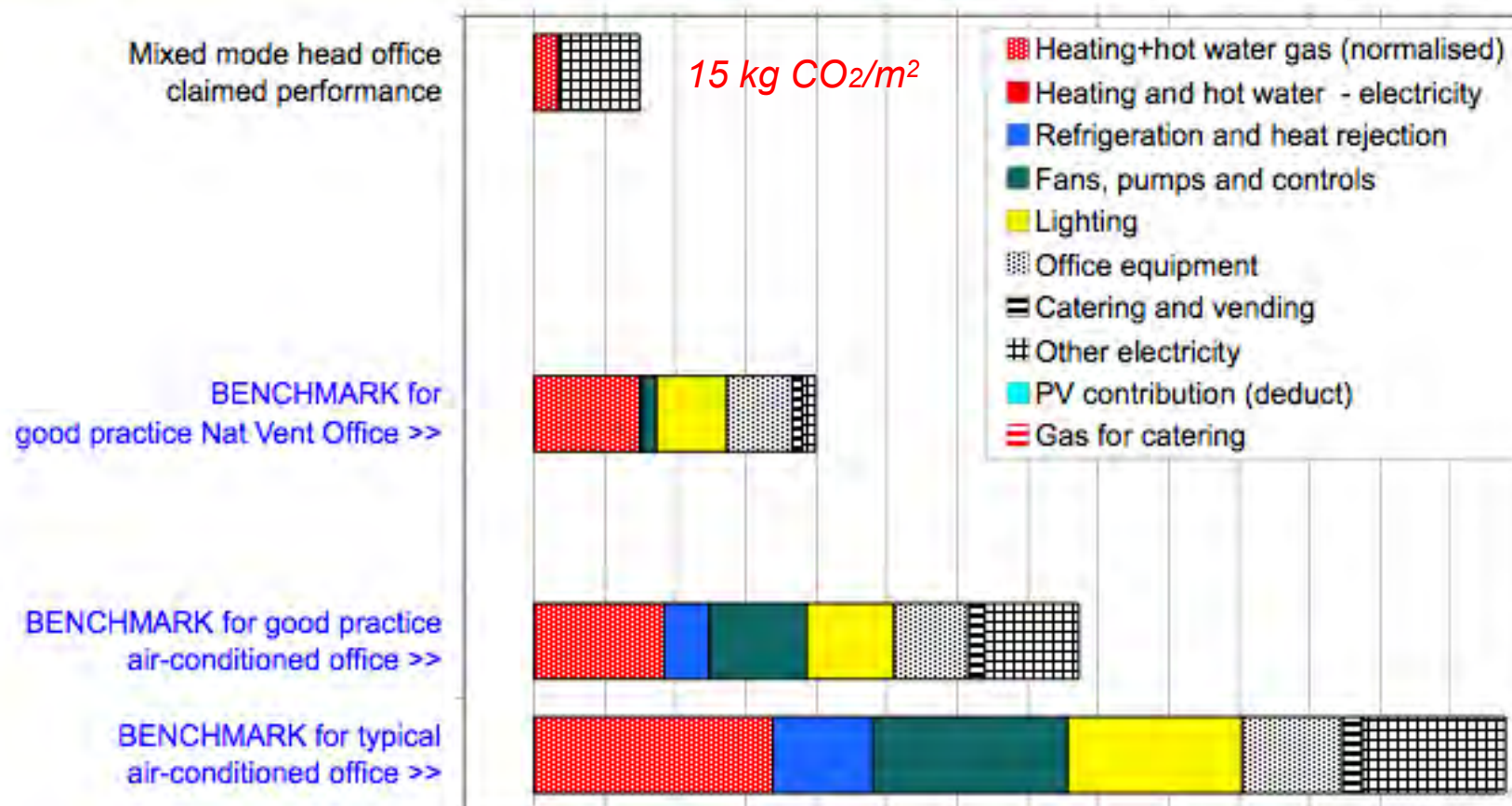
Design intent to reality: perspectives

1: the design claim, as published

Annual CO₂ emissions of energy use in a low-energy office building

kgCO₂/m² Treated Internal Floor Area at UK ECON 19 CO₂ factors of 0.19 for gas and 0.46 for electricity

<< Onsite renewable supply << >> Building energy demand >> expressed as CO₂



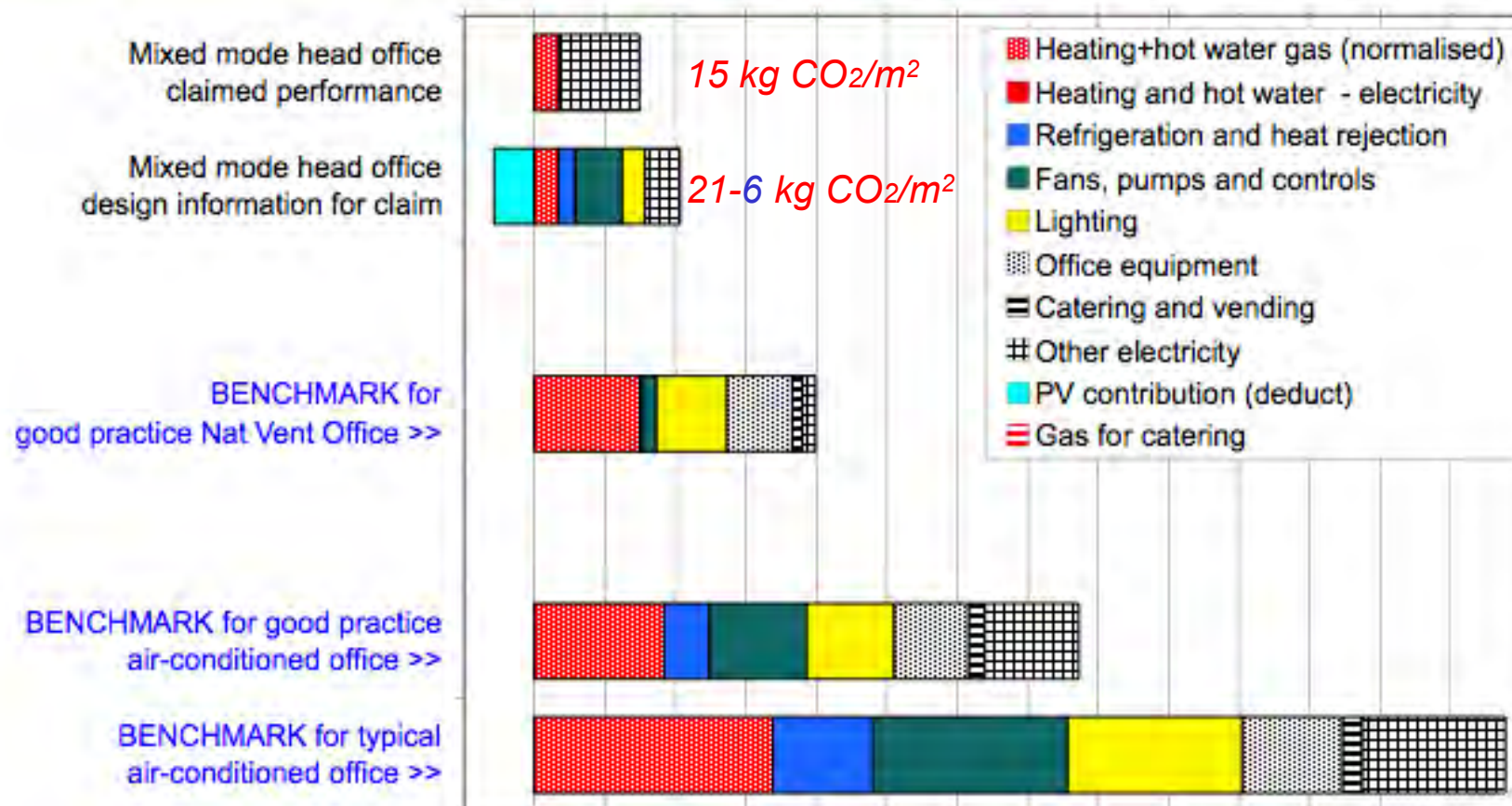
Design intent to reality: how the gap widens

2: the basis for the design claim

Annual CO₂ emissions of energy use in a low-energy office building

kgCO₂/m² Treated Internal Floor Area at UK ECON 19 CO₂ factors of 0.19 for gas and 0.46 for electricity

<< Onsite renewable supply << >> Building energy demand >> expressed as CO₂



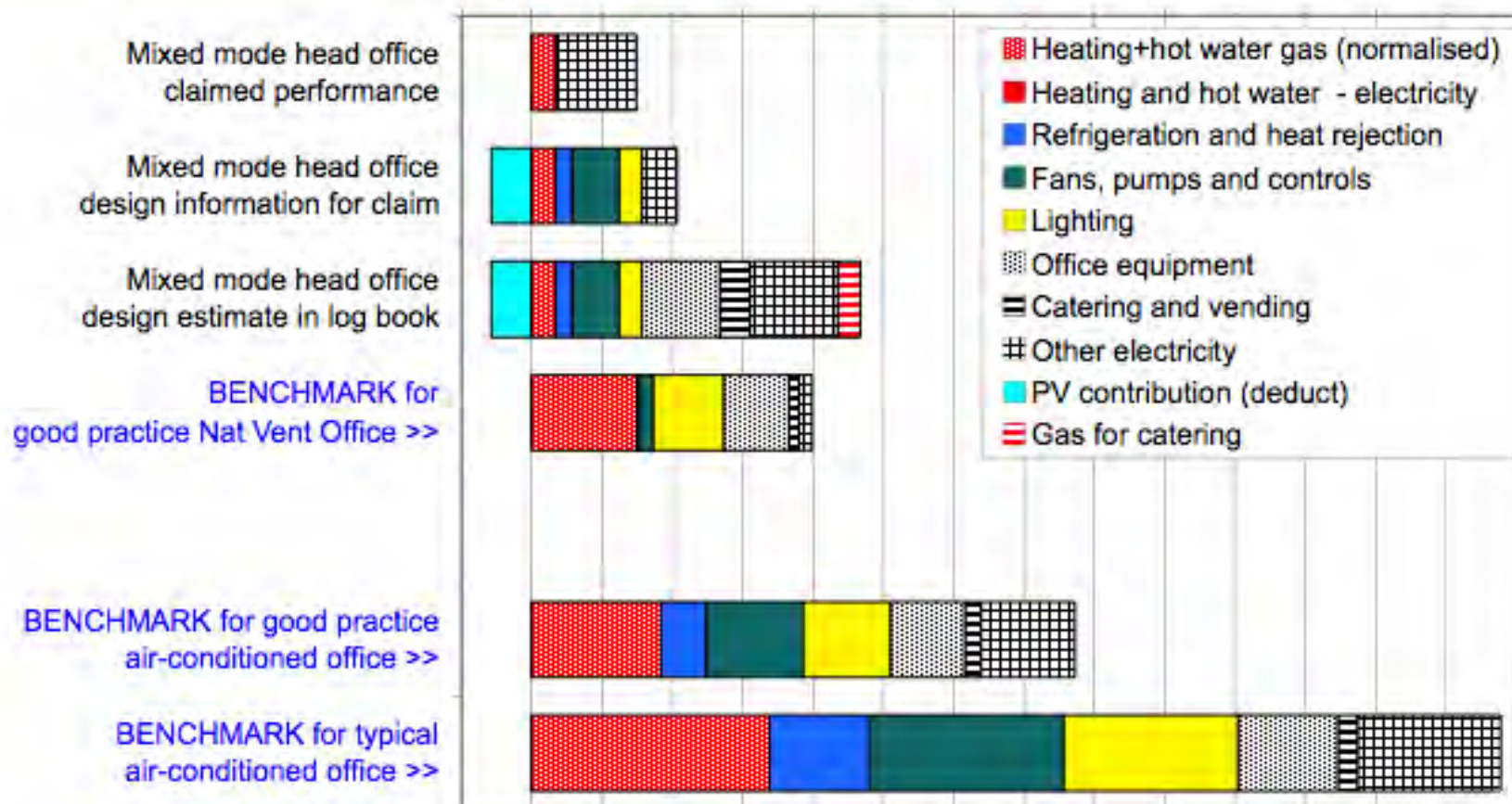
Design intent to reality: how the gap widens

3: what it said in the log book supplied at handover

Annual CO₂ emissions of energy use in a low-energy office building

kgCO₂/m² Treated Internal Floor Area at UK ECON 19 CO₂ factors of 0.19 for gas and 0.46 for electricity

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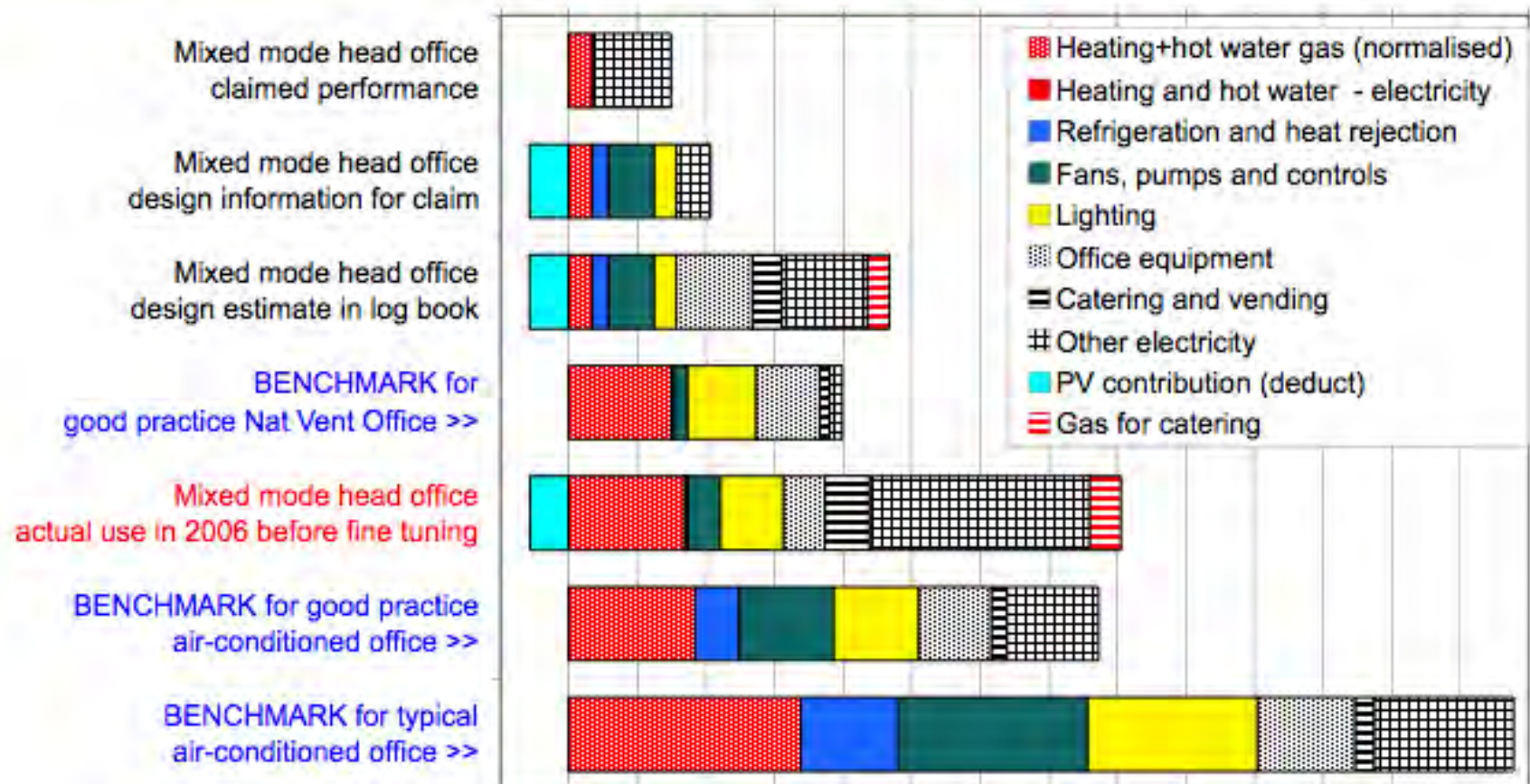
Design intent to reality: how the gap widens

4: actual performance in use, before fine tuning

Annual CO₂ emissions of energy use in a low-energy office building

kgCO₂/m² Treated Internal Floor Area at UK ECON 19 CO₂ factors of 0.19 for gas and 0.46 for electricity

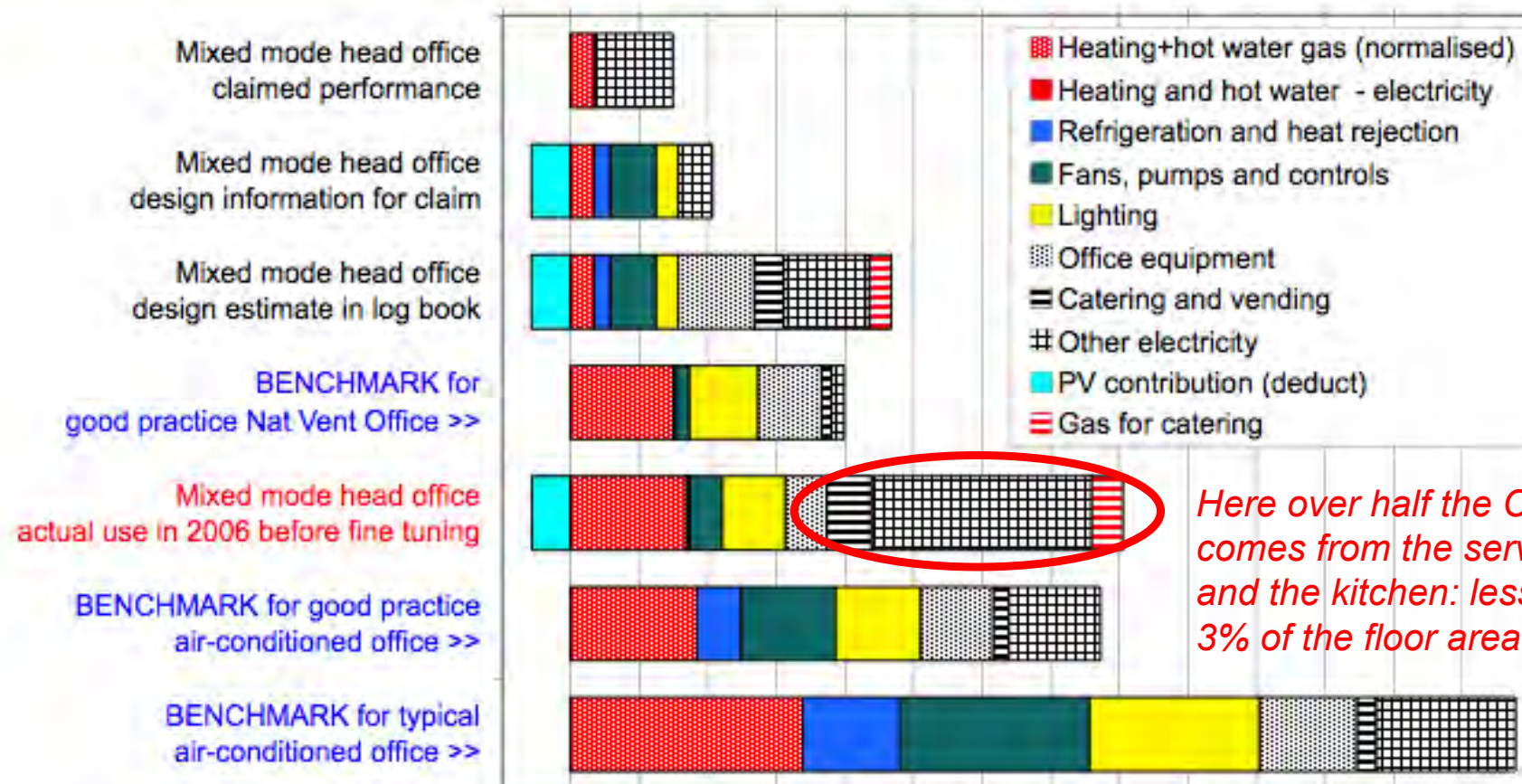
<< Onsite renewable supply << >> Building energy demand >> expressed as CO₂



Components of energy performance:

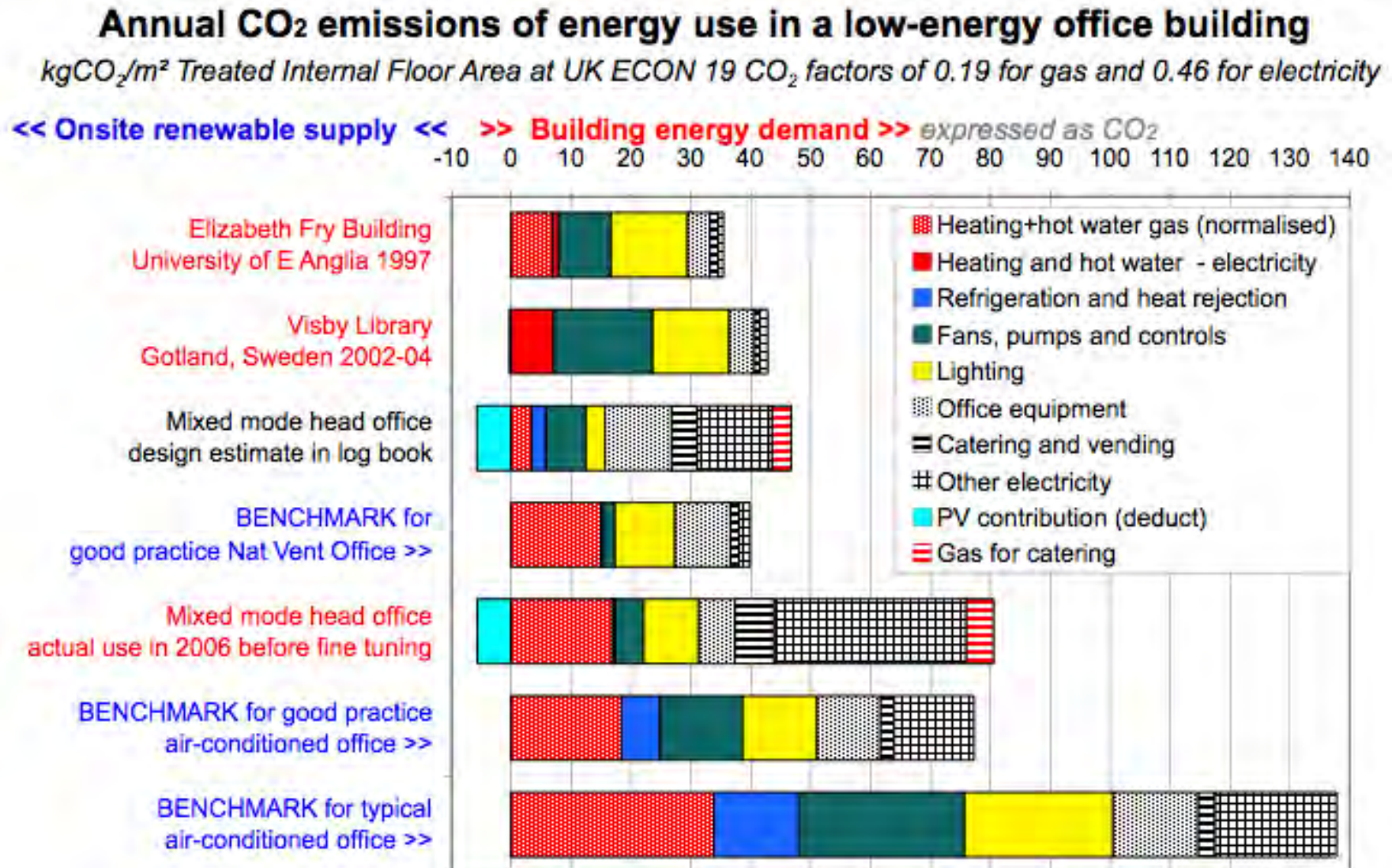
5: designers need to influence “unregulated” loads!

Annual CO₂ emissions of energy use in a low-energy office building
 kgCO₂/m² Treated Internal Floor Area at UK ECON 19 CO₂ factors of 0.19 for gas and 0.46 for electricity
 << Onsite renewable supply << >> Building energy demand >> expressed as CO₂



Here over half the CO₂ comes from the server room and the kitchen: less than 3% of the floor area!

We must learn from the fine structure:
6: how it relates to two other low-energy buildings



How do newer buildings compare with E Fry?

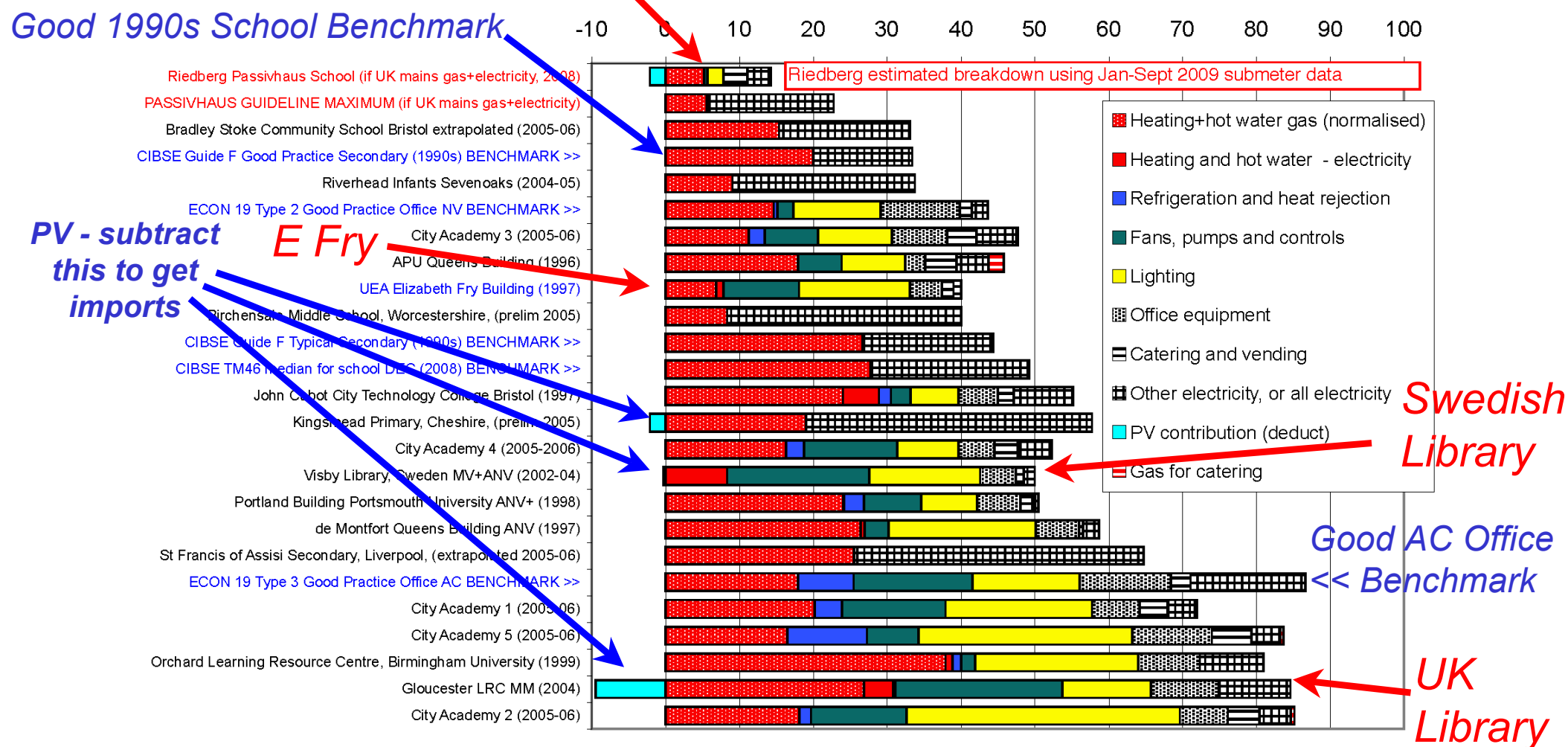
Annual energy use expressed as $\text{kg CO}_2/\text{m}^2$ (UK factors)

German School (based on gas heating CO_2 factor - actually pellets)

Annual CO_2 emissions from low-energy school and university buildings

kg/m^2 Treated Floor Area at Defra 2008 CO_2 factors of 0.185 for gas and 0.537 for electricity

Good 1990s School Benchmark



So why are we being encouraged to spend money on green bling when we aren't getting the fundamentals right?



Getting the leverage on emissions:

First people, then energy, then carbon

- Engage people - *if not, there may well be unintended consequences.*
- Reduce demand - *prevention is better than cure!*
- Increase efficiency - *of the services that meet the demand.*
- Avoid waste, *a priority for both new **and existing buildings.***
- Decarbonise supplies - *but low-carbon energy is a scarce resource not to be squandered: be sure to get the demand down first.*
- Get results by doing things simply, cheaply ... **and well!**

BIG SAVINGS ARE POSSIBLE USING THE MULTIPLIER EFFECT

e.g:

- Halve the demand **X**
- Double the efficiency **X**
- Halve the carbon in the supplies ... **AND**

You are down to one-eighth of the carbon.

Controls, manageability and usability need to receive much more attention



“An intelligent building is one that doesn’t make its occupants feel stupid” ... ADRIAN LEAMAN

“We sell dreams and install nightmares” ... BMS SUPPLIER

3

MOVING FORWARD

The context today: the party's over *need to make better use of what we've got*

- Decline of North Sea oil and gas. Peak oil.
- Need to slash fossil fuel use and emissions anyway.
- Chronic shortage of money. International power shifts.
- Pressures to cut costs, *but we need to do things better.*
- Additional costs of infrastructure and climate adaptation.
- Fewer opportunities for new university revenue.
- Buildings will need to become much more sustainable.
- Most of the buildings we will have in 2050 are already here. *We will need to make them perform much better.*
- Many of the buildings procured over recent years may give cause for regret as the context changes.

Is High Performance the Answer?: strategic conclusions from the Probe POEs

		Technological complexity	
		More	Less
Building management input	More	<i>Type A</i>	<i>Type D</i>
	Less	<i>Type C</i>	<i>Type B</i>

Technology - management interactions: strategic conclusions from the Probe POEs

		Technological complexity	
		More	Less
Building management input	More	Type A High Performance	Type D Rare, not replicable?
		Risky with performance penalties Type C	Simple Smart Sense + Science Type B

Secure Type A
Seek more Type B
(and possibly Type D)
Avoid Type C.

Things we already know need improving

- Better **briefing** and clarity of **design intent**, with transparency between expectations and outcomes, *to minimise the credibility gaps*.
 - **Expectations management** during design, construction and alteration and into use, *with better processes, such as Soft Landings - see following slides*.
 - Better **engagement, understanding and communication** *between designers, clients, users and operators*.
 - **Interfaces:** *between components, skills, and silos, and across gateways*.
 - Much better **usability and manageability** of control and BMS systems, both manual and automatic. *“We sell dreams and install nightmares”*.
 - Pay attention to **critical detail**. *Prevention is better than cure!*
 - Seek **resilience, robustness and adaptability** in the solutions. *Seek to avoid unintended consequences and “revenge effects”*.
 - Seek to **avoid unmanageable complication**, the enemy of good performance. *Keep it simple and do it well*.
 - Much better **handover and aftercare** *to communicate design intent, fine tune, minimise unintended consequences, pass on knowledge, and obtain feedback*.
 - Seek **continuous improvement** of the building in use, *otherwise vicious circles of decline are likely to occur*.
-

Soft Landings: *supporting a new professionalism that engages routinely with outcomes on any project*

Soft Landings can run alongside any procurement system, and:

- Link actual building performance and FM to design.
- Ease transition to occupation.
- Reduce post-handover problems and assist fine-tuning.
- Facilitate feedback.
- Capture learning, and improve professional competences.

Soft Landings can help to:

- Relate client and design targets to achieved outcomes.
- Manage expectations and review performance at intervals throughout a project, and on into use.
- Allocate responsibilities, *including client responsibilities*.
- Improve relationships between designers, builders, clients and users.

The golden thread ... MARK WAY

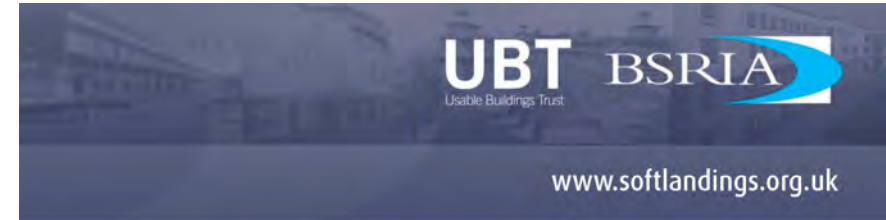
Soft Landings: the Five main stages

From the Framework published in July 2009

1. **Inception and Briefing**
*Appropriate processes.
Assigned responsibilities.
Well-informed targets.*
2. **Design and construction**
Including expectations management.
3. **Preparation for handover**
better operational readiness.
4. **Initial aftercare**
*Information, troubleshooting, liaison,
fine tuning, training.*
5. **Longer-term aftercare**
*monitoring, review, independent POE,
feedback and feedforward.*

Downloadable free
from www.usablebuildings.co.uk
and www.softlandings.org.uk

BSRIA is hosting an industry group



the **SOFT LANDINGS FRAMEWORK**

for better briefing, design, handover and building performance in-use



4

CONCLUSIONS

Where next?

- There's a lot to do, and less money and things to do it with, *though there might be more manpower, and scope for more care.*
- Existing buildings and infrastructure will be strong constraints, *we will need to make better use of we've got where we can.*
- Massive potential for engineering, *but we need to clear our minds and get closer to the decision-makers, and to ordinary users.*

SOLUTIONS WILL INCLUDE THE SIMPLE AND THE ADVANCED:

- Loosely coupled systems.
- Robust buildings, with options available.
- Demand destruction.

IT WON'T JUST BE "GREENED" BUSINESS AS USUAL

- There will be cultural and behavioural changes.
 - There will be some surprising and disruptive innovations.
 - 19th and 20th Century solutions (e.g. District Heating and CHP) will have a role but may well be less of panacea than policymakers think.
-

Some questions to ask when planning changes

- Is it an enabler?
 - Does it meet real needs properly?
 - Does it give you options against different scenarios?
 - Is it as local as practicable?
 - Is it reversible?
 - Is it manageable?
 - Are there downside risks and dead ends?
 - Can you afford to look after it?
 - Is it robust against social, cultural and technical change?
 - Is there a risk of sunk costs and stranded assets?
 - Are there contractual traps with service providers?
 - Are you maintaining the golden thread in procurement?
-

*Take one zero off your budget and creativity begins.
Take two zeros off and you have sustainability ...*

JAIME LERNER, former Mayor of Curitiba, Brazil

www.usablebuildings.co.uk
