

1
Joint Workshop SEAI and SFI-SRC ITOBO
University College Cork, 30 June 2011

Design intent to Reality:
*Post-Occupancy Evaluation,
comfort and human factors*

Bill Bordass

the Usable Buildings Trust
www.usablebuildings.co.uk

Structure of the talk

- 1. Background: what POE tells us**
 - 2. Tuning up existing buildings**
 - 3. Improving new construction and refurbishment**
 - 4. Towards a new professionalism**
-

1

BACKGROUND
what POE tells us

For most designers and builders, *performance in use is another country ...*

“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

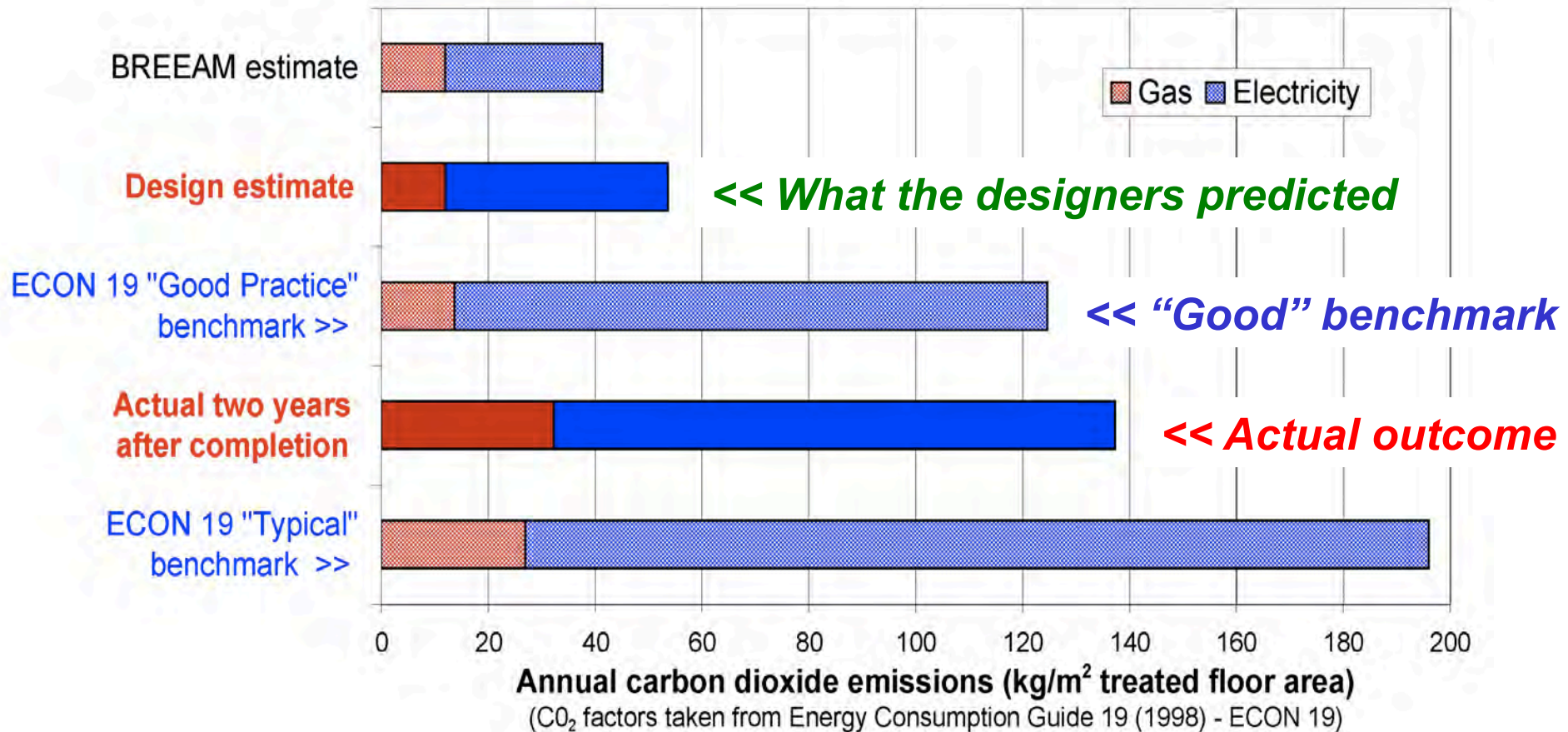
*“I’ve seen many low-carbon designs,
but hardly any low-carbon buildings”*
ANDY SHEPPARD Arup, 2009



Why are these lights on
in a new university building?

The Design-Performance Gap: *We couldn't deliver low-energy performance reliably in the 1990s. It is still 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

**Usable
BUILDINGS**

... 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](#)

Donations: We welcome donations. Please use the Donations and Gift Aid form on the Sponsorship section of our [Brochure](#). Thank you.

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 /st 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, because the policy emphasis on construction and the related research was largely ignoring building performance in use. Registered UK charity from 2002.

New non-domestic buildings: *What do we tend to find?*

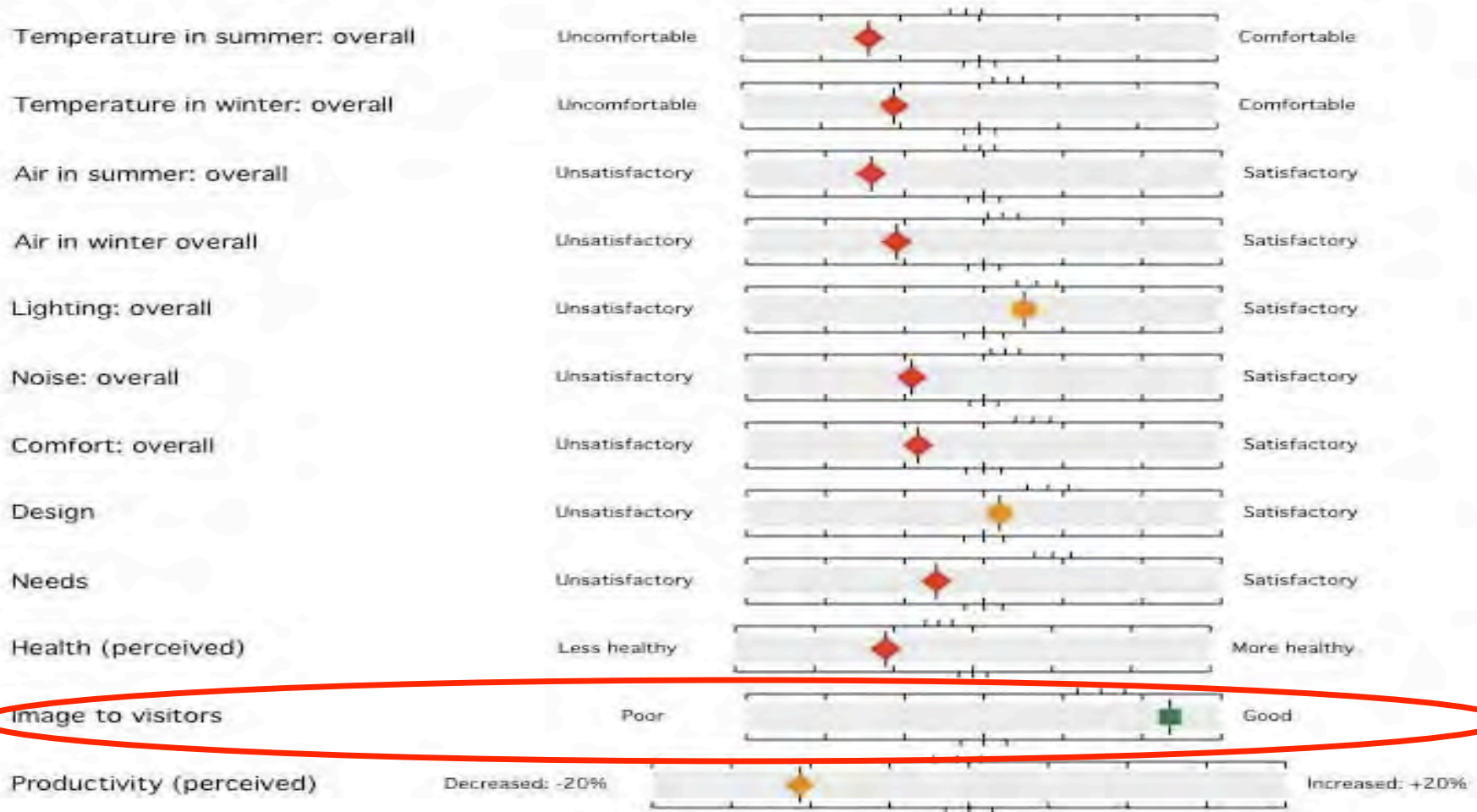
- Too often they perform much less well than anticipated, *especially for energy and carbon, often for occupants, with high running costs, and sometimes technical risks.*
- Not enough attention to detail in design and construction.
- Unmanageable complication is the enemy of good performance. *So why are we making buildings technically and bureaucratically complicated in the name of sustainability, when we can't get the simple things right?*
- Buildings are seldom tuned-up properly. Controls are a mess. *If we have more to do, what chance do we have?*
- Good performance and occupant satisfaction can go hand in hand, *but only where committed people have made it happen.*
- Design intent is seldom communicated well to users. *Designers and builders tend to go away at handover.*
- Modern procurement systems make it difficult to pay attention to critical detail. *A bad idea when promoting innovation.*
- FM services often leave a lot to be desired.



**KEEP IT SIMPLE, DO IT WELL, FOLLOW IT THROUGH,
TUNE IT UP, CAPTURE THE FEEDBACK**

There are gaps in occupant satisfaction too

Occupant survey, award-winning educational building, 2009



What impresses the judges may not impress the users!

2

TUNING-UP EXISTING BUILDINGS *with monitoring, feedback and continuous commissioning*

A focus on performance can mobilise management *without spending vast amounts of money*

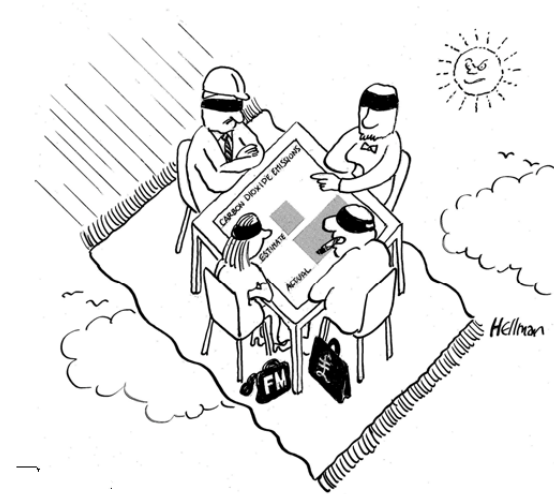


A focus on performance can mobilise management *without spending vast amounts of money*



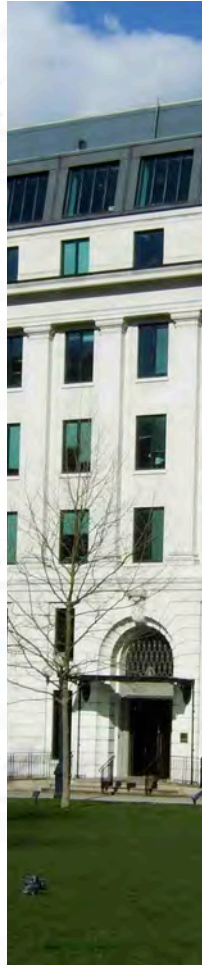
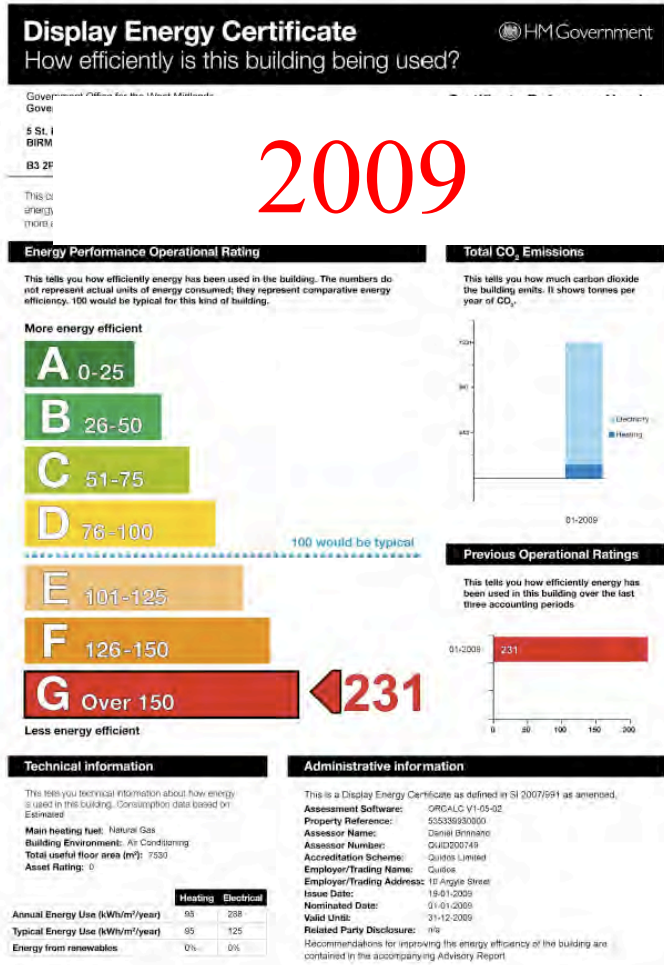
FLYING BLIND

Everything you wanted to know about energy in commercial buildings but were afraid to ask



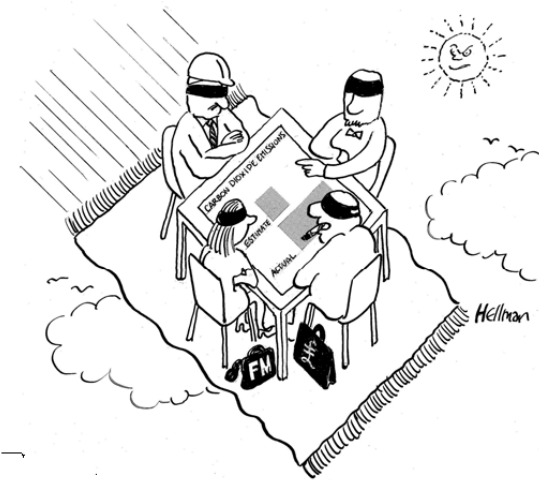
October 2001

A focus on performance can mobilise management without spending vast amounts of money



FLYING BLIND

Everything you wanted to know about energy in commercial buildings but were afraid to ask



October 2001

A focus on performance can mobilise management without spending vast amounts of money

Display Energy Certificate

How efficiently is this building being used?

HM Government

Government Office
C
S
E
E

5 St. 1
BIRM
B3 2F

This is an energy certificate

2009

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
- F 126-150
- G Over 150

100 would be typical

Total CO₂ Emissions

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

01-2009

Previous Operational Ratings

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

01-2008: 231

01-2009: 231

01-2010: 121

Technical information

This tells you technical information about how energy is used in this building. Consumption data based on Estimated.

Main heating fuel: Natural Gas
Building Environment: Air Conditioning
Total useful floor area (m²): 7530
Asset Rating: D

| | Heating | Electrical |
|---|---------|------------|
| Annual Energy Use (kWh/m ² /year) | 95 | 238 |
| Typical Energy Use (kWh/m ² /year) | 95 | 125 |
| Energy from renewables | 0% | 0% |

Administrative information

This is a Display Energy Certificate as defined in SI 2007/591 as amended.

Assessment Software: ORCALC V1-05-02
Property Reference: 55335930001
Assessor Name: Daniel Strimling
Assessor Number: QUID007419
Accreditation Scheme: Quirex Limited
Employer/Trading Name: Quirex
Employer/Trading Address: 10 Angle Street
Issue Date: 18-01-2009
Nominated Date: 01-01-2009
Valid Until: 31-12-2009
Related Party Disclosure: Nil
Recommendations for improving the energy efficiency of the building are contained in the accompanying Advisory Report



Display Energy Certificate

How efficiently is this building being used?

HM Government

Government Office
C
S
E
E

Certificate Reference Number: 03

2010

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
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Total CO₂ Emissions

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01-2009 01-2010

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

01-2008: 231

01-2009: 231

01-2010: 121

Technical information

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

Main heating fuel: Natural Gas
Building Environment: Air Conditioning
Total useful floor area (m²): 7530
Asset Rating: Not available

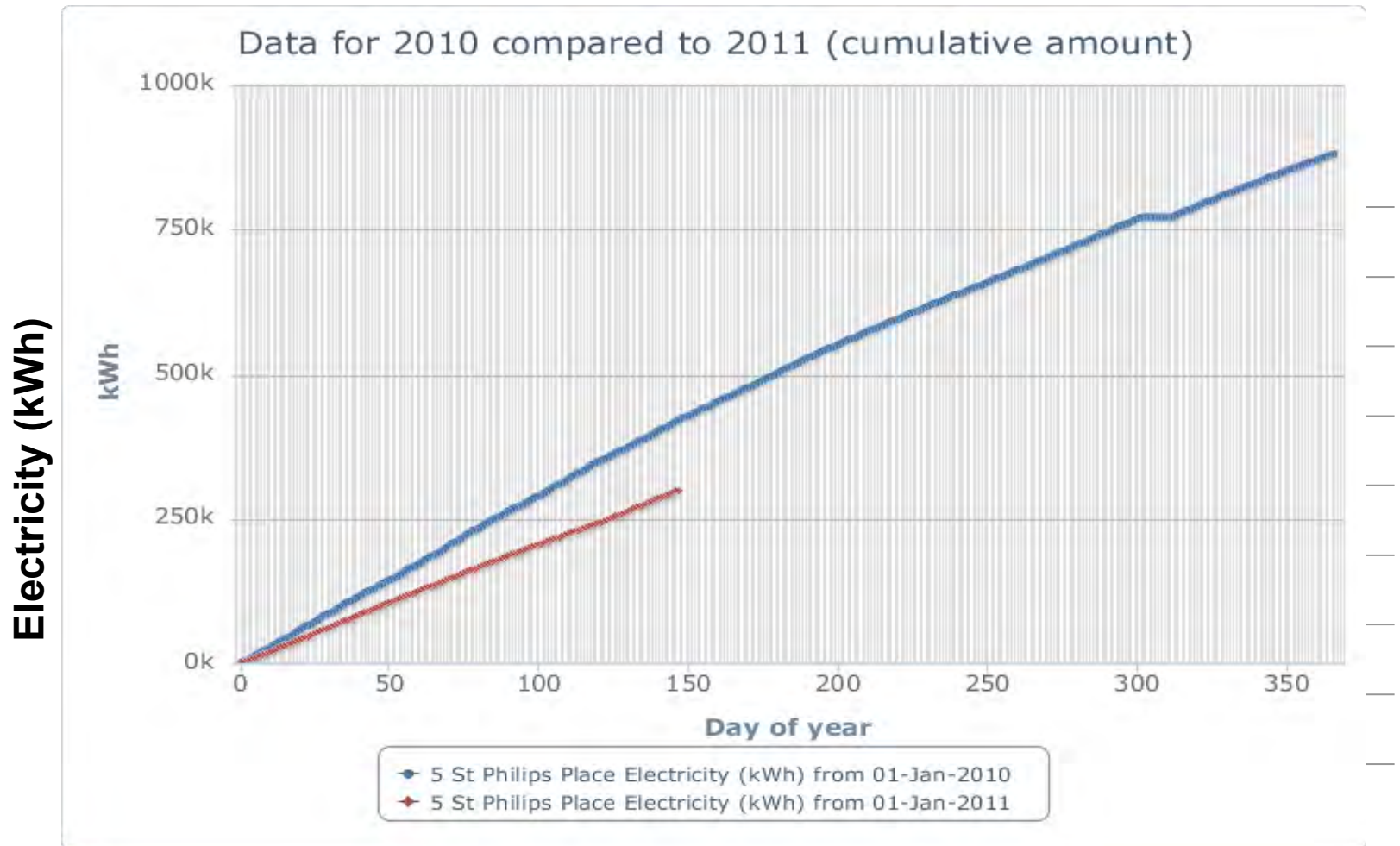
| | Heating | Electrical |
|---|---------|------------|
| Annual Energy Use (kWh/m ² /year) | 65 | 139 |
| Typical Energy Use (kWh/m ² /year) | 125 | 95 |
| Energy from renewables | 0.0% | 0.0% |

Administrative information

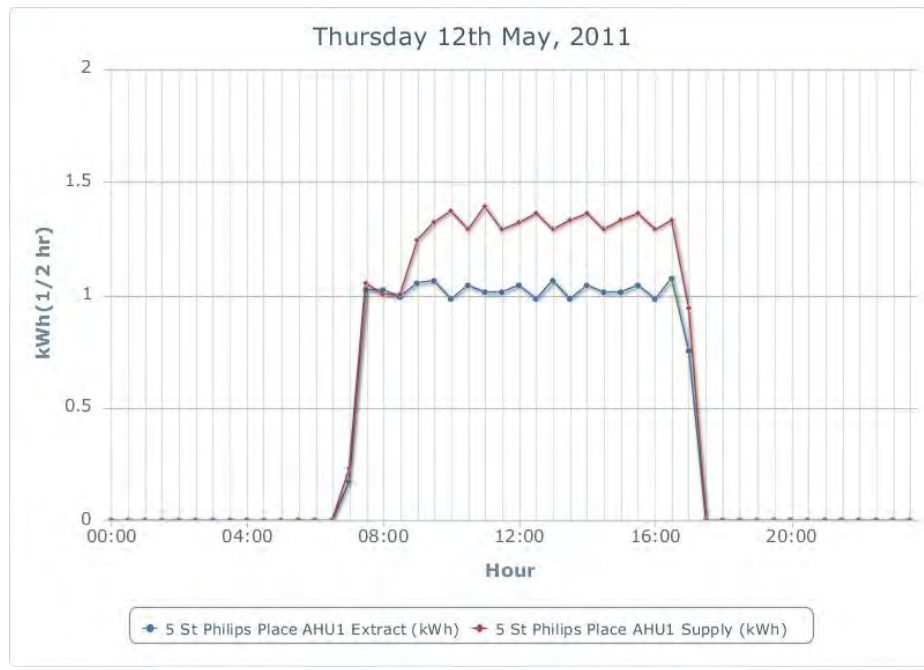
This is a Display Energy Certificate as defined in SI 2007/591 as amended.

Assessment Software: TEAM, Sigma DEC, V2.0
Property Reference: 838335930000
Assessor Name: MPEnc Kesi
Assessor Number: IJERPD5588
Accreditation Scheme: NHER
Employer/Trading Name: Team (Energy Auditing Agency Ltd.)
Employer/Trading Address: 34 The Forum, Rockingham Drive, MILTON KEYNES, MK14 6LJ
Issue Date: 15-04-2010
Nominated Date: 01-01-2010
Valid Until: 31-12-2010
Related Party Disclosure: Not related to the occupier
Recommendations for improving the energy efficiency of the building are contained in the accompanying Advisory Report

Further savings in 2011 *with sub-metering and support on Continuous Commissioning by ABS*



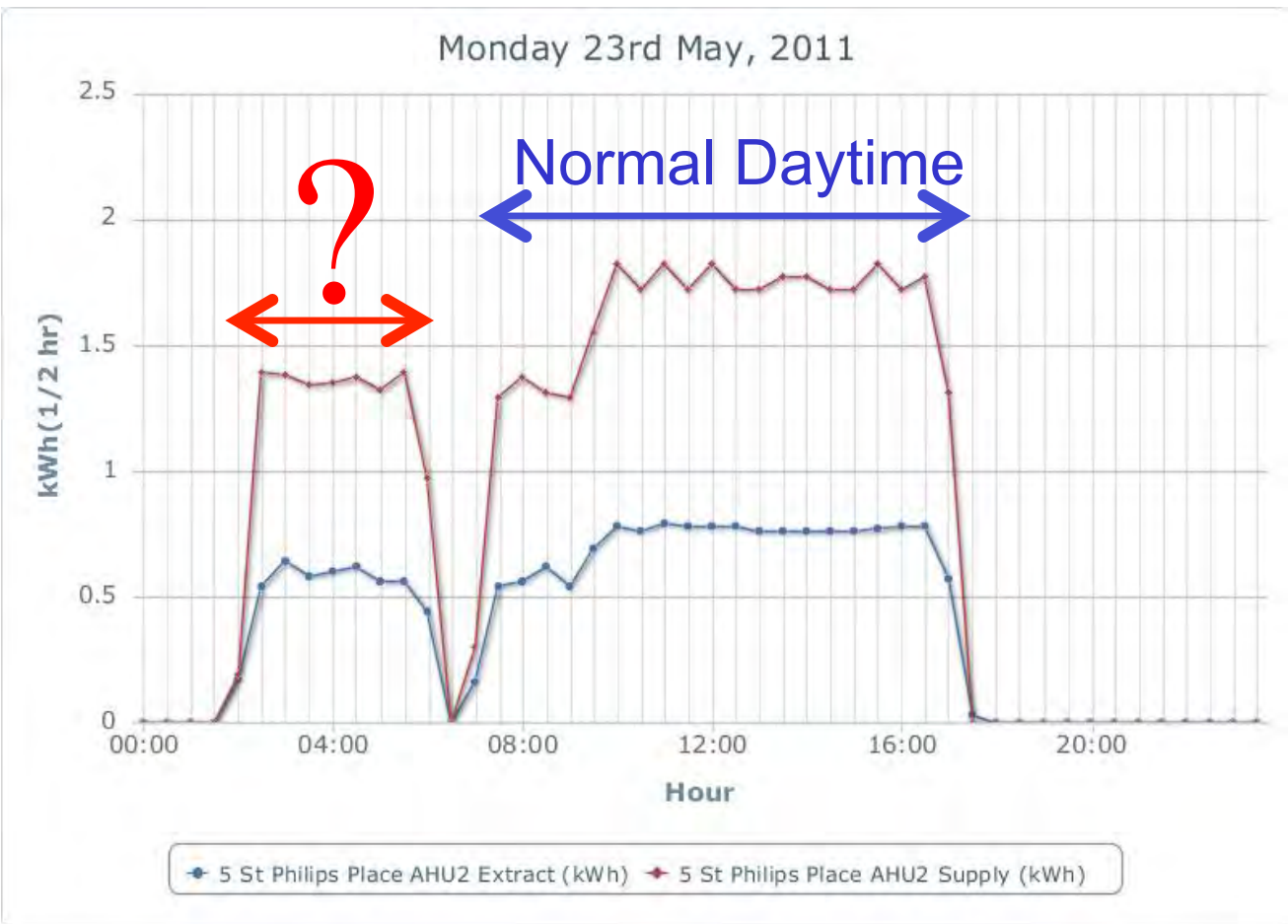
Metering points to re-commissioning: *energy use by air handling unit fans*



AHU 1 **BEFORE**
Extract fan set incorrectly
(max 2.5 kWh/ half hour)

AHU 1 **AFTER**
Extract fan setting corrected
(max 1 kWh/ half hour)

Metering exposes abnormal activity: *air handling unit operation at night*

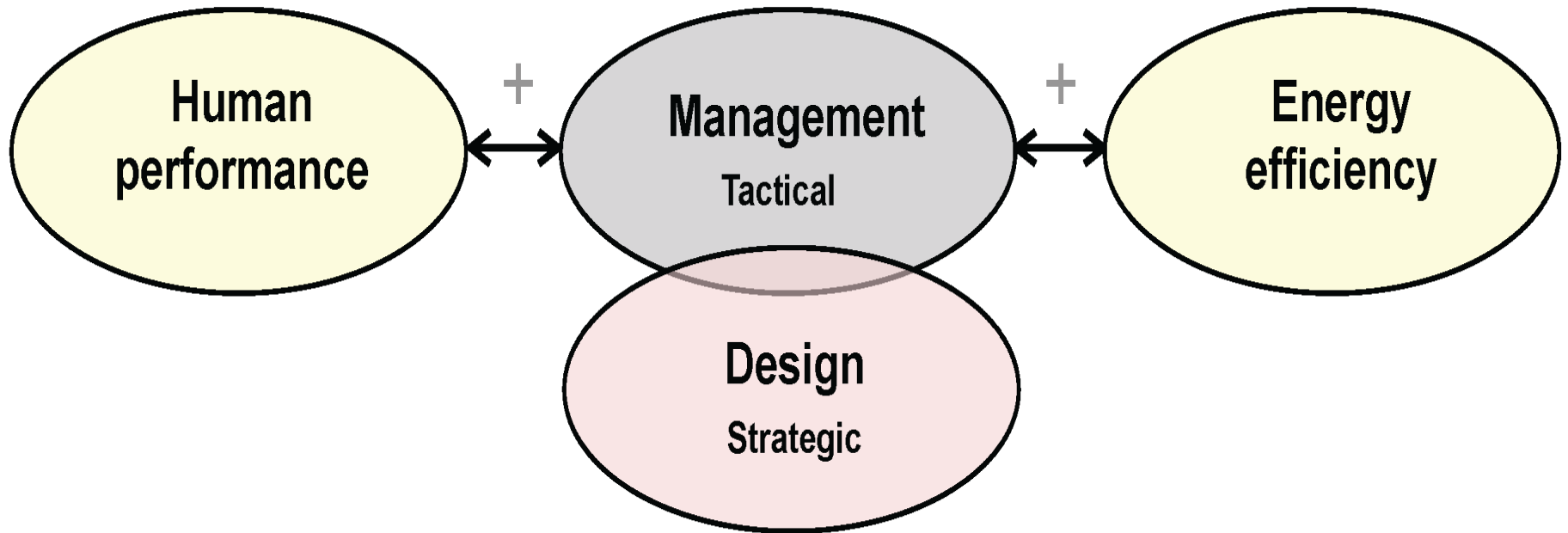


Don't procure what the occupier can't afford to manage



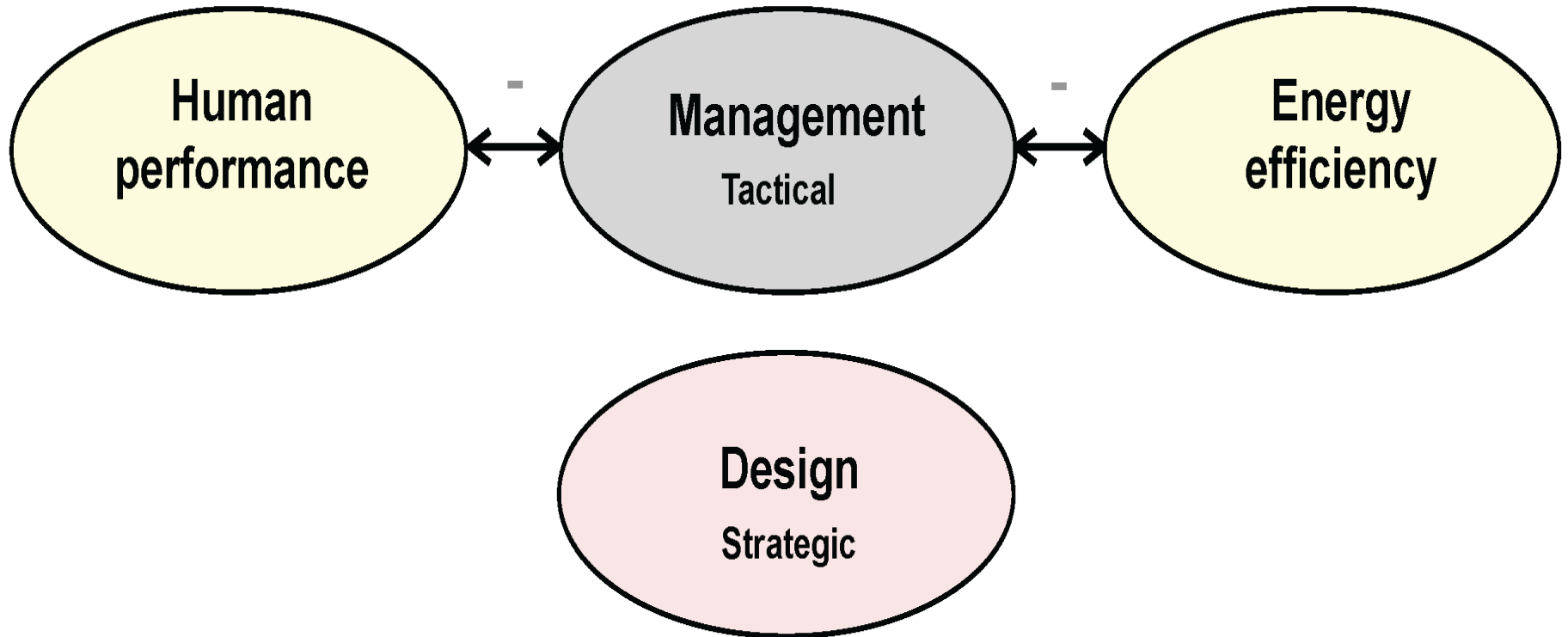
Design for manageability

... where good things happen



Design for manageability

... and where they don't



3

IMPROVING NEW CONSTRUCTION AND REFURBISHMENT

You can't tell if you have a good building
... unless you find out how it is working

Elizabeth Fry building has the last laugh

The story of the Elizabeth Fry building (AJ 23.4.98) contains a number of ironies. My favourite is that it didn't even make the shortlist of the Green Building of the Year Award in 1996.

DR ROBERT LOWE

Leeds Metropolitan University

When natural ventilation was all the rage, a novel form of mechanical ventilation was quietly slipping into Britain: the Swedish Termodeck system. One of the first buildings to use Termodeck and other Swedish detailing was an academic facility at the University of East Anglia. How has it fared?

BY THE PROBE TEAM

PROBE

14: Elizabeth Fry Building



14 ELIZABETH FRY BUILDING

LETTER TO ARCHITECTS' JOURNAL

The good performers don't necessarily impress the judges

Fabric First:
*Efficient services need
to be able to rely on it.*



Air pressure test of the Maths Building Cambridge as part of a Probe POE

Gentle engineering *Not over-engineering*

“Evening out fluctuations has become an egalitarian enterprise which it is heresy to question.”

MICHAEL YOUNG, *The Metronomic Society* (1988).

“There is something inelegant in the mass of energy-consuming machinery needed at present to maintain constant RH ... something inappropriate in an expense which is beyond most of the world's museums.”

GARRY THOMSON, *The Museum Environment* (1978).

“What we’ve got used to, we’re not entitled to” ... R BUNN (2008)

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

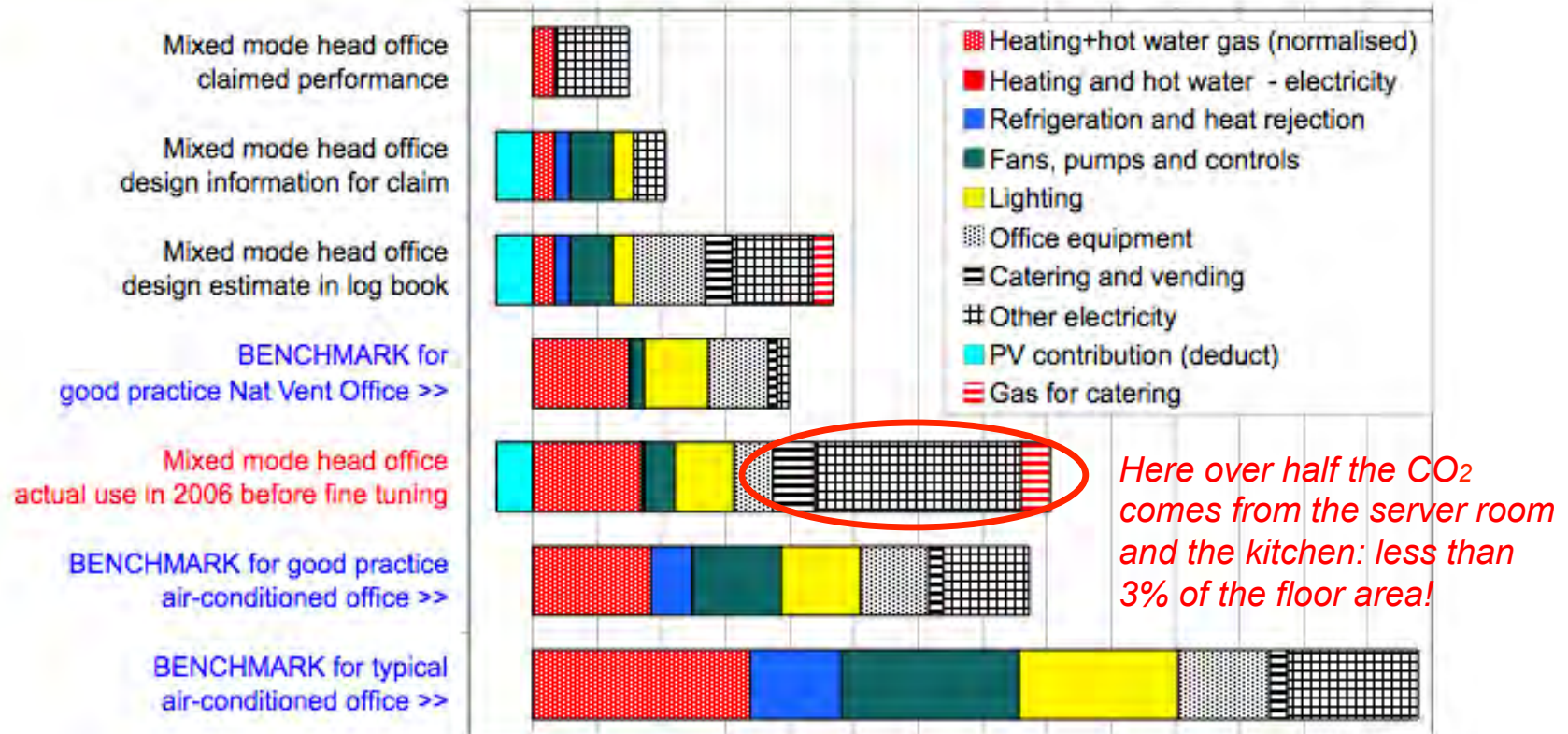
“We sell dreams and install nightmares” ...BMS SUPPLIER

Watch out for the “unregulated” loads: Designers can influence them by better client dialogue

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
-10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140



Don't add "green bling" *unless you've got the fundamentals right*

Prevention is
better than cure



It's the process, not just the product

Factors for success at the Elizabeth Fry Building, UEA

- A good client.
- A good brief.
- A good team *(worked together before on the site).*
- Specialist support *(e.g. on insulation and airtightness).*
- A good, robust design, efficiently serviced *(mostly).*
- Enough time and money *(but to a normal budget).*
- An appropriate specification *(and not too clever).*
- An interested contractor *(with a traditional contract).*
- Well-built *(attention to detail, but still room for improvement).*
- Well controlled *(but only eventually, after monitoring and refit).*
- Post-handover support *(triggered by independent monitoring).*
- Management vigilance *(easier now, but must be sustained).*

But only its technical features were mentioned when a Royal Commission used it an exemplar

4

**TOWARDS A NEW
PROFESSIONALISM**
with help from Soft Landings

Changing the way we do things: *A new professionalism?*

- Construction-related institutions require their members to understand and practice sustainable development.
- How can members do this unless they understand the consequences of their actions?

SO WE NEED TO:

- Re-define perceptions of the building professional's role, to engage properly with outcomes.
 - Get to places that markets cannot reach.
 - Close the feedback loop – rapidly.
 - Make much more immediate and effective links between research, practice and policymaking.
 - Make follow-through, feedback and POE routine.
-

Soft Landings:

Helping to enable the new professionalism

1. **Inception and Briefing**
*Appropriate processes, better relationships.
Assigned responsibilities, including client.
Well-informed targets related to outcomes.*
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.*

Runs alongside any construction process

Downloadable free

from www.usablebuildings.co.uk

and www.softlandings.org.uk

BSRIA is hosting a UK industry group

Launched in Australia and NZ in Nov 2010



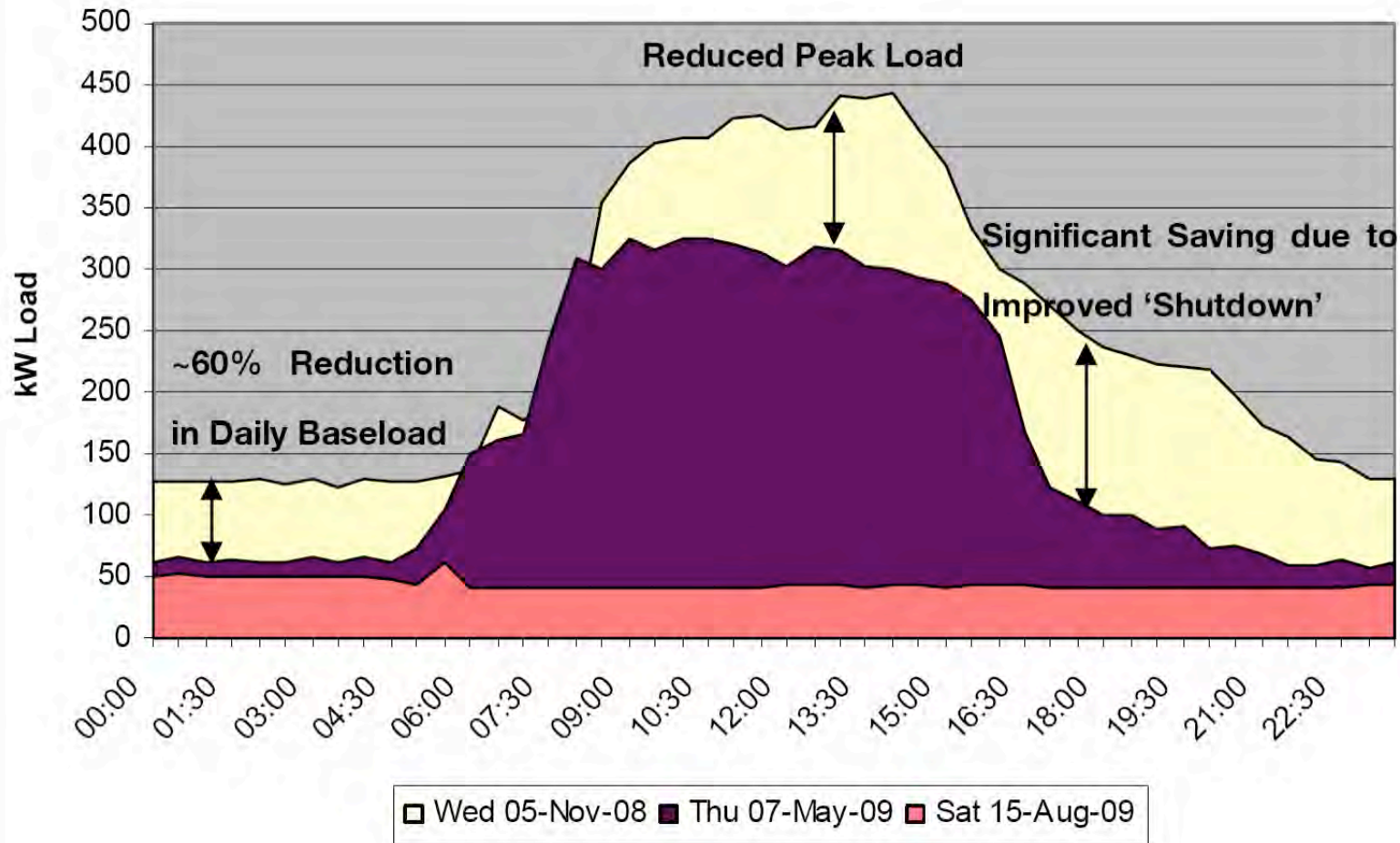
the **SOFT LANDINGS FRAMEWORK**

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



Follow-through can pay for itself

Intervention in a recently-completed school



*Saving over £ 40,000 p.a. in electricity bills: **avoid default to ON** ... and occupant satisfaction improves too!*

Soft Landings: *Everybody can win*

- Better communication, proper expectations management, *fewer nasty surprises*.
- More effective building readiness. *Less rework*.
- Natural route for feedback and Post-occupancy evaluation, *to improve the product, occupant satisfaction, and performance in use*.
- Teams can develop reputations for customer service and performance delivery, *building relationships, retaining customers, commercial advantage*.
- Vital if we are to progress towards more sustainable, low-energy, low-carbon, well-liked buildings and refurbishments, *closing the credibility gaps*.

SO WHAT IS STOPPING US?

- **ATTITUDES:** *Everybody needs to be committed, starting with the client - perhaps the biggest obstacle. The “golden thread” needs to be put in place.*
 - **PROCESSES:** *There is a learning curve to pay for (probably best from marketing budgets), and the feedback has to be managed.*
 - **TECHNIQUES:** *Independent POE surveys cost money (but not much).*
 - **CAPACITY:** *We need facilitators, investigators, troubleshooters and fixers.*
 - **MONEY:** *Particularly allocation for tune-up etc. after practical completion.*
 - **IMAGINATION:** *Often constrained by burgeoning bureaucracy!*
-

New professionals

follow design intent through into reality

- They understand what is needed *strategic briefing*
- Are clear what they want, and communicate it plainly *strategic design*
- Are ambitious, but realistic *question all assumptions, understand users*
- Follow things right through *e.g. using **Soft Landings** procedures*
- Review what they do *manage expectations, undertake reality checks*
- Make others aware of what they are after *specify: what, why and how*
- Check that things will work *technical feasibility, usability and manageability*
- Get things done well, with attention to detail *communicate, train, inspect*
- Finish them off *commission, operational readiness, handover, dialogue*
- Help the users to understand and take ownership *provide aftercare support*
- Review performance in use *including **post-occupancy evaluation***
- Work with occupiers to make things better *monitoring, review and fine tuning*
- Anticipate and spot unintended consequences *revenge effects*
- Learn from it all *and share their experiences*

***TRY TO MAKE THINGS SIMPLER AND DO THEM BETTER ...
only making them complicated where this is essential.***

And what can you do - tomorrow?



SOFT LANDINGS FOR SCHOOLS
Case Studies

Feedback from use of the Soft Landings Framework in new schools

Edited by Mike Buckley, Bill Bordass and Roderic Bunn

BSRIA BG 9/2010

Research funded by
Technology Strategy Board

SOFT LANDINGS

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