Design for Performance: a scheme to guarantee new build energy performance

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UK CAP Feasibility Study and Pilots

Aims and objectives:

- Demonstrate energy efficient operation can be achieved in new buildings
- Ensure new stock does not ‘add to existing problem’
- Identify exemplar pathways for improving existing stock.
Executive Board (funders)
- BBP British Land
- EDSL Laing O’Rourke
- L&G Stanhope
- TH Real Estate NG Bailey
- Impax, DECC (observers)

Other supporters
- BCO
- BPF
- DECC
- UK-GBC
- CIBSE (tentative)

UK core team
- Verco Arup
- BSRIA UBT

BBP support
- BBP staff
- Main membership
- Managing Agents Partnership

Australian support
- Energy Action (expertise)
- OEH (government officials)
Project to introduce Commitment Agreements to UK

Feasibility study October 2015 – March 2016
- Review and comparison of the situation in the UK and in Australia
- Major industry workshop 1st December 2015
- Report on the potential technical, legal and financial issues
- Draft specification for a UK CAP
- Options for establishing a UK CAP scheme if pilots are successful

Pilot projects April 2016 – September 2017
- Apply CAP at various points in procurement and operational journey
- Finalise draft UK CAP
- Stakeholder engagement and dissemination continues throughout
- Two more industry workshops
What is guaranteed?

Initial focus is on large, new office buildings (> 2,000 m²)

And their base building performance as defined by NABERS in Australia
What is Base Building energy performance?

Base building and tenancy ratings

Whole building rating - same scope as a DEC

Energy end uses divided between base building and tenant rating

Tenants lighting, small power, ICT, etc.

All in common parts
Lifts
Hot water, kitchens
Whole building HVAC

Tenant D Energy
Tenant C Energy
Tenant B Energy
Tenant A Energy

Base building (actual occupancy)

All energy use for the building
Base Building performance is the objective of the EPBD

ANNEX I

Common general framework for the calculation of energy performance of buildings
(referred to in Article 3)

1. The energy performance of a building shall be determined on the basis of the calculated or actual annual energy that is consumed in order to meet the different needs associated with its typical use and shall reflect the heating energy needs and cooling energy needs (energy needed to avoid overheating) to maintain the envisaged temperature conditions of the building, and domestic hot water needs.

Annex 1 allows Member States to take Australian approach of measuring base building performance to get the EPC for the sale or let of an existing building (and to calculate the same for a new building)....

....but none have chosen to do this
Design for Compliance generates the performance gap

- Base Building energy use
- Lighting
- Tenant energy use

Performance gap for regulated loads

- BER: Regulated loads - as reported
- A. Model simplifications
- B. As-built imperfections
- C. Non-standard hours & activities
- D. Imperfect management/control
- E. Unregulated loads not in model

Total emissions (kg CO2/m2/year)
Energy certificates (EPCs) calculate the Base Building performance relative to a reference building, not as an absolute value.

The proposition of the Design for Performance project is to calculate the Base Building performance of a design and then build, commission and operate the building with measured performance (when the building is occupied) in line with design intent.
Why is base building performance in use so pivotal?

A. Typically, Base Building emissions may be around half whole building total.

B. In principle it is under control and influence of developer and landlord via their designers, contractors and management agents: Base Building performance is determined by building design, construction, heating and cooling services, controls, commissioning, management in use. But sometimes landlord/tenant responsibilities are blurred.

C. Differentiates buildings for investors and tenants seeking energy efficient premises.

D. Represents portion of whole building energy use targeted by regulations, and thereby creates risk for asset owners if regulators seek to address performance gaps through a policy of disclosure of actual energy use eg Voluntary Certification Standard (VCS).

E. Opens up UK stock to international comparisons which indicate huge potential for Base Building energy reductions: UK prime office base buildings may be using 2-5 times more energy than their best counterparts on like-for-like basis.
The current building energy certificate regime is broken:
- EPCs lack credibility and do not correlate with performance outcomes

UK/EU have a misplaced perspective they lead world on energy performance

EPBD requires new buildings to be ‘nearly zero energy’ (NZE) by 2020:
- Probably only the energy for heating, ventilation and cooling (HVAC) for a comfortable working environment, together with domestic hot water (EPBD Annex 1)
- Zero carbon buildings ambition abandoned, but in any case was a mirage:
  - Only in theory; assumed standard conditions; relied on ‘Allowable Solutions’
  - NZE can be fulfilled by theoretical calculations at the design stage of new buildings, not actual performance in use. We think most stakeholders would disagree.
  - How close to zero is ‘nearly’? 6 stars on the NABERS scale is credible contender

Australia successfully deploys a measured performance solution. Why not here?
NABERS

National Australian Built Environment Rating System
The NABERS star rating scale (half stars also available)

6 stars........ Market leading performance
5 stars........ Excellent performance
4 stars........ Good performance
3 stars........ Average performance
2 stars........ Below average performance
1 star.......... Poor performance
What do NABERS stars imply about Base building energy use?

kWhE is the “electricity equivalent” of total energy use: kWh of electricity are added to kWh of any fuel multiplied by 0.4 and kWh of hot or chilled water multiplied by 0.5. The ratio between electricity and gas is consistent with the UK Climate Change Levy’s new rates.

6 stars is half-way from 5 stars to net zero NB Not a theoretical zero carbon mirage with allowable solutions.
How does the UK compare?
Base building energy is 2 to 4 times higher in London than Melbourne

Annual energy use (kWhe/m\(^2\)NLA)

- **London, UK**: 80-160 kWhe/m\(^2\)
- **Melbourne**: 40-70 kWhe/m\(^2\)

LER case studies
1960s office refurb

LER data average

- **4X more energy**
- **2X more energy**

Best in Melbourne
Commitment Agreements in Australia: how they have fared

30% achieved, 40% pending, 25% overdue, 5% failed

Achieved: 18
Pending: 33
Overdue: 9
Not achieved: 2
Terminated: 5

Achieved: 24
Pending: 24
Overdue: 23
Not achieved: 2
Terminated: 5
Closing the gap

How Commitment Agreements can be UK’s truly NZE solution
Commitment Agreements map onto Soft Landings Framework

**Commitment to base-building operational energy performance target in kWh/m² NLA**

**Stage 1: Inception and briefing**
- Clarify operational outcomes in the Client’s Requirements
- Monitor, review, fine-tune, and perform periodic feedback studies
- Confirm energy rating achieved, confirm IEO. Use experience to inform next design

**Soft Landings Stage 5: Extended aftercare & POE**
- Support occupants in first few weeks of occupation, be resident on site to react to emerging issues
- Monitor and report energy use of each sub-meter against budgets, fine tune to resolve differences

**Soft Landings Stage 4: Initial aftercare**

**Soft Landings Stage 3: Pre-handover**
- Prepare more thoroughly for occupation: train FM staff, demonstrate control systems
- Check sub-metering matches strategy. Set hourly and daily operational energy budgets for meters

**Soft Landings Stage 2: Design, construct**
- Review past experience, agree performance metrics, agree design targets, initiate “reality-checking”
- Advanced dynamic modelling of base building and HVAC plant; agree sub-metering strategy

**KEY**
- Soft Landings stages
- Commitment Agreement activities
Implementing Commitment Agreements

1. An initial workshop to explain the performance requirements and potential risks to the design and building team

2. Including the performance target process in contractual documentation between the developer and the lead contractor

3. Computer simulation to predict base building energy performance in-use

4. Independent energy efficiency design review by a member of a prequalified panel of reviewers with experience in both design and post-construction operation of buildings

5. Use of the soft landings process

6. A monitoring and verification process (informed by the simulation results) from building occupancy through to achievement of the target

7. Third party review and validation of the achievement of the final target

8. A requirement to advise affected parties (tenants, investors) of the achievement or otherwise of proposed target within 18 months of building reaching 75% occupancy.
We must start by predicting things we can measure!

| Calculations predict absolute values so can be compared with meter data |
|---|---|---|---|
| **Base Building** (standard occupancy) | **Base Building** (expected occupancy) | **Base Building** (expected occupancy) | **Base Building** (actual occupancy) |
| **Part L** – different scope, focus on BER vs TER | **TM54** – focus on managing expectations | **Advanced simulation to indicate absolute performance** | **Measured performance in use before tuning** |
| | | | **Measured performance in use after tuning** |

Calculations predict absolute values so can be compared with meter data.
Sub-meter strategy (initially) is to measure and verify predictions.

- **Regulated loads (expected occupancy)**
  - Advanced simulation to indicate absolute performance
  - Predicted energy end use breakdown
  - Measured performance in use

- Feedback to calibrate and validate model

  - Other
  - Lifts
  - Lighting in common parts
  - Hot water
  - Cooling
  - Fans
  - Heating
  - Other
  - M9
  - M8
  - M6+M7
  - M5
  - M3+M4
  - M2
  - M1
Fine tuning after handover to achieve target performance

• Produce monthly monitoring reports comparing submetered performance to simulated predictions

• Undertake at least 4 tuning exercises during Defects Liability Period, each including a detailed review of BMS operation

• Continue commissioning activity to identify and rectify operational inefficiencies

• Set contractual retentions on the builder and mechanical contractor based on Base Building performance (i.e. performance failure is treated as a defect)

• End-of-period formal assessment of Base Building rating prior to contractual release.
Can UK copy the success factors behind NABERS?

- In Australia, utility metering generally follows the base building / tenant split.
- In 2002, Commitment Agreements conceived to ensure new offices operate at target energy efficiency level and pre-let occupiers get promised performance.
- From 2004, Federal and State government tenants demanded 4.5 stars or better for the base buildings they rented.
- Some large corporates followed suit.
- In 2006, the Property Council of Australia set the definition of Prime or grade A office to include being at least 4.5 stars (and 5 stars in 2012 for new build).
- In 2010, the government mandated disclosure of base building ratings on sale or let of office premises over 2,000 m².
- Investment-grade (yet consumerised) star rating has total market credibility.
- Norm in Australia is for landlord to “own” base building performance. Single party control over HVAC for whole building has been pivotal.

The prize is huge but there’s a lot to catch up with.
• Closing performance gap is technically feasible with Commitment Agreements (tenant activities have marginal influence on base building ratings, which take occupancy hours into account)

• Financial feasibility depends on energy performance in-use being valued by stakeholders eg reflected in rentals, voids, retentions and therefore asset values

• Value should be reflected through an easy to understand (consumerised) ‘brand’

• To enable base building energy performance to be recognised in valuations, it must be visible: defined, measured and rated

• In absence of established rating scheme in UK, value brand can be communicated by ‘Designed for Performance’ with target performance set by advanced simulation and verified by measured performance in use (Australian experience shows simulation can predict performance outcomes)
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