Learning from Australia: how better modelling can help close the performance gap

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Advanced Building Systems Modelling
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By following the process in a NABERS Commitment Agreement, Australian teams can now routinely achieve in-use operational energy performance ratings in line with the predictions of design stage models.
Delineating a suitable metric for building energy efficiency

Energy scope for Base building rating
- Energy for Tenant D rating
- Energy for Tenant C rating
- Energy for Tenant B rating
- Energy for Tenant A rating

All energy use for the building

Tenants lighting, small power, ICT, etc.
- All in common parts
  - Lifts
  - Hot water
  - Whole building HVAC

By delineating, measuring, rating and disclosing base building operational energy performance, the base building rating expressed as NABERS stars has become a KPI for all stakeholders, FM to FD
What has been achieved in Australia (new office buildings)

- 2.5 stars Melbourne Average 2002
- 4.5 stars Melbourne Minimum 2018
- 5 stars Melbourne Average 2018
- 6 stars Melbourne Best 2018
How does new build in the UK compare with Australia?

- **London Average 2012**
- **2.5 stars Melbourne Average 2002**
- **4.5 stars Melbourne Minimum 2018**
- **5 stars Melbourne Average 2018**
- **6 stars Melbourne Best 2018**

**Base building star rating**

**Annual energy use (kWhe/m²NLA)**
DfP pilot study: measured annual performance vs modelled target and industry benchmarks

Base building annual energy use (kWhe/m² NLA)

- **Targets**
  - TYP: -1.3 stars
  - GP: 2.2 stars
  - 5ES: 2.5 stars
  - Target: 5 stars

- **Energy Use Breakdown**
  - Gas (catering)
  - Gas for heating + hot water or District heating
  - District cooling
  - Refrigeration and heat rejection
  - Fans, pumps and controls
  - Humidification - if fitted (in Other elec for 5ES)
  - Catering and vending
  - Other electricity
Factors behind change
What has been transformational in Australia 1 of 2: Market asks for and values performance

- Occupiers demand higher ratings
- Investor decisions influenced by rating
- Developer competes to offer higher ratings
- Supply chain prioritises higher ratings
- Leasing agent recognise ratings in valuations and rent

Virtuous circle when Better rating equated to Better building
What has been transformational in Australia 2 of 2: Commitment Agreements and Design for Performance

- Set target for measured base building rating
- Integrate target into requirements for supply chain
- Advanced simulation model to predict base building performance
- Independent Design Review to check target will be achieved
- Intensive fine-tuning and monitoring against model targets
- Verify & disclose rating; lessons learnt by supply chain
Delineation enables unfettered agency for whole supply chain to pursue achievable outcome.

Transparency through measurement and disclosure - entrains all stakeholders into endeavour.

Accountability
Owner commits to target
Landlord takes control of operational levers to deliver target
Occupiers obtain the quality of building they asked for.
Advanced Building Systems Modelling: Learning from Australia
Simulation helps check at every stage that the project is delivering the designed energy performance.

Feedback so designers can learn from outcomes.

1. Simulate to improve design and confirm performance targets.
2. Tune controls in early operation to match simulation and revised DesOps.
3. Build and commission to match design.
5. Write draft DesOps.
6. Compare actual energy with targets.
7. Diagnose control improvements.
9. Feedback so designers can learn from outcomes.
Confirm the performance target is achievable

Test ability of design to perform efficiently under non-standard conditions
To improve performance, we must target performance

>>>>> weather
>>>>> hours of use and occupant/equipment densities in each tenancy
>>>>> voids
>>>>> all of the above

Strengthen resilience of design to whatever actual operational parameters might occur

Test benefits of “advanced” control strategies and select
Empower designers to specify more optimum plant capacity

Just because we don’t know about future operation, doesn’t mean we shouldn’t explore

Off-axis scenario analysis producing load duration curves can create greater confidence to reduce plant capacity contingencies

Importance of avoiding wasteful over-capacity is doubly important in a net zero, resource constrained world
Defending design intent during RIBA stages 5 - 6

Resisting VE which undermines performance
e.g. Proving the value of more sophisticated controls

Oversight of tenant fit-out proposals
Understanding commissioning, tuning-up and M&V activities

Model creates collateral which identifies to all parties what should happen which can then be verified by detailed measurements

O&M teams can tune the actual building (BMS) to the simulation

M&V teams have monthly targets (budgets) for each sub-meter, can track progress towards achieving rating and identify remedial measures where necessary

Performance feedback to original designers will improve their next design

To improve performance, we must measure performance