Active analytics for better building performance

Jesse Steinfeld & Marc Gillespie
Melbourne Forum
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What’s wrong with this chart?

GtCO₂-eq/yr

Energy supply  Transport  Buildings  Industry  Agriculture  Forestry  Waste

Non-OECD/EIT  EIT  OECD  World total

US$/tCO₂-eq

IPCC 2007
“…the potential reduction through non-technological options is rarely assessed and the potential leverage of policies over these is poorly understood. Due to the limited number of demand-side end-use efficiency options considered by the studies, the omission of non-technological options and the often significant co-benefits, … the real potential is likely to be higher (high agreement, limited evidence).”

(Levine et al. 2007:389)
“In addition to technologies and architecture, behaviour, lifestyle, and culture have a major effect on buildings’ energy use, presently causing 3–5 times differences in energy use for similar levels of energy services (limited evidence, high agreement).”

(Lucon, et al., 2014, p. 5)
Quantifying the benefit of the ‘people factor’

<table>
<thead>
<tr>
<th>Measure</th>
<th>NABERS Energy Impact</th>
<th>Measure Summary</th>
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</thead>
<tbody>
<tr>
<td>Economy Cycle</td>
<td>0.6 stars</td>
<td>Buildings with Economy cycles outperform those without</td>
</tr>
<tr>
<td>Building technology</td>
<td>1.4 stars</td>
<td>Buildings with current good practice facade and services technology perform better</td>
</tr>
<tr>
<td>Management</td>
<td>1.3 stars</td>
<td>Buildings where management is at least partially in-sourced perform better</td>
</tr>
<tr>
<td></td>
<td>0.9 stars</td>
<td>Buildings where building, asset and portfolio manager all feel able to affect efficiency perform better</td>
</tr>
<tr>
<td>Weak</td>
<td></td>
<td>Buildings perform better when there is support for efficiency from building owners</td>
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<tr>
<td>Weak</td>
<td></td>
<td>Buildings perform better when energy efficiency savings can be retained in the building budget</td>
</tr>
<tr>
<td>Disclosure</td>
<td>0.5 stars</td>
<td>Buildings that disclose their NABERS performance to tenants perform better</td>
</tr>
<tr>
<td>Incentives and Penalties</td>
<td>0.4 stars</td>
<td>Buildings that provide efficiency penalties/incentives to maintenance contractors perform better</td>
</tr>
<tr>
<td>Training and skills</td>
<td>0.5 stars</td>
<td>Buildings where there is an efficiency training program perform better</td>
</tr>
<tr>
<td></td>
<td>1.3 stars</td>
<td>Buildings where the manager reports a higher level of energy efficiency knowledge perform better</td>
</tr>
<tr>
<td>Weak</td>
<td></td>
<td>Buildings where the building manager is conservative with respect to new technologies perform poorer</td>
</tr>
<tr>
<td>Incremental Improvement</td>
<td>0.6 stars</td>
<td>Buildings where incremental investments have been made in efficiency perform better than those where no such investment has occurred.</td>
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Rapid Efficiency Feedback (REF)

Building operators experiment and learn through cause and effect

Performance measured, analysed, evaluated and communicated

Stakeholders demand and appreciate enhanced performance

Operators identify and respond to opportunities

Controls, metering and monitoring tools are better utilised

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Steady-state assessment of performance

Actual electricity consumption versus Buildings Alive’s model for a typical building

- Measured Consumption
- Predicted Consumption

Daily Electricity Consumption (kWh)
Subject: 1 Sample Street's electricity: good day yesterday

Great news, yesterday 1 Sample St used 26.6% less energy than expected. Nearby buildings used 11.0% less energy than expected. Over the past 30 days 1 Sample St has used 14.0% less energy than expected.

NMI Data for Thursday 03 October 2013, its Closest Like Weather Day (Monday 26 August 2013) and REF’s expected profile

Electricity consumption details from 04:45 to 18:00:

- Friday 04 October 2013: 1,613.10 kWh
- REF’s expectation: 2,197.55 kWh
- Like weather day (Monday 26 August 2013): 1,730.19 kWh
Results across a portfolio of ~2 million m²
Novion Property Group: We’re Bigger Than You Think

- Novion Property Group is the 2nd largest listed retail real estate platform in Australia
- Novion Property Group is a Top 50 company on the ASX

<table>
<thead>
<tr>
<th>$14.9b AUM¹</th>
<th>38 retail assets</th>
<th>800+ people</th>
</tr>
</thead>
<tbody>
<tr>
<td>250m+ customers</td>
<td>5,100+ retailers</td>
<td>$9.6b retail sales</td>
</tr>
</tbody>
</table>

Number 1 sales across Australia
Chadstone Shopping Centre, VIC
Novion Property Group: Portfolio

- Midland Gate Rockingham
- Castle Plaza Elizabeth The Myer Centre Adelaide
- Eastlands Northgate
- Clifford Gardens Grand Plaza Mount Pleasant Queens Plaza Runaway Bay The Myer Centre Brisbane
- Bathurst City Centre Chatswood Chase Sydney DFO Homebush Lake Haven Riverside Plaza Salamander Bay
- Hyperdome
- Altona Gate Bayside Brimbank Broadmeadows Chadstone Corio DFO Essendon DFO Moorabbin
- DFO South Wharf Emporium Melbourne Forest Hill Chase Gateway Plaza Keilor Mildura Central Northland Roxburgh Park
Novion Property Group: Operational performance strategy

- Benchmarking performance
  - NABERS
  - GreenStar

- Asset efficiency
  - Sub-metering
  - SLDs

- Management systems
  - EMS
  - Bill validation
  - Reporting

- Research and development
  - Trials
  - New technology

Operational Performance Strategy
- Energy
- Water
- Waste
- Active building mgmt
- Development and design
Enabling effective building management and optimisation

Asset efficiency program (AEP)

1) Develop single line diagrams (SLDs) of electricity and water reticulation

2) Metering strategies - Install sub meters for energy, water, on large impact equipment such as chillers, cooling towers etc.
Operational adjustments and ongoing tuning include:

- **Zone setpoints**: progressive temperature setpoint and dead-band adjustments to find the optimal balance between comfort and air conditioning efficiency.

- **Lighting setpoints**: carpark lighting setpoints based on PE cells were lowered to reduce unnecessary lighting during the day.

- **Economy cycle**: outside lockout was raised from 17-18°C to 20°C to make better use of outside air ‘free cooling’ and then ‘enthalpy comparison’ economy cycle was added.

- **Night auditing**: auditing found several incorrect schedules and timeclocks resulting in increased consumption.

Model shows a significant reduction in electricity consumption since September 2013.
Case Study: Keilor Shopping Centre – water

Water Data for Yesterday (Monday 24 November 2014), the preceding Monday (17 November 2014) and an average of the Mondays in the month prior

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[Graph showing water consumption over time, with different lines indicating Yesterday, Average of Mondays in the month prior, and Previous Monday.]
Operational adjustments and ongoing tuning include:

- **Identifying faulty time schedules:** significant ‘poor’ performance was observed and rectified using daily feedback to isolate two AC units.

- **Economy cycle:** where possible outside lockout was raised 18C to 21C to make better use of outside air ‘free cooling’.

- **Zone setpoints:** progressive temperature setpoint and dead-band adjustments to find the optimal balance between comfort and air conditioning efficiency.

- **Carpark fan control:** adjustments to fan operation were achieved with the implementation of CO sensors and the manual adjustment to exhaust air fan speeds.

- **BMS upgrades:** progressive BMS upgrade to increase the usability of the building’s BMS.
Case Study: Brimbank Shopping Centre – water
Moving towards an energy - water - comfort nexus?

Dynamic Benchmarking

Peak demand forecasting

Submeter analytics

Energy - water analytics

Target setting