BUILDING TUNING CASE STUDIES
TOWER 3 COLLINS SQUARE
AND
COUNCIL HOUSE 2

Building Tuning for Fun and Profit
National Target: Carbon neutral built environment by 2050

How can you achieve this?

- Improved building energy efficiency
  - Plant upgrades (including life-cycle renewals)
  - Lighting upgrades
  - Façade upgrades
  - **Tuning – usually the lowest cost improvement**
- On-site generation
- GreenPower
- Carbon offsets

Energy efficiency reduces the need for fallback options
GreenPower and carbon offsets the final step: i.e. no payback
Council House 2
- Constructed in 2005
- 7,000 m² NLA, 11 storey, Little Collins St Melbourne

Technology
- Chilled beams, underfloor outside air system, high thermal mass wave ceiling
- Western shading screens, automated windows
- Small PV system and solar DHW
- Wind turbines, shower towers, PCM storage (things that didn’t work)
- Everything is interconnected…

- Flagship green building, intended on being experimental and trialing new ideas, leading the way –
- ≈20 awards for sustainable design between 2005 and 2010, first 6 star Greenstar building
- CoM has been very open in talking about what’s worked and what hasn’t, in the spirit of industry learning and leadership
Tower 3 Collins Square

- A Grade office constructed 2012
- First of 5 towers at Collins Square
- 38,000 m² NLA
- 5.0 star Greenstar and 5.5 star NABERS
- Single tenant

Technology

- Pressure independent VAV system, trigeneration, high performance chillers, regenerative breaking lifts
- Designed to achieve 5.0 stars,
- first rating 2014 at 5.5
- Building tuning started at 5.68 stars

2018 CIBSE Building Performance Award for Best Energy Management Initiative.
2017 Energy Project of the Year (Oceania region)
2016 Solar Design and Installation Award - Grid-Connect 15 kW - 100 kW
2016 Premier’s Sustainability Award - Finalist
CH2 - What we did

Energy Action’s responsibilities included:
• Energy audit – completed 2013
• 2014 Independent delivery – project management/steering, scoping, specification, witness testing
• 2015 - 2017
• Undertaking operational reviews (quarterly)
• Developing a monitoring plan
• Setting subsystem targets (annual)
• Producing monthly monitoring reports
• Attending monthly monitoring meetings with site management
• Facilitating tuning with the site’s BMS contractor
CH2 - What we did

Electricity savings: 50% (tuning)
Gas savings: 23%
Emission savings: 42%
Cost savings: $56,000/annum

Cooling system performs at 6.0 star equivalent
Current NABERS energy performance (with further exclusion): 4.35 stars

Implemented recommendations:
- Shutdown of PCM charging
- Chiller staging
- AHU dewpoint control
- Zone temperature dead band
- Partial CHW, HHW rebalance
- TCW shut off valves and rebalance
- Economy cycle optimisation
- Lift motor room AC controls
- Base building PAC unit staging and deadbands
- Tenant server room PAC unit replacement
- TCW shut off
- Reinstate passive ventilation windows

Yet to be completed:
- Rectification of CO₂ sensors
- Operative temperature control
- Integrated cooling system operation
- Predictive optimum start, optimum stop
- Resize TCW pumping
- Lift shutdown and natural ventilation
- AHU system floor zoning
- General ventilation optimisation
- Reinstatement and upgrade of base building lighting control
- Lifecycle upgrade – chillers, boilers
Tower 3 - What we did

Energy Action’s responsibilities include:
• Undertaking a BMS operational review (annual)
• Developing a monitoring plan
• Setting subsystem targets (annual)
• Producing monthly monitoring reports
• Attending monthly monitoring meetings with site management
• Facilitating tuning with the site’s BMS contractor
Tower 3 - What we did

Electricity savings: 44% (tuning), 15% (solar PV)
Gas savings: 19%
Emissions savings: 34%
Cost savings: $65,000/annum
Current NABERS energy performance: 6.15 stars

Implemented recommendations:
- Air handler pressure reset controls
- Increased VAV dead band
- Heat recovery loop optimisation
- Economy cycle optimisation
- Maintenance items
- Lift motor room AC controls
- Minimum VAV air flow reduction (to 40%)

Yet to be completed:
- Minimum VAV air flow reduction (to 20%)
  (20% reduction in AHU energy month on month so far)
- Optimisation of supply air temperature controls
- Condenser water temperature controls
- Car park lighting controls tuning
- Lift controls tuning
- Discrete AHU control optimisation
Typical tuning processes:

- Modification of control strategies
- Reprogramming of controls to match the functional description
- Recommissioning of mechanical systems
- Rebalancing of hydraulic and air distribution
- Installation of new sensors, controllers and VSDs
PROS

Usually very good cost/benefit
May fall within regular BMCS maintenance budget
Significant potential for energy and comfort improvement
Can be incorporated with major plant upgrades to maximise savings (yet often overlooked)

CONS

A BMCS usually required
Some control hardware upgrades may be required
Older plant may not have same tuneability/savings
Tuning can be unsuccessful due to lack of management
Consultant Tasks:

• Setting energy baselines for subsystems
• Identifying tuning opportunities (annually)
• Clear prioritisation of tuning measures
• Facilitation of tuning
• Monthly monitoring and reporting

Energy Action was recently awarded a 2nd 3-year monitoring/tuning contract
Driving successful tuning:

- Engagement of a specialist consultant
- A strong working relationship between the consultant, FM, and BMS contractor
- Site staff with direct responsibility for energy/comfort
- Trust and open dialogue
- Ongoing monitoring and review of the building’s operation
- Regular contact between all parties
- Regular (i.e. quarterly) tuning sessions with all parties

The role of the FM is critical to tuning success.
If the consultant’s responsibilities end at the delivery of a report... DANGER!

<table>
<thead>
<tr>
<th>...What may happen:</th>
<th>Tuning result</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMS contractor doesn’t understand recommendation/ can’t convert to logic</td>
<td>Not implemented</td>
</tr>
<tr>
<td>BMS contractor disagrees with recommendation</td>
<td>Not implemented</td>
</tr>
<tr>
<td>BMS contractor misinterprets intent of recommendation</td>
<td>Incorrectly implemented</td>
</tr>
<tr>
<td>BMS contractor does not have enough time</td>
<td>Project outcomes delayed</td>
</tr>
</tbody>
</table>

NOTE:

- No one party is to blame: the consultant and BMS contractor have different skills and experience
- Most failures are due to communication breakdown
- The FM can manage the process to avoid these issues
## The Role of Management

<table>
<thead>
<tr>
<th>Measure</th>
<th>NABERS Energy Impact</th>
<th>Measure Summary</th>
</tr>
</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>
</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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</tbody>
</table>