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

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

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Case Study - CH2 Building, Little Collins St, Melbourne

Council House 2

- Constructed in 2005
- 7,000 m^2 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**

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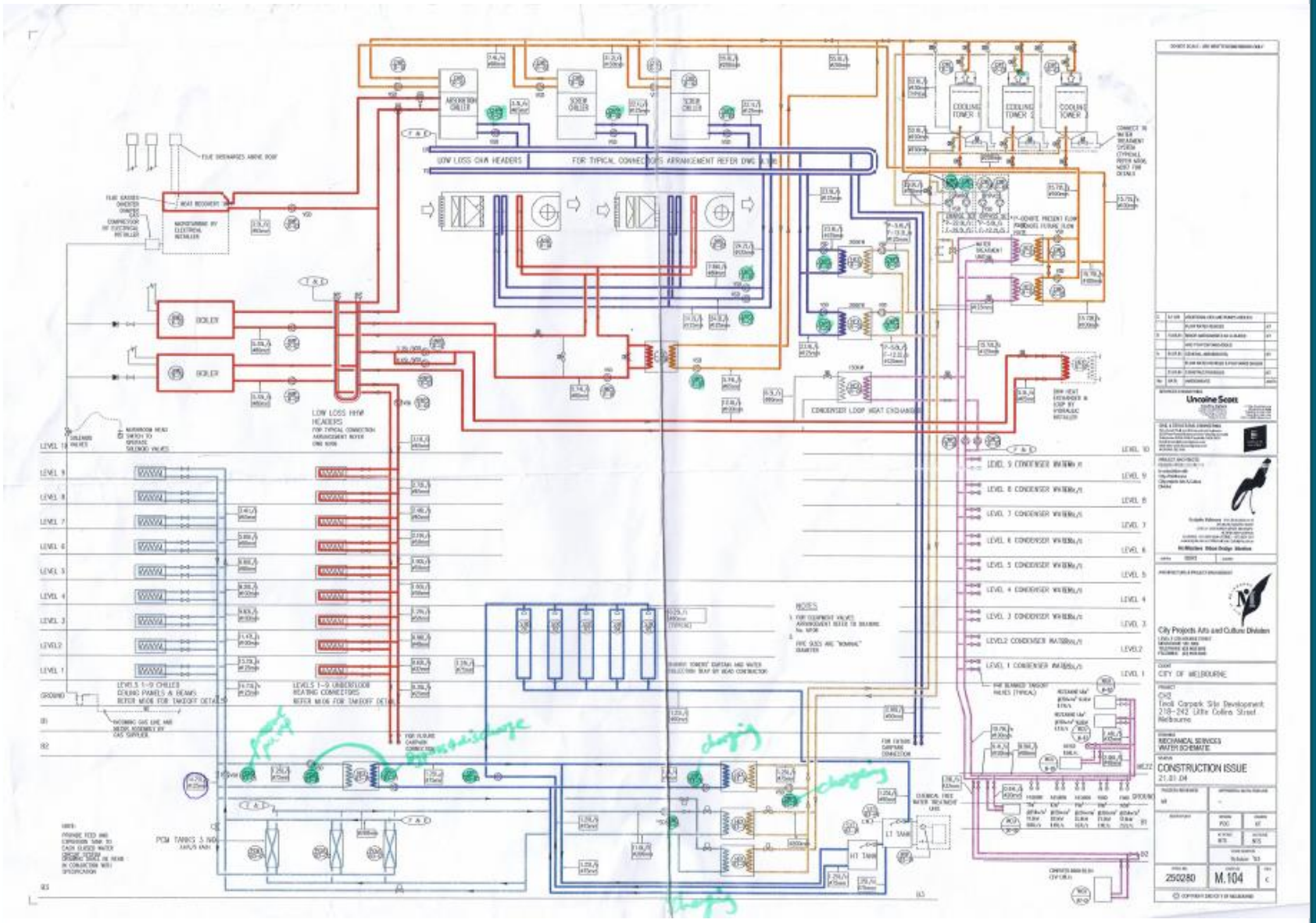
Case Study - CH2 Building, Little Collins St, Melbourne



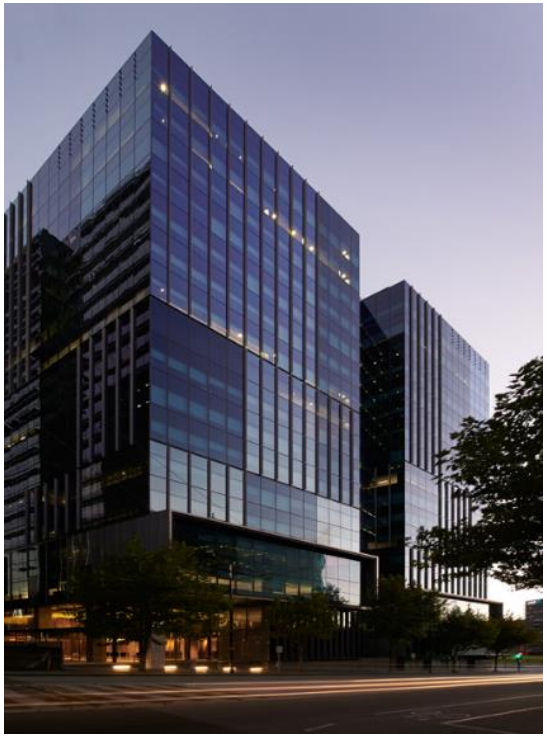
Tower 3, Collins Square, Docklands

Tower 3 Collins Square

- A Grade office constructed 2012
- First of 5 towers at Collins Square
- 38,000 m^2 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

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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

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CH2 - What we did

Electricity savings: 50% (tuning)

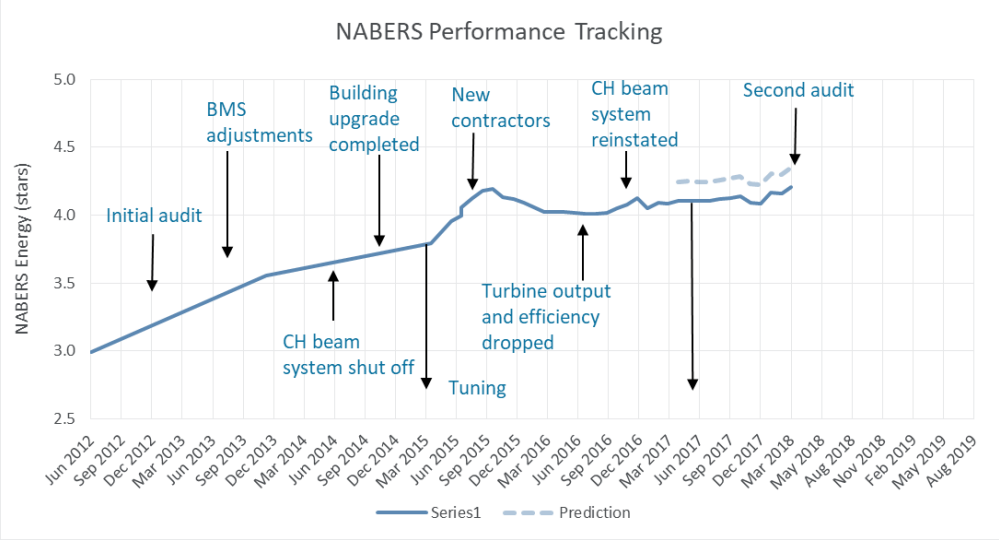
Gas savings: 23%

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 CO_2 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

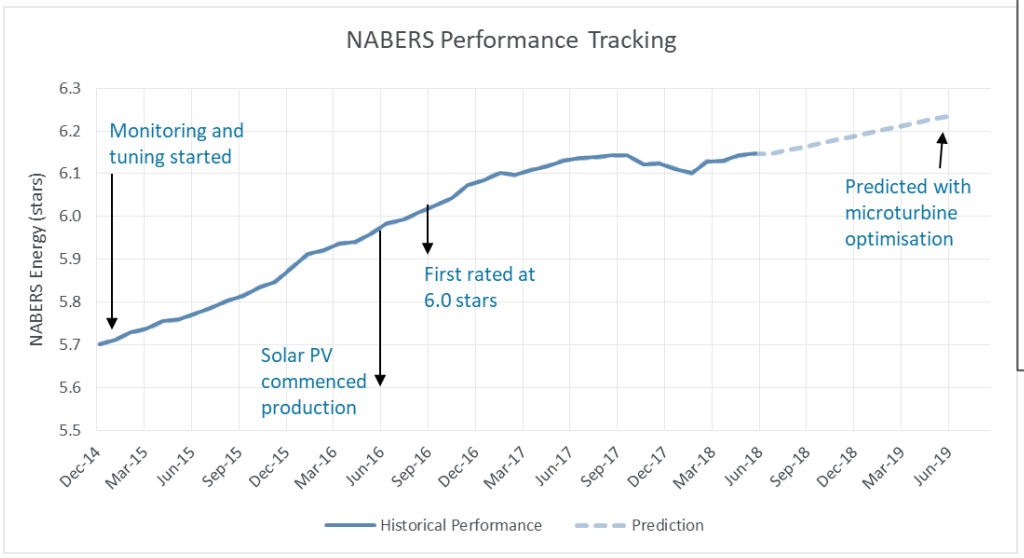
Electricity savings: 44% (tuning), 15% (solar PV)

Gas savings: 19%

Emissions savings: 34%

Cost savings: $65,000/annum

Current NABERS energy performance: 6.15 stars



Implemented recommendations:

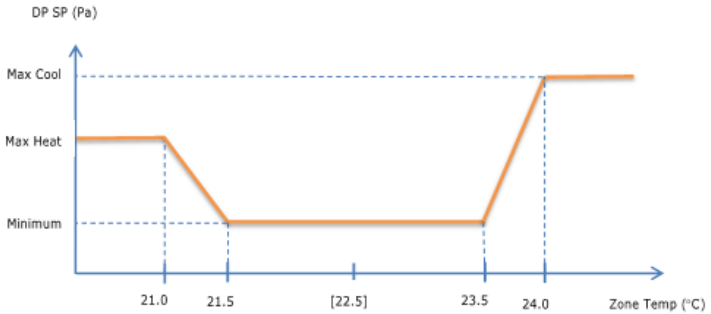
- Air handler pressure reset controls
- Increased VAV dead band
- Heat recovery loop optimisation
- Economy cycle optimisation
- Maintenance items
- Lift motor room AC controls
- Minimum VAV air flow reduction (to 40%)

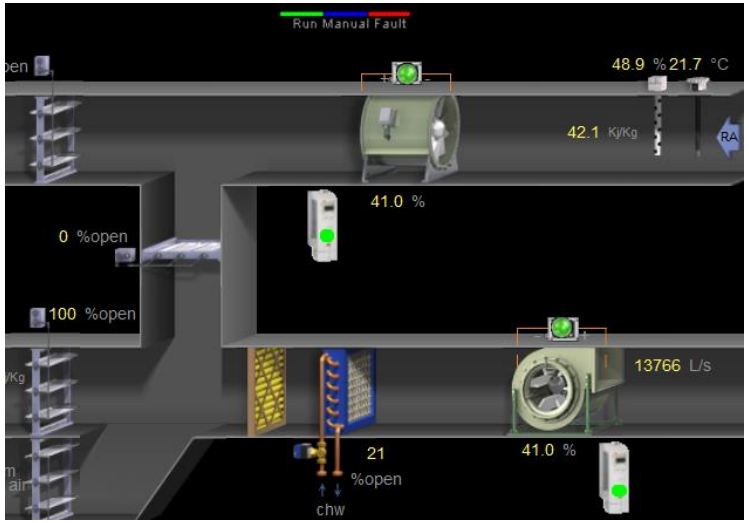
Yet to be completed:

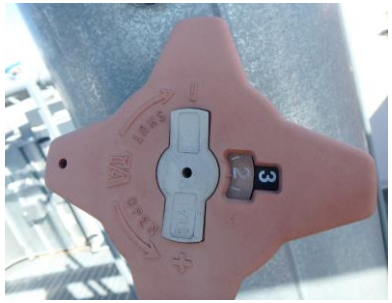
- Minimum VAV air flow reduction (to 20%) (20% reduction in AHU energy month on month so far)
- Optimisation of supply air temperature controls
- Condenser water temperature controls
- Car park lighting controls tuning
- Lift controls tuning
- Discrete AHU control optimisation

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







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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)

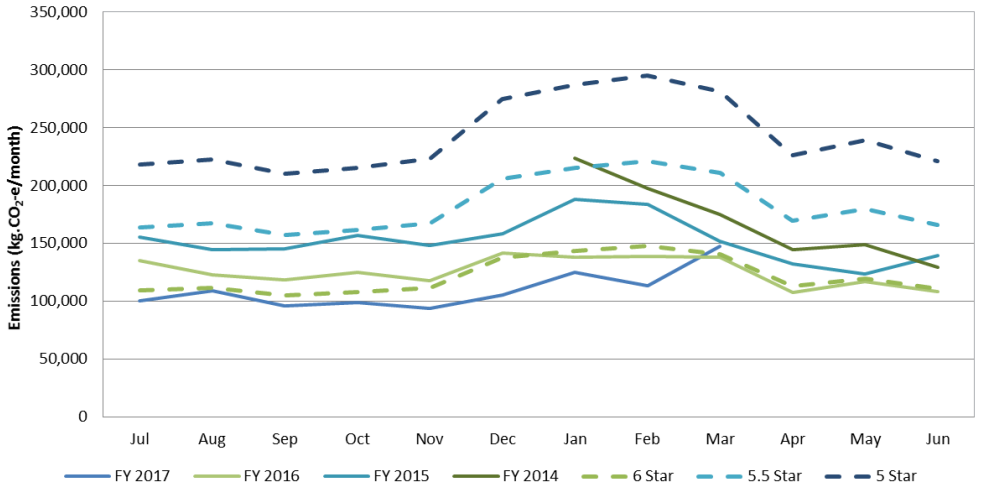
CONS

- 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



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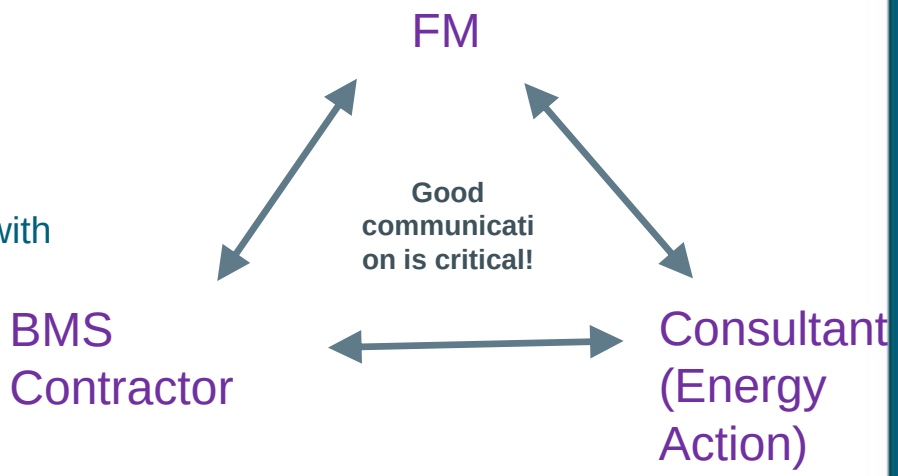
Driving successful tuning:

- 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!

…What may happen:	Tuning result
BMS contractor doesn't understand recommendation/ can't convert to logic	Not implemented
BMS contractor disagrees with recommendation	Not implemented
BMS contractor misinterprets intent of recommendation	Incorrectly implemented
BMS contractor does not have enough time	Project outcomes delayed

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

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The Role of Management

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