


The Sustainable Refurbishment of Existing Buildings  
**Good for the Planet and The Bottom Line**  
Presentation to The Corenet Global Brisbane Symposium  
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## Re-Living - The Sustainable Refurbishment of Commercial and Public Architecture

*This presentation will cover the following topics:*

- **Compelling reasons for the refurbishing existing buildings**
- **Sustainable retrofit options - from building tune ups to large scale refurbishments.**
- **Case studies**
- **Incentive Programmes**
- **Further information.**

## Aurecon Leading, Vibrant, Global

Aurecon is a leading, vibrant, global group created by the recent coming together of three world-class companies, Africon, Connell Wagner and Ninham Shand. This new global group has a combined 210-year history; a staff complement of 6 700; and an office network extending across 28 countries worldwide.

Aurecon provides a broad range of multidisciplinary professional services across diverse market sectors, and serves clients globally. Aurecon is committed to securing an enduring sustainable future and embraces diversity.

The company is principally owned by our executive staff, a group of hands-on professionals who continue to build their technical expertise. They are heavily involved in team management, staff development, and project work, with a strong focus on economic viability, constructability, functionality and sustainability.

The market sectors in which the groups forming Aurecon currently operate and in which they will continue to operate in an enhanced manner are:

- Community Infrastructure
- Oil and Gas
- Mining and Metals
- Industrial
- Buildings and Property
- Water
- Transportation
- Energy
- Environment
- Local Government
- Defence
- Health
- Integrated Communications Technology
- Advisory and Management Consulting
- Education and Training
- International Development Assistance

With our stability, geographic reach, depth of knowledge and experience Aurecon is able to effectively, efficiently and constructively manage your project.

### Our Buildings Group

Aurecon provides world class building engineering services and elegant design solutions. We have an outstanding reputation for our lateral thinking with over 50 years' experience.

Focusing on economy, buildability and functionality we pride ourselves on our sustainability solutions.

With our strength in structural, civil, mechanical and electrical engineering, we are also specialists in:

- Facades
- Sustainable buildings
- Fire engineering
- ICT
- Security
- Wind engineering
- Acoustics



## Global network, global resources



offices: 87  
countries: 28  
employees: 6 700  
contact numbers:  
AME Zone: +27 12 437 2000  
APAC Zone: +61 3 9463 1333



## Compelling Reasons for the Sustainable Refurbishment of Existing Commercial and Public Buildings

### 1. To reduce the environmental impact of commercial and public buildings on the environment

- Built Environment  
= **23%** of Australia's GHG emissions
- Commercial buildings  
= **8.8%** of National GHG emissions.
- Buildings produce  
= **40%** of waste
- Office Buildings  
= **10%** of capital city water consumption

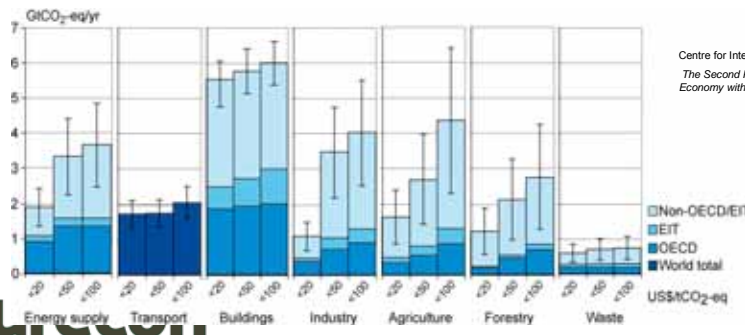


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## Compelling Reasons for the Sustainable Refurbishment of Existing Commercial and Public Buildings

### 1. To reduce the environmental impact of commercial and public buildings on the environment

- New buildings constructed in the last 5 years have achieved 4, 4.5 and 5 Star NABERS rating.
- However 98% of the existing stock has a NABERS Energy rating of **2.5 Stars** or less.
- Greening the built environment offers governments the **lowest cost abatement opportunities** available



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## Compelling Reasons for the Sustainable Refurbishment of Existing Commercial and Public Buildings

### 2. Tenants are demanding sustainable buildings

eg. Australian Government tenants (30% of market) require NABERS and Green Star energy requirements.

Location	Base Building Rating	Tenancy Rating
Commonwealth	4.5 Star NABERS	4.5 Star NABERS
Northern Territory	Policy in development	Policy in development
Queensland	4.5 Star NABERS	4.5 Star NABERS
NSW	3.5 Star NABERS	4 Star NABERS
Victoria	4.5 Star NABERS New 4 Star NABERS Existing 5 Star Greenstar	5 Star NABERS 5 Star Greenstar
South Australia	5 Star NABERS	5 Star NABERS
Western Australia	4.5 Star NABERS	4 Star NABERS



Many new tenant briefs have a minimum requirement for a 4.5 Star NABERS Energy rating and a 5 Star Green Star rating.



## Compelling Reasons for the Sustainable Refurbishment of Existing Commercial and Public Buildings

### 3. Tenants expectations are higher

Colliers International 2008 Tenant Survey:  
Tenants prefer

- more natural environments
- access to daylight
- excellent indoor air quality
- thermal comfort.

- Other things that are important to tenants:
  - More effective air-conditioning
  - Quick and efficient lifts
  - Workplaces that assist team development and collaboration
  - Security

- 91% of tenants surveyed said they were seeking to occupy a green building.



## Compelling Reasons for the Sustainable Refurbishment of Existing Commercial and Public Buildings

### 4. To retain the value of their assets existing building

Owners need to invest to improve environmental performance of their buildings

*"It is highly likely that a **two tiered market** will emerge with **Green Star buildings attracting premiums** and/or **existing assets being discounted.**"*  
GBCA Valuing Green 2008.

*"Non-Green Star buildings may have the prospect of major capital works to meet future performance standards which currently appears omitted from contemporary valuation considerations."*

The potential upsides for Green Star buildings are:

- **Increased renewal** probability
- Improved occupancy rates
- Decreased down times
- **Lower operating costs**



## Compelling Reasons for the Sustainable Refurbishment of Existing Commercial and Public Buildings

### 5. Potential Productivity Benefits

Green buildings out perform non-green buildings in terms of comfort and productivity.

- Natural light
- Fresh air
- Access to view
- Control over their own individual work space temperature and lighting

#### Recent examples:

1. 500 Collins Street in Melbourne found
  - **9% increase** in typing speeds of secretaries and a
  - **7% increase** in lawyers bill rates.
2. At the City of Melbourne's CH2
  - **productivity has risen** by **10.9%** since staff moved into their Green office,
  - an annual saving of \$2M.
3. 40 Albert Road, Melbourne **13%** increase in staff **productivity**.
4. The Building Commission of Victoria indicates that optimal levels of Indoor Environmental Quality would increase Australian workforces' productivity by 30%



## Compelling Reasons for the Sustainable Refurbishment of Existing Commercial and Public Buildings

### 6. You will have to – Mandatory Disclosure

The Federal Government have proposed the introduction of legislation for “Mandatory disclosure of the energy efficiency of commercial office buildings at the time of sale or lease or sub-lease.”

	Net Lettable Area	Building / Tenancy Type	Star Rating	Building Energy Efficiency Certificate	Energy Efficiency Assessment Report
Constitutional Corporations	> 2000m <sup>2</sup>	Whole Building	Mandatory	Mandatory	Mandatory
		Tenancy	Mandatory	Mandatory	Mandatory
		Sub-lease	Mandatory	Mandatory	Mandatory
	< 2000m <sup>2</sup>	Whole Building	Mandatory	Mandatory	Mandatory
		Tenancy	Voluntary	Voluntary	Voluntary
		Sub-lease	Voluntary	Voluntary	Voluntary
Parties other than Constitutional Corporations	Any	Whole Building	Voluntary	Voluntary	Voluntary
		Tenancy	Voluntary	Voluntary	Voluntary
		Sub-lease	Voluntary	Voluntary	Voluntary



## Compelling Reasons for the Sustainable Refurbishment of Existing Commercial and Public Buildings

### 6. You will have to – Mandatory Disclosure

The Federal Government have proposed the introduction of legislation for “Mandatory disclosure of the energy efficiency of commercial office buildings at the time of sale or lease or sub-lease.”

- A **whole building** with more than the **2,000 square metres** threshold of NLA is **sold**
- A **whole building** with an NLA above the threshold is **leased or subleased**; and
- When a **part of a building with an NLA above the threshold** is **leased or subleased**
- The scheme is due to come into place by **August 2010**
- The requirements will be for
- A **Building Energy Efficiency Certificate** (NABERS Energy base building rating valid for 1 year)
- **Tenant lighting details**
- An **Energy Efficiency Assessment Report** (improving a building or tenants energy efficiency through detailed analysis and advice, valid for 7 years )
- There will be **finances of up to \$100,000** for building owners who fail to comply



## Compelling Reasons for the Sustainable Refurbishment of Existing Commercial and Public Buildings

### 6. You may have to – BCA 2010 contd

Proposed changes to the BCA Volume 1 2010 (from May 2010)

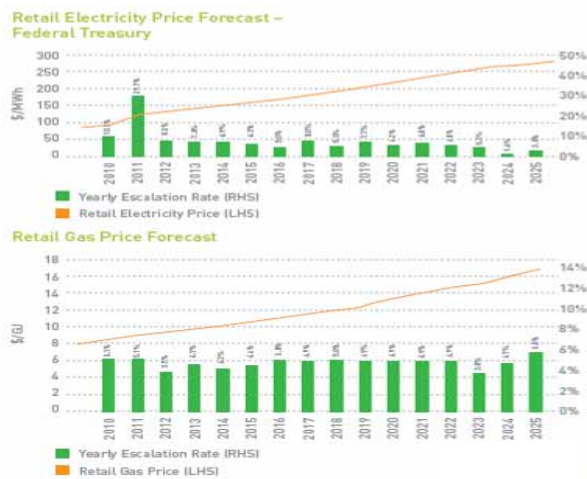
### Increased Energy Efficiency Requirements

- Section 3 – energy efficiency requirements increase by approx 25%.
- Increases in duct work and piping insulation.
- Additional sealing of doors and window frames.
- Improving glazing performance (approx. 20%)
- Reduced fan and pump power allowance.
- Requirements for metering.
- Require services to be commissioned.
- Request for measurement of settings and maintenance manuals.



## Compelling Reasons for the Sustainable Refurbishment of Existing Commercial and Public Buildings

### 7. The Rising cost of Electricity and Gas



Graphs from Davis Langdon Guide to Green Property

## The Sustainable Retrofit Process

### 5 Step Sustainable retrofit process (as advocated by the City of Melbourne for their 1200 buildings program)

#### Step 1: Baseline assessment

- Rate your building's environmental performance. Determine how much energy and water your building consumes. Set yourself a benchmark by undertaking an energy/water baseline assessment.

#### Step 2. Retrofit action plan

- Conduct an asset improvement plan and learn how to improve your building's performance. What energy/water/dollar savings are possible? How long will it take to complete your retrofit and see a return on your investment? Seek competitive financing.

#### Step 3. Undertake retrofit works

- Begin your energy/water improvement works. Apply for planning/building approvals, if necessary, at this point.

#### Step 4. Annual update

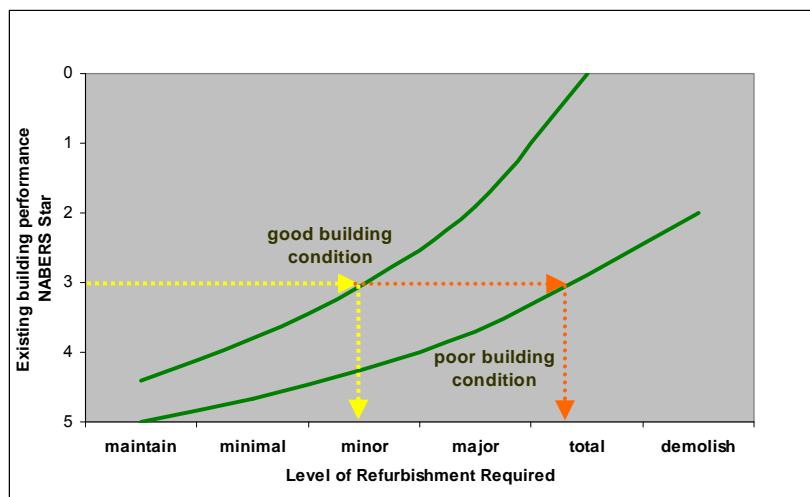
- Review your progress. Check how you are tracking against your Retrofit Action Plan. Are works proceeding on time and on budget?

#### Step 5. Completion of works

- Retrofit works are complete. Undertake a final energy/water assessment to assess your building's improvement compared with your original baseline ratings



## Guide to refurbishment level required



## Guide to refurbishment level Required

Level	Example of works	Impact on tenants	Duration of works
<b>Maintenance</b>	Minimal degree of maintenance to maintain systems	Minimal	Less than a day
<b>Minimal</b>	Building tune up and aesthetics, minor repairs to bring building systems up to excellent condition	Could be done out of office hours	a few days depending on the scope
<b>Minor</b>	Work is mainly done in plant rooms to upgrade equipment, including central plant. Non tenancy upgrades in ablutions and common areas as well as that associated with all above.	Some disruptions associated with plant replacements, ie no services available, but managed to minimise impact on occupants	Depends on type of systems ie central vs floor by floor but could be 6 to 12 months
<b>Major</b>	Replacement of central plant and all elements noted above. Upgrade of technologies including on floor refurbishments such as lighting, air conditioning etc involving the replacement of ceilings.	Depends on type of systems ie central plant or floor by floor. Tenants need to vacate spaces preferably rolling 3 floors at a time to minimise noise and disruptions to other floors. Disruptions will occur throughout the works.	Depends on type of systems ie central vs floor by floor but could be 12 to 18 months. Need fire brigade approval to maintain building occupied while major works carried out if fire and life systems are affected.
<b>Total</b>	Strip back to base building structure, remove all building services and replace with new technologies. Upgrade façade.	All tenants to move out	over 2 years construction time depending on size of building.
<b>Demolish</b>	Demolish and rebuild	All tenants to move out	over 2 years construction time depending on size of building.



## Guide to refurbishment level required

### Air Conditioning

#### Maintenance

- Clean filters to improve air quality
- Clean diffusers and grilles and entrained dirt on ceilings
- Ensure things are working correctly and efficiently
- Measure and monitor energy used by air conditioning plant
- Monitor tenant satisfaction, air temperature, drafts, cold spots
- Adjust set points based on season
- Educate tenants on building use

#### Minimal refurbishment

- Building management tune-up
- Review start and finish times of base building plant, supplementary plant operation,
- Adjust set points and calibrate temperature sensors
- Check and find rogue zones, why are they rogue zones?
- Randomly check air flows quantity, quality and temperatures
- Chilled water temperature setback



## Challenges of improving the sustainability existing buildings

- Glazing performance is normally poor (single glazed).
- Insulation value of facades, roofs and floors is often poor.
- Infiltration through poorly sealed facades and roofs.
- Heating and cooling systems often old, inefficient and poorly commissioned and controlled.
- Lighting systems may be inefficient
- Water usage may be inefficient
- Poor indoor air quality



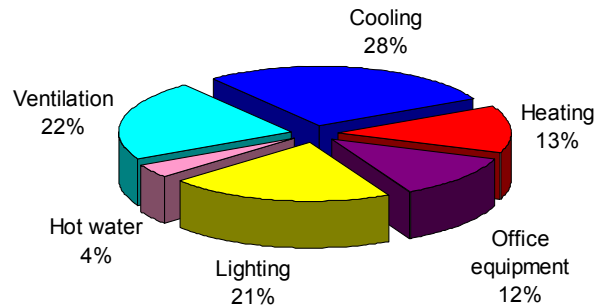
## Favourable Attributes of Buildings

- Good Location
- Favourable Orientation
- Good Access to Daylight and Views
- Appropriate % of Glazed area
- Appropriate Façade Shading system
- Well sealed double glazed facades
- Generous Floor To Ceiling Heights
- Plenty of Riser space for pipes and ducts
- Generous Plant room areas
- Flexible Structure with plenty of capacity
- Ability to easily upgrade and replace plant and Equipment
- A well trained and highly motivated facilities team



## What are the major CO2 emitters?

**Australian Commercial Sector - CO2 emissions by application**

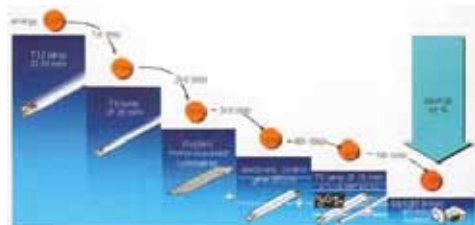


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## Key upgrade opportunities

### Reduce lighting and small power loads

- Install energy efficient lighting – T5 lights and automatic lighting controls.
- Replace incandescent lamps with compact fluorescent or LED's.
- Minimise/avoid low voltage lighting
- Upgrade to energy efficient appliances and equipment.
  - Energy efficient fridges
  - Energy efficient multi function devices
  - Energy efficient computers and IT equipment.



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## Key upgrade opportunities

### Improve the passive design features of the building.

- Improve the insulation of the building envelope (whilst ideally maintaining the exposed thermal mass).
- Improve the thermal and daylight performance of the glazing.
- Seal up the gaps “Build tight ventilation right”
- Shade the building where possible

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## AIR TIGHTNESS TESTING OR HOW TO BLOW UP A BUILDING!



## Air Leakage testing



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## Building Sealing

Seal Gaps at junctions  
in building elements

- Roofs
- Walls
- Floors
- Roof lights
- Windows
- Doors
- Chimneys
- Vents



Source: [www.maverickinspection.com](http://www.maverickinspection.com)

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## Improving Indoor Air Quality

- Ventilation rates
- Air change effectiveness
- Contaminant exhaust
- Low VOC materials
- Formaldehyde
- Mould prevention
- Central vacuum



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## Key upgrade opportunities

Improve the efficiency of the existing air conditioning systems.

- Install metering and data collection for major energy users.
- Recommission existing air conditioning systems.
- Upgrade and tune up controls and bms
- Replace old and inefficient equipment
  - Clean and rebalance ductwork and pipe work systems.
  - VSDs on fans and pumps
  - Upgrade filters on AHUs
  - Select more efficient pumps and fans
  - Install primary and secondary pumps
- Convert existing VAV systems to low temperature VAV systems.
- Replace existing air conditioning systems with new low energy high comfort air conditioning system.

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## Smart technology upgrade opportunities

### Low energy high comfort air conditioning systems



#### Underfloor air conditioning systems

##### Advantages

- Low energy
- Excellent indoor air quality
- Individual control by occupants
- Very flexible for change
- Minimal disturbance to ceiling details

##### Disadvantages

- Use of fan energy not as efficient as radiant systems.
- Requires a 350-450mm raised floor
- Requires a well planned construction process.



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## Smart technology upgrade opportunities



### Chilled ceilings and chilled beams

##### Advantages

- Low energy usage
- Comfortable cooling for occupants
- Can be retrofitted into building with low floor to ceiling heights.
- Becoming more cost efficient

##### Challenges

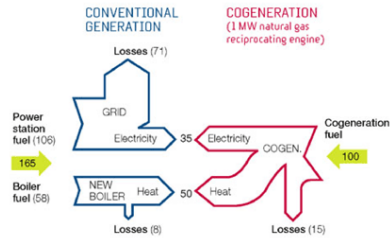
- Building must be sealed to prevent condensation.
- Not as flexible for future tenants change
- Cost is still comparatively high
- Harder to integrate as part of a mixed mode building.
- No individual control for occupants

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## Smart technology upgrade opportunities

Improve the energy efficiency of the power generation system

### Co-generation and tri-generation



- Generate power using gas and use waste heat for heating and hot water.
- Fuel efficiency increase from 30% to 90%
- Great opportunity to improve the energy efficiency of existing buildings.
- Regulatory, maintenance and cost challenges.



## Smart technology upgrade opportunities

Renewable energy options



[http://www.c40cities.org/bestpractices/renewables/melbourne\\_solar.jsp](http://www.c40cities.org/bestpractices/renewables/melbourne_solar.jsp)

- Solar hot water heating
- Solar air conditioning
- Photovoltaic panels
- Photovoltaic glass
- Wind generators



## Key upgrade opportunities

### Monitor energy usage and control



- Four seasons of commissioning
- Set an energy budget and monitor against it.
- Regular maintenance of plant and equipment.
- Provide regular retraining for operators.
- Energy efficiency awareness training for occupants.



## Vertical Transportation

- Regenerative Drives
- Lift controllers located in separately air-conditioned room
- LED Lighting
- Lighting controlled to turn off when car not in use
- Lifts and controllers enter standby mode during periods of reduced demand
- Reduced acceleration rates



## Key upgrade opportunities

### Water Saving Strategies



- 6 Star WEL tap ware
- 5 Star WEL WC
- Water Efficient dishwashers etc
- Waterless Urinals
- Collect Fire Sprinkler Test water
- Rainwater collection and reuse
- Grey Water Treatment and reuse
- Black Water Treatment and reuse
- Water efficient cooling towers
- Water efficient landscaping
- Meter and monitor major water use

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## What about tenants?

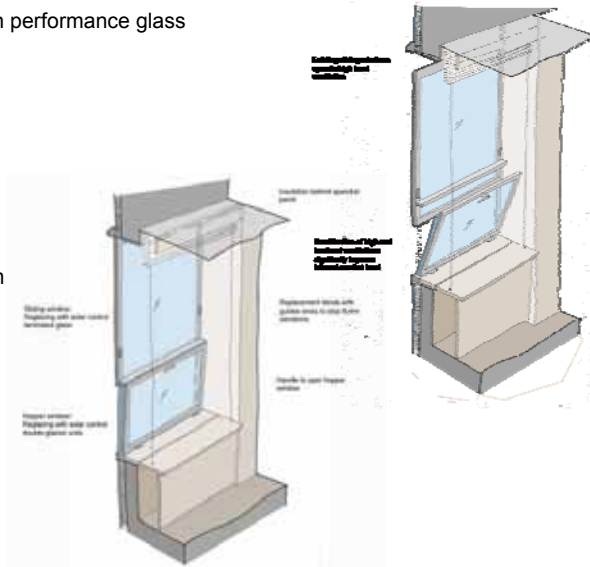
- Tenant fitouts and operations effect approximately 50% of the Energy usage in the building
- Green lease can formalise tenants commitments on:
  - Energy efficiency: fitout lighting and office equipment selection, operational guidelines
  - Water efficiency: kitchen fittings and appliance
  - Material selections: fitout design and material selection
  - Waste Recycling
  - Indoor plants



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## Façade improvement

- Reglaze the window with high performance glass
- Provide solar control film
- Provide automated blinds
- Insulate spandrel panel
- Reseal cracks and gaps
- Replace entire façade system



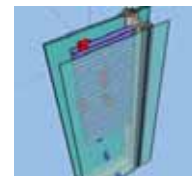
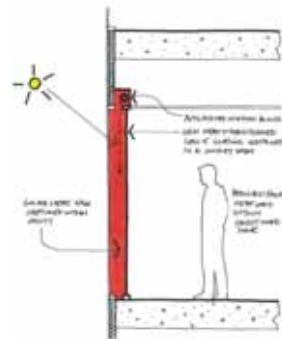
## Façade improvement

### Jockey Sashes

This initiative is essentially the installation of an additional panel of glazing to the inside of the buildings façade.

This will improve the thermal performance of the façade, that is, less heat will be conducted into the building in summer and less heat will escape from the building in winter.

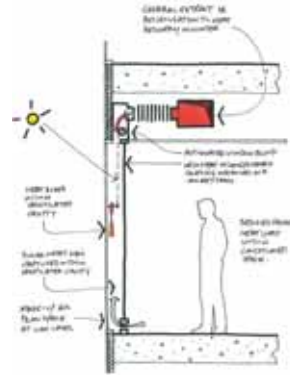
Can reduce the visible light transmission into building



## Façade improvement

### Ventilated Jockey Sashes

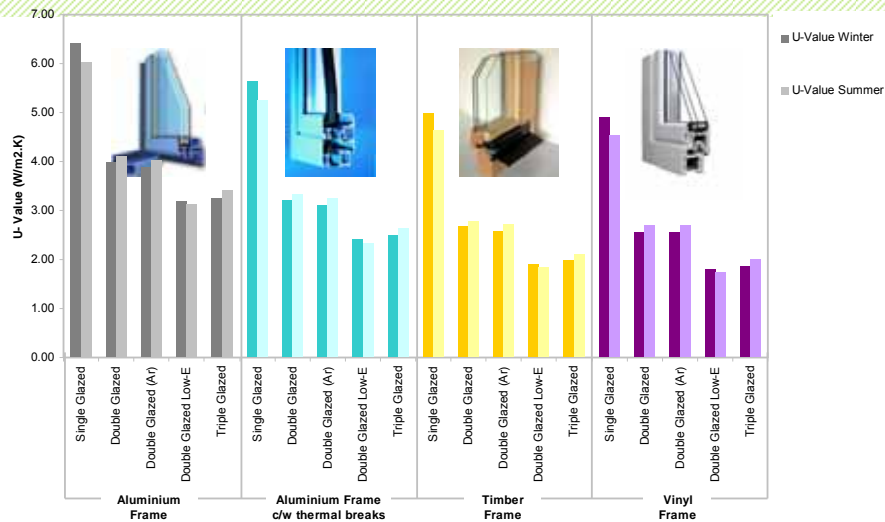
This is similar to the Jockey Sashes however the extract ventilation is drawn through the air gap to remove heat trapped during summer. This option assumes that the additional glass installed has had a solar control film applied.



Scenario	Decrease in Peak Summer Heat Gain
Existing Façade	-
With Automated Blind	2.2%
With Solar Control Film	3.5%
With insulated frame	3.8%
With Solar Control Film and Automated Blind	5.3%
With Jockey Sash	7.1%
With Ventilated Jockey Sash	7.8%
With Ventilated Jockey Sash and Blind	9.8%



## Window thermal performance



Source: Window 5, NFRC 100-2001, 1200mm wide x 1800mm high window



## Atrium

- Retrofitting to include an atrium



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## Selecting glass – glass types and aperture

30 The Bond, Sydney; KPMG, Sydney; DIMIA, Canberra, Composite blind down



30 The Bond, Sydney - Floor to ceiling Glass set by limiting VLT 33% for glare KPMG, Sydney - Glass with VLT50% plus shades; DIMIA, Canberra,, heat and cost limited

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## Don't Forget To Up Grade the Staff !!!

- Findings from the Low Energy High Rise Building Research Project published by the Warren Centre for Advanced Engineering March 2009
- The report involved a survey of 127 buildings in Australia's capital cities and it indicates that Buildings work better when:
  - The staff and contractors care about performance
  - The Management Chain all work positively with efficiency issues
  - Energy efficiency training is provided
  - The NABERS rating is declared to Tenants





## Low Energy High Rise Building Research Report Key Findings

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

Table of Key Research Results (adapted from Warren Centre Low Energy High Rise suite of adoption report)






### Case Studies




### Case Study for a Total Refurbishment 40 Albert Road, South Melbourne

Client	Szencorp	6 star Greenstar Office Design
Architects	SJB	5 star NABERS Energy
ESD Engineers	Aurecon & ECS	5 star NABERS Water



71% reduction in energy consumption  
54% lower waste generated over average office  
13% increase in productivity  
94% water savings over average office building

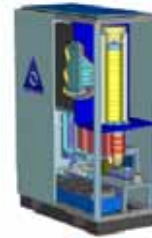


## Key Building Technologies



### • Energy

- Integrated occupancy controls for lighting, HVAC and security
- High-efficiency (dimnable) lighting ballasts and fixtures
- Ceramic Fuel Cell and PV arrays
- Gas VRV air conditioning
- Solar hot water heating



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## Key Building Technologies



### Water

- Rain water harvesting
- Water efficient appliances
- Grey water treatment and recycling

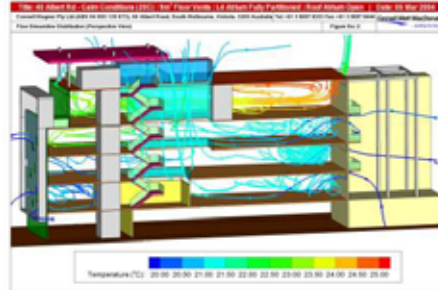


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## Key Building Technologies

### Indoor Environment Quality

- Fresh air mechanical ventilation
- Hybrid ventilation
- Drykor dehumidification
- Low-VOC measures

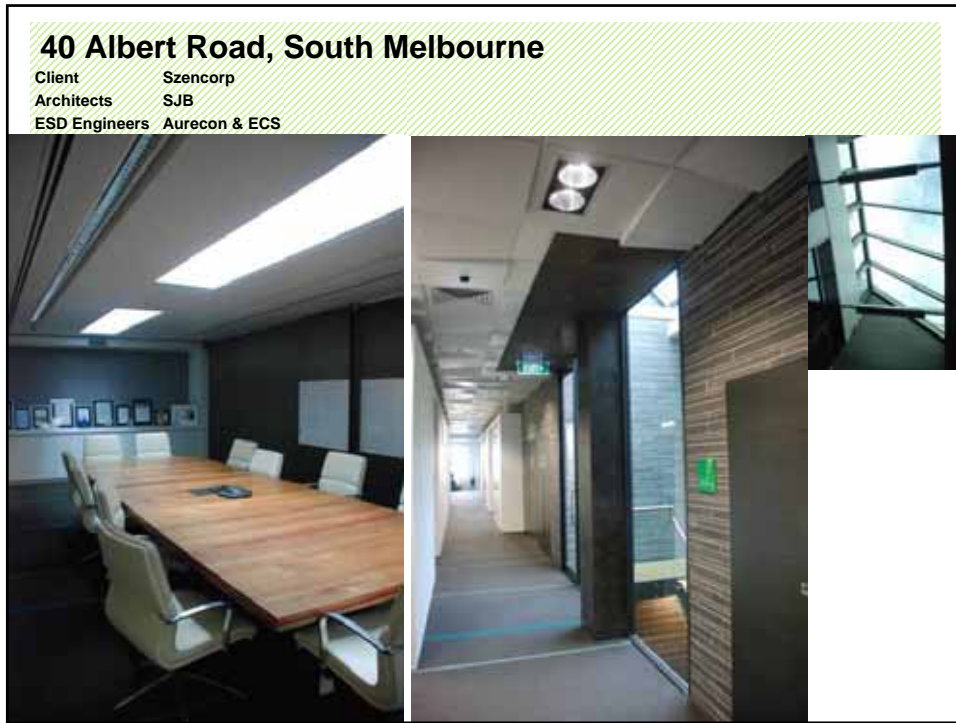


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## 40 Albert Road, South Melbourne


Client Szencorp  
Architects SJB  
ESD Engineers Aurecon & ECS





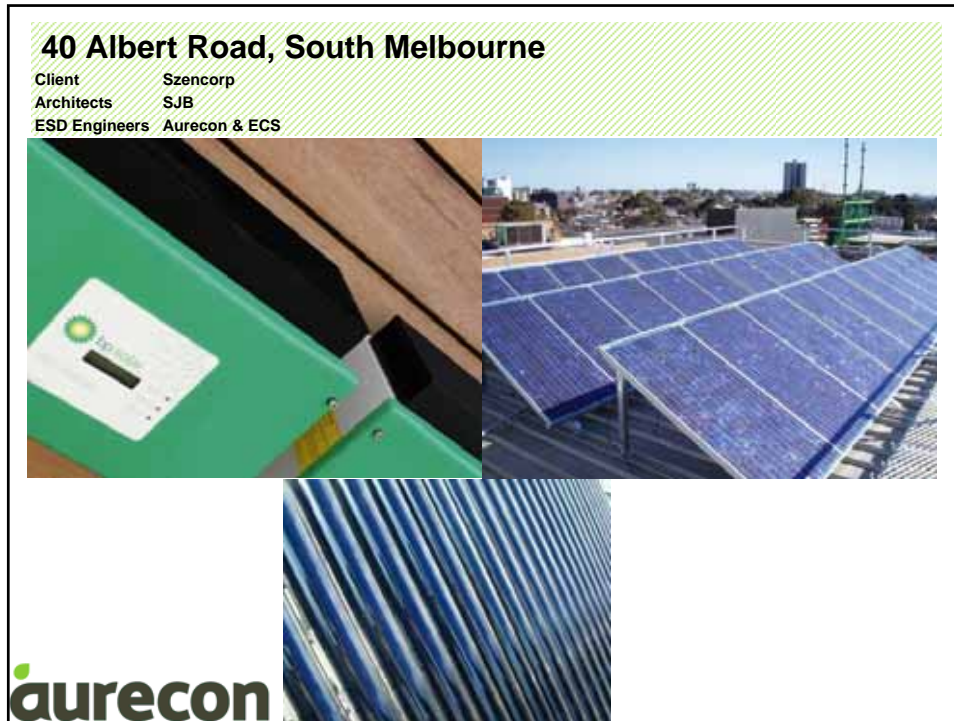
## Recycled Materials

- Reuse of the structure - 96% of the existing structure re-used
- Re-use of façade (88%)
- Re-cycled content of structural concrete
- Re-cycled Timber



The image block features a title bar, a bulleted list of recycled materials, and a photograph. The photograph shows the exterior of the building during renovation, with a blue safety net covering the upper floors and a white car parked in the foreground.







## Performance results

- **Extensive monitoring** to ensure expected results can be achieved in e.g. **energy, water**:
- The importance of worker productivity to the business case for green buildings
  - **13% productivity improvement** recorded in **2006** survey; second survey in **2009** recorded a **9%** productivity improvement

	Before	Actual Results		
		1st Year	2nd Year	3rd Year*
Annual Electricity Consumption (MWh)	235	92 (-61%)	69 (-72%)	84 (-60%)
Annual Water Consumption (kL)	1,250	121 (-90%)	76 (-94%)	157(-87%)



## Key Lessons Learned from the Project

- Interaction of complex variables
- Positives can also be negatives – e.g. fresh air cooling
- Post Occupancy monitoring essential for up to 12 months
- Staff feedback: perception vs reality
- Balancing occupant comfort with systems performance
- Grid-connect issues are a barrier to distributed generation solutions

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## Owning a Green Building – The Business Case



- Increase in asset value
- Improved rental returns
- Reduced outgoings
- Enhanced staff productivity
- Branding and profile
- New business opportunities

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## Increase in Asset Value

- Building purchased in 2004 – \$3.2m
- Refurbishment cost – approx. \$4.5m
  - Inclusions/exclusions
  - Commercialisation of new technologies
- **Post-completion valuation – \$6.3m**



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## Improved rental returns

- Approx. 10-15% premium
  - Subject to market conditions?
- Fit-out compliance for tenants an issue
- Green Lease to ensuring ongoing compliance



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## Reduced outgoings



- Outgoings \$40-50m<sup>2</sup> compared to industry standard of ~\$70-90m<sup>2</sup>
- offsets rent premium

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## Enhanced staff productivity

- Fundamental to the business case
- Significant post occupancy testing completed - with some interesting conclusions
- Not always about the
- environmental result...



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## Branding and profile

- Live marketing demonstration for company products
- Media coverage, including international
- Building tours and links to universities
- Attraction of new staff
- New project opportunities



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## 500 Collins Street, Melbourne

Client: Kador Property Group  
Architects: Peddle Thorp  
ESD Engineers: SBE






**au**

Photographer: Erica Lauthier


## 500 Collins Street, Melbourne

**Client** Kador Property Group  
**Architects** Peddle Thorp  
**ESD Engineers** SBE

Staff wellbeing results related to Indoor Environment Quality improvements





Symptoms effecting productivity	Improvement resulting from move to refurbished floor	
	Tenant one	Tenant two
Headache	7% reduction	20% reduction
Cold and flu	21% reduction	24% reduction
Fatigue	28% reduction	16% reduction
Poor concentration	20% reduction	5% reduction



## GBCA Fitout, Melbourne

**Client** Green Building Council Australia  
**Architects** Hassell  
**ESD Engineers** Aurecon

- The fitout was designed to achieve a 5 Green Star Interior Rating although an official Green Star rating was not sought.
- Key Features
  - Lower level of background lighting with task lights
  - Energy efficient office equipment and appliances
  - Close attention to sustainable material selections
  - Extensive indoor planting
  - Dedicated Exhaust from Multi Functional Printer area

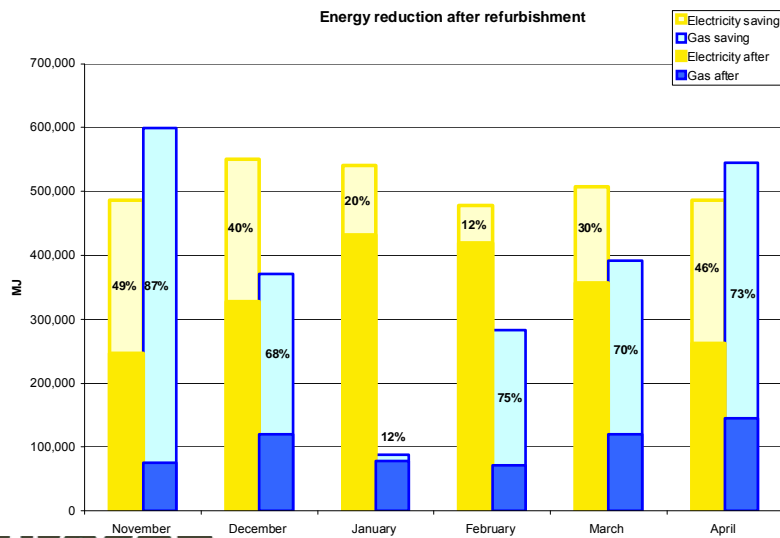
## 414 La Trobe Street, Melbourne



## 414 La Trobe Street Melbourne

Client Investa  
ESD Engineers Aurecon

Energy reduction after refurbishment



## 414 La Trobe Street Melbourne

Client  
ESD Engineers

Investa  
Aurecon

### Major Services Upgrade

New electric motors to main fans

Fan Assist VAV → Standard VAV

Atmospheric Boilers → Fully Condensing

Upgrade to Electronic TX valves on chillers

Replace Cooling Towers to low energy fans

Variable speed pumps and Tower fans

Reconfigure reprogram controls strategies

Comprehensive metering for monitoring

Storage DHW → Instantaneous Gas

T5 automated lighting



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## Case Study for a Building Tune up

- 17 storey office building in Melbourne CBD
- Construction completed in 1991 for a single government tenant
- NLA = 14200m<sup>2</sup>
- Building fabric
  - Precast concrete (no insulation)
  - Punch hole windows with single glazed clear glass
- HVAC System
  - VAV system with only two AHUs for the whole building
  - No perimeter zoning with fan assist internal zone

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## What We've Achieved

- 45% Decrease in Emissions
- 45% Decrease in Electricity
- 70% Decrease in Gas Usage

	Savings			Savings	
	Elect	Gas		Elect	Gas
Nov	49.3%	87%	May	45.7%	70%
Dec	40.4%	68%	June	39.5%	58%
Jan	20.2%	12%	Jul	63.7%	64%
Feb	12.2%	75%	Aug	46.3%	64%
Mar	29.6%	70%	Sep		57%
Apr	46.1%	73%	Oct		53%



## About the Upgrade

- Upgrade began upon vacancy from 6 of the 14 office floors in November 2007
- Initial upgrade was on the floors to enable the building to be leased (included addition of significant shower facilities)
- Building was fully tenanted in February 2008 when base building/plant upgrades began
- Plant upgrade completed in November 2008
- Significant weekend works
- Cost of upgrade was approximately 6months rent



## What we did...

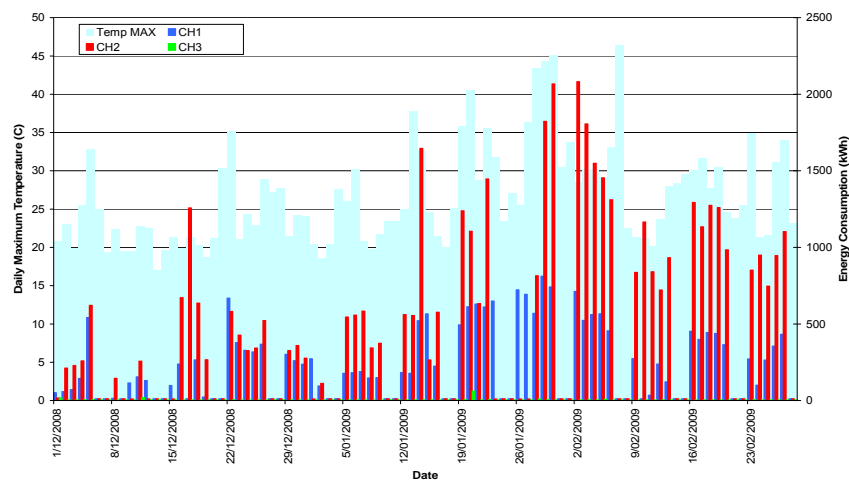


1. New electric motors to main fans
2. Fan Assist VAV → Standard VAV
3. Atmospheric Boilers → Fully Condensing
4. Upgrade to Electronic TX valves on chillers
5. Replace Cooling Towers to low energy fans
6. Variable speed pumps and Tower fans
7. Reconfigure reprogram controls strategies
8. Comprehensive metering for monitoring
9. Storage DHW → Instantaneous Gas
10. T5 automated lighting
11. Top and bottom floor HVAC systems
12. Removal of Tenants Chilled Water Loop
13. Quarterly metering analysis and building tuning



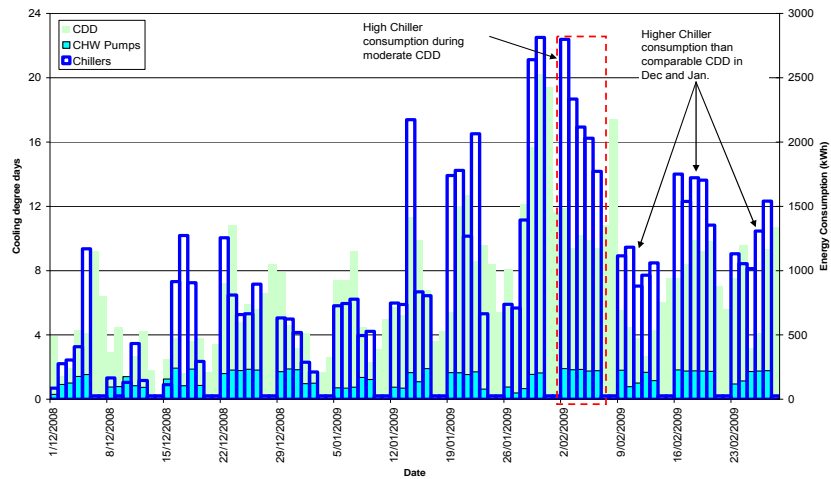
## Metering and Monitoring.....

➤ Unexpected Energy Use - Chillers



## Metering and Monitoring.....

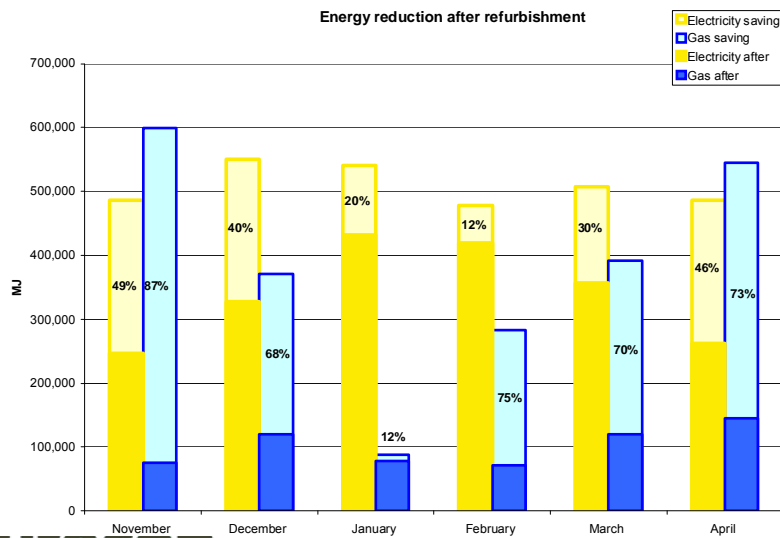
### ➤ Alterations to operational settings




## 414 La Trobe Street Melbourne

Client: Investa  
ESD Engineers: Aurecon

### Energy reduction after refurbishment




- **No fiddling!**
- **Coordinated approach to complaint response**



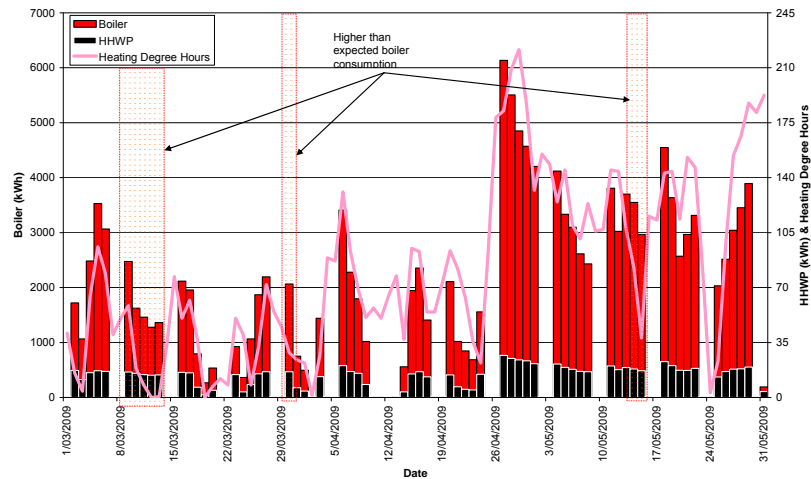
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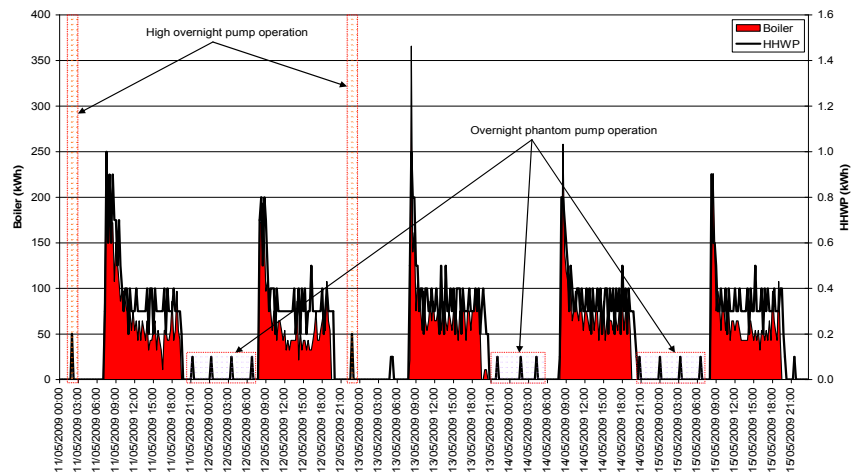
## Metering and Monitoring...

### ➤ Unexpected Energy Use - Boilers



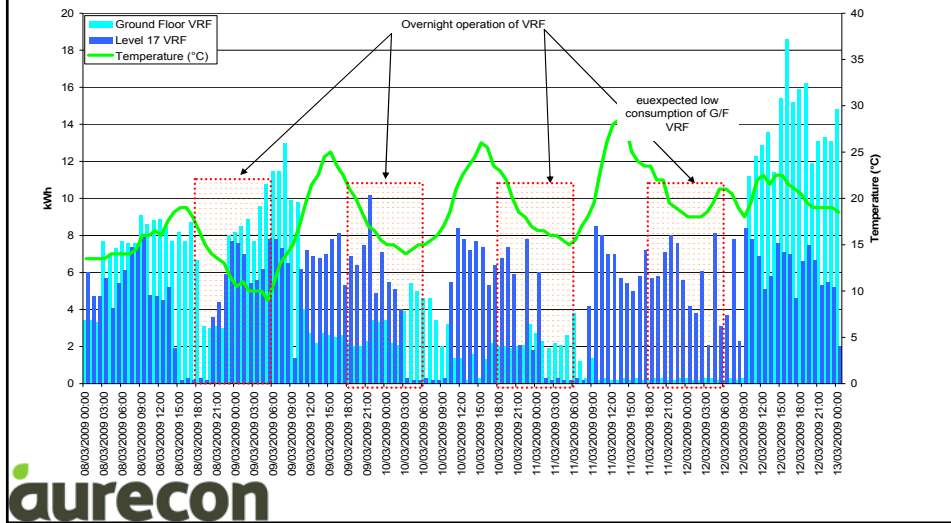
## Metering and Monitoring...

### ➤ Unexpected Energy Use - Pumps



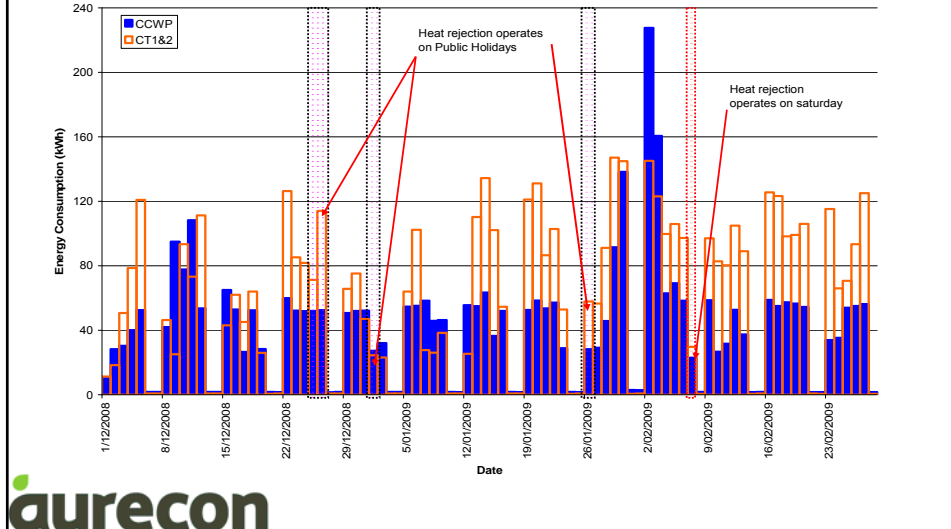
## Metering and Monitoring...

### ➤ Unexpected Energy Use - After Hours



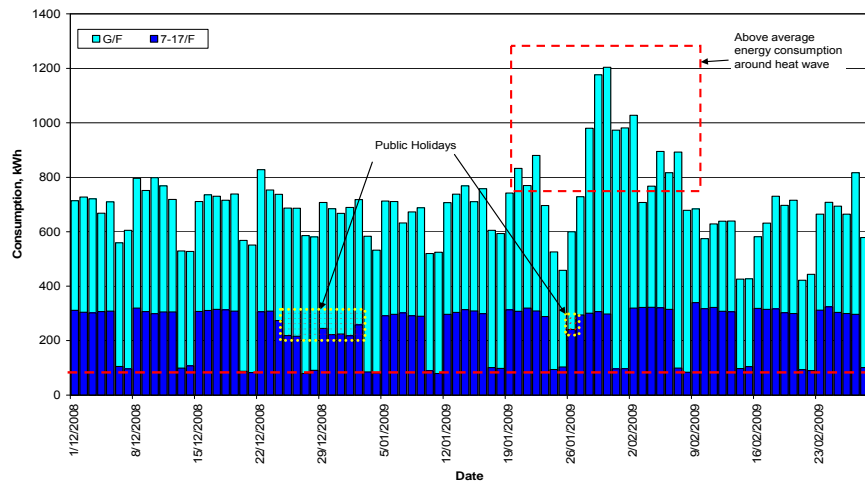
## Metering and Monitoring...

### ➤ Unexpected Energy Use - Public Holidays



## Metering and Monitoring...

### ➤ Unexpected Energy Use - Seasonal Operation on Lighting Circuit



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## What did we learn?

- Poor design does not necessarily mean poor performance
- Control strategies will not remain in place unless understood
- Log and meter everything, you never know what will be useful
- Always room for more improvement
- No fiddling! Co-ordinated approach to complaint response
- Controls logic and programming is complex and requires significant time for trouble shooting

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**Transport House**  
**99-113 Macquarie Street, Sydney**




Client: Mulpha Australia  
ESD Engineers: Aurecon  
Architect: Crone Partners Architecture Studios



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**Transport House**  
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## Programs to Encourage Re-Living of Existing Buildings

### PCA's Proposed "Tune Up Victoria Program"

- Opportunity is to retrofit 100 buildings over next 4 years
- Aim is to have a \$20m funding pool over 4 year matched funding for building owner
- \$100,000 per building
- Aim to improve Victoria average NABERS Rating (currently 1.5-2.0 star)
- Minimum of 2,000m<sup>2</sup> (NLA)



## Government Programs to Encourage Re-Living of Existing Buildings

### 1. AUS Industry Green Building Fund

Aims to reduce impact of Australia's built environment on Greenhouse emissions from commercial office buildings. The program will provide \$90m in grants for 5 years 2008 – 2013.

Stream A targets owners of existing commercial buildings.

Grants from \$50K to \$500K for 50% of project cost of retrofitting or recommission projects.

- Round 4 Open till 22 September 2009
- Round 5 Open till 12 January 2010
- Round 6 Open till 27 April 2010





## Bibliography and Useful Websites

- List of useful websites for advice on the sustainable refurbishment of existing buildings
- 1. City of Melbourne 1200 buildings initiative  
<http://www.melbourne.vic.gov.au/info.cfm?top=218&pg=4462>
- 2. The University of Sydney's Warren Centre report on Low Energy High Rise  
<http://www.warren.usyd.edu.au/LEHR/main.htm>
- 3. Mandatory disclosure of Commercial Buildings Energy Efficiency homepage  
<http://www.environment.gov.au/settlements/energyefficiency/buildings/consultation.html>
- 4. NABERS Website  
<http://www.nabers.com.au/>
- 5. Greenstar rating tools website  
<http://www.gbca.org.au/green-star/rating-tools/>
- 6. City Of Melbourne *Greening your Building Toolkit*  
<https://www.melbourne.vic.gov.au/rsrc/PDFs/EnvironmentalPrograms/GreenYourBuilding.PDF>
- 7. ESD operation guide for owners managers and tenants  
<http://www.environment.gov.au/sustainability/government/publications/pubs/esd-operations-guide.pdf>
- 8. ESD Design Guide for Offices and Public buildings  
<http://www.environment.gov.au/sustainability/government/publications/esd-design/pubs/esd-design-guide.pdf>
- 9. Department of Environment and Climate Change ( NSW ) Sustainable Property Guide  
<http://www.environment.nsw.gov.au/sustainbus/SustainPropertyGuide.htm>
- 10. City Switch Green Office  
<http://cityofsydney.nsw.gov.au/cityswitch/>
- 11. Valuing Green;- How Green Buildings Effect Property Values and getting the valuation method right  
[http://www.gbca.org.au/docs/NSC0009\\_ValuingGreen.pdf](http://www.gbca.org.au/docs/NSC0009_ValuingGreen.pdf)
- The Facility Management Association of Australia  
<http://fma.com.au/cms/index.php>
- International Faculty Management Association Foundation  
<http://www.ifmafoundation.org/index.cfm>
- The Cooperative Research Centre (CRC) for Construction Innovation  
<http://www.construction-innovation.info/index.php>



## Questions?

**Thank You for listening**  
**Any Questions?**

