

Making  
Energy  
Efficiency  
Work For You

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# Optimising Building Performance

Presented by

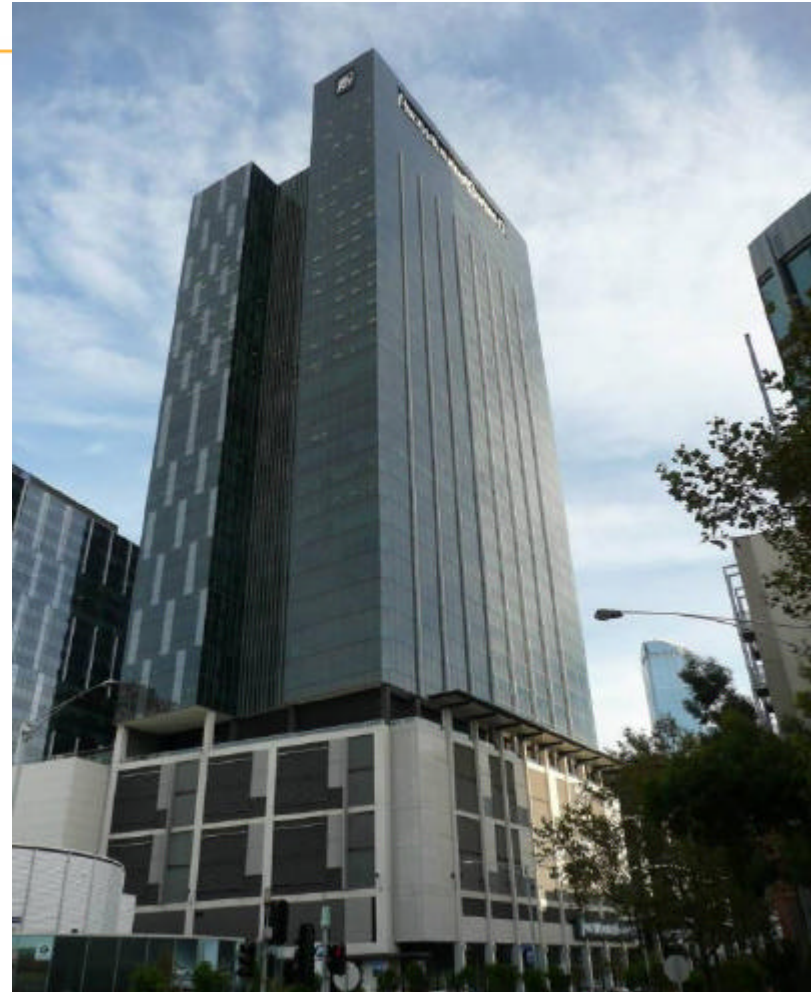
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22/05/2012

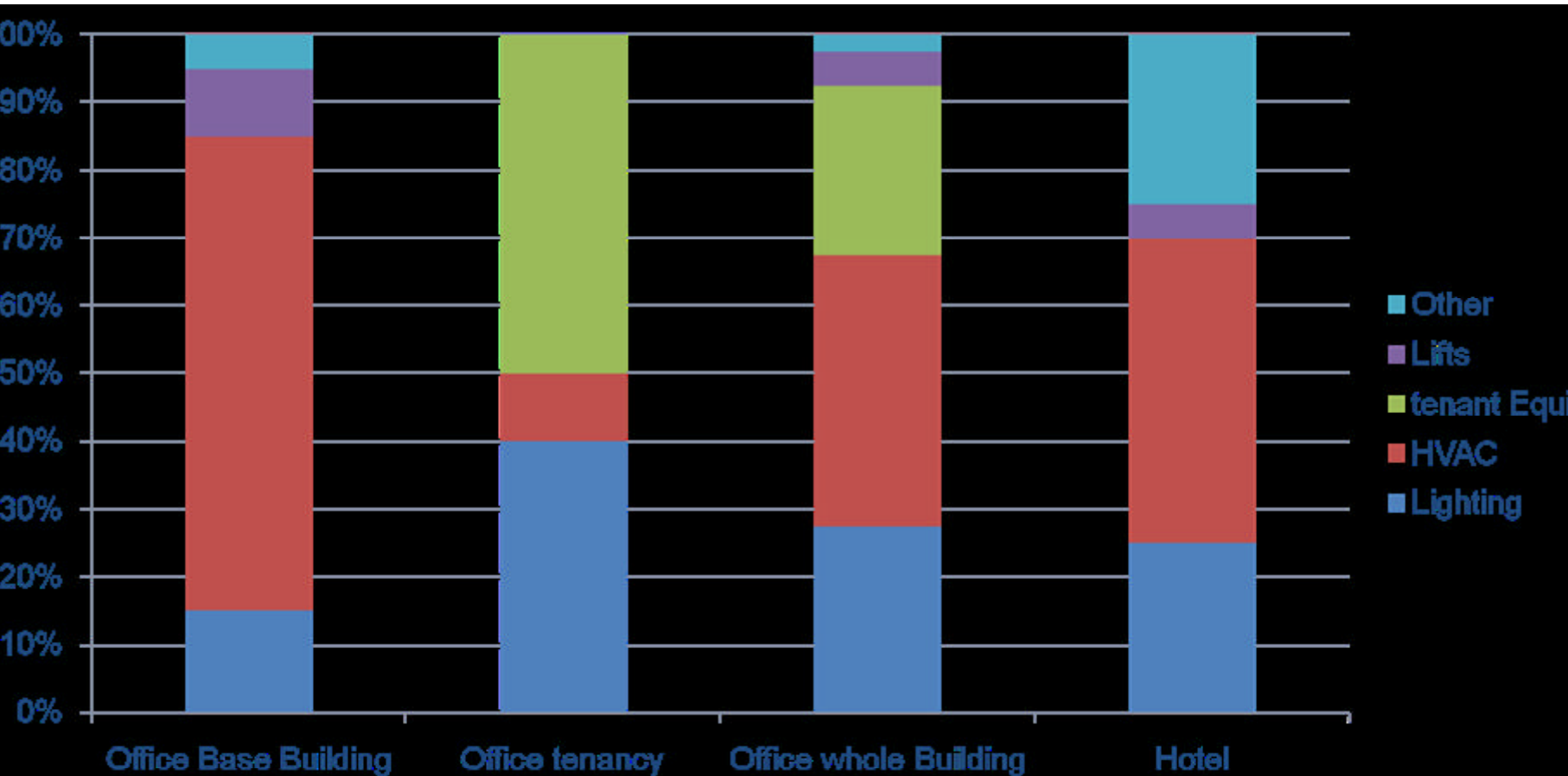
# Overview

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- Where does the energy go?
- HVAC technologies
- Lighting technologies
- Office equipment
- Other technologies
- Conclusions



# Where does the Energy Go?



# HVAC Technologies

- ➔ HVAC consists of
  - ➔ Chillers
  - ➔ Cooling towers
  - ➔ Boilers
  - ➔ Cogen/trigen
  - ➔ Fans and Pumps
  - ➔ Package units
  - ➔ HVAC control system
  - ➔ And some other bits and pieces



## Chiller Hardware

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- Optimum chiller technologies
  - <300kW – scroll
  - 300-700kW – magnetic bearing VSD centrif
  - 700-1000kW mag bearing VSD centrif, small VSD screw
  - 1000-2000kW VSD screw, VSD mag bearing centrif
- Savings – up to 50% relative to 10-15 year old technologies
- Economics: long payback, coordinate with routine replacement if possible.
- Note: R22/R123 (HCFCs) are becoming obsolete

# Chiller Operation

- Don't run when they aren't needed
  - Outdoor temperature lockout
- Operate at higher chilled water temperatures
- Operate at lower condenser water temperatures
- Stage up and down at the right time
- Economics: great



# Cooling Towers

- ➔ Hardware:
  - ➔ Replace old tired cooling towers
  - ➔ Use induced draft towers not forced draft towers
  - ➔ Variable speed fans
- ➔ Operation
  - ➔ Spread load out across multiple towers
  - ➔ Optimise temperature set-point in conjunction with chillers



# Boilers

- ➔ Hardware:
  - ➔ Replace tired old boilers
  - ➔ Eliminate steam boilers as far as possible
  - ➔ Upgrade burners to fully modulating burners
  - ➔ Use condensing boilers
- ➔ Operation
  - ➔ Tune the burner regularly
  - ➔ Turn off as much as possible
  - ➔ Reduce operating temperature when loads permit





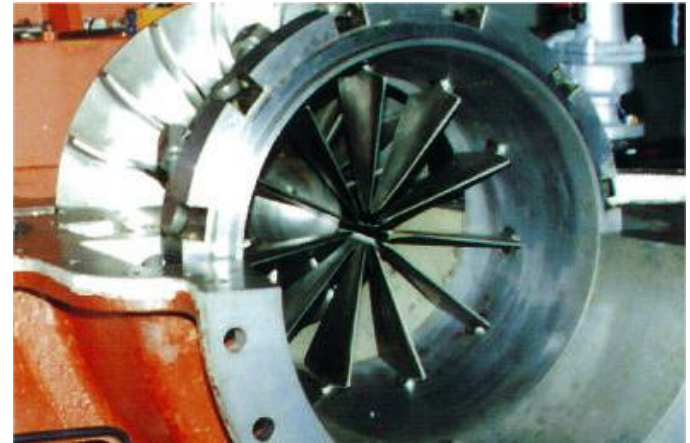
## Cogen/trigen

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- ➔ Hardware:
  - ➔ Not a magic bullet, and very expensive
  - ➔ Sizing a critical issue
  - ➔ Can you actually use the waste heat?
- ➔ Operation
  - ➔ Consider third party operation and management
  - ➔ Maximise run hours during peak electricity cost periods to get return
  - ➔ Don't create false loads to justify thermal use
  - ➔ Not a substitute for efficiency

# Fans

- ➔ Hardware:
  - ➔ Replace stuffed bearings and sagging V-belts
  - ➔ Use VSD control not guide vane
- ➔ Operation
  - ➔ Set up controls to minimise operating speed and pressure to meet load
  - ➔ Turn off when not needed



# Pumps

- ➔ Hardware:
  - ➔ Replace stuffed bearings
  - ➔ Use VSD control not throttling valves
- ➔ Operation
  - ➔ Set up controls to minimise operating speed and pressure to meet load
  - ➔ Turn off when not needed



# Water Cooled Package Units

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- ➔ Hardware:
  - ➔ Replace dying units
  - ➔ Install condenser water shut-off valves
- ➔ Operation
  - ➔ Turn off when not needed
  - ➔ Widen dead bands
  - ➔ Refrigerant charge
  - ➔ Filter cleaning

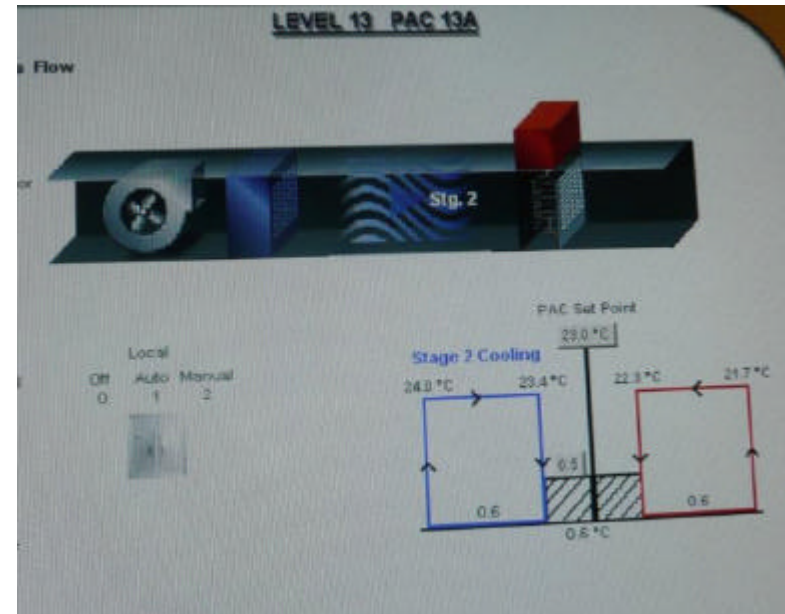
## Air Cooled Package Units

- ➔ Hardware:
  - ➔ Replace with inverter units
- ➔ Operation
  - ➔ Turn off when not needed
  - ➔ Widen dead bands
  - ➔ Refrigerant charge
  - ➔ Filter cleaning



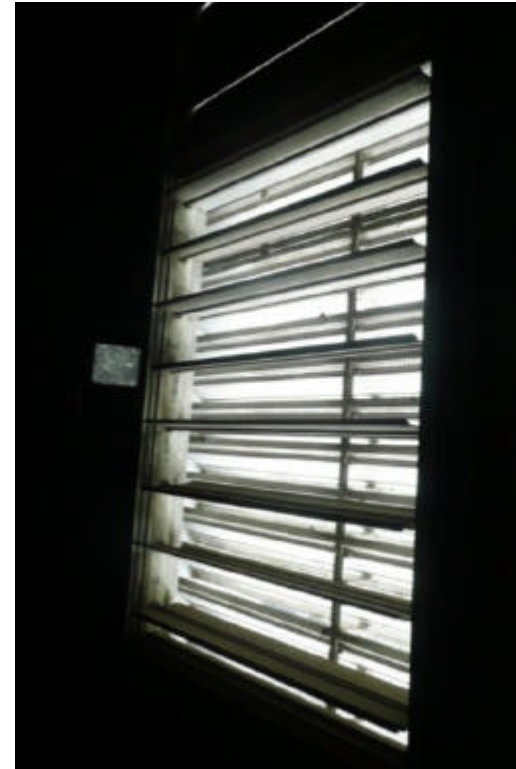
# HVAC Controls

- ➔ Hardware:
  - ➔ Replace pneumatic systems
- ➔ Operation
  - ➔ See operational measures
  - ➔ Widen dead bands
  - ➔ Commission!
  - ➔ Time-of-use control



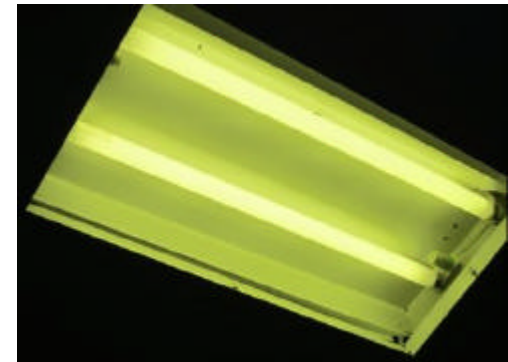
## Other HVAC Bits and Pieces

- ➔ Outside air control
  - ➔ Optimise economy cycle
  - ➔ Minimise unnecessary outside air
- ➔ Air Filters
  - ➔ Clean regularly
  - ➔ Use high energy efficiency filters (Eurovent standard)



# Lighting Technologies

- Halogen downlights
  - Replace with LED (with care!)
- Metal Halide
  - Consider LED replacements if control possible
- Fluorescent
  - Aim for  $<9\text{W}/\text{m}^2$  in office space
  - T5 or T8 with electronic ballast
  - Grid spacing and design important
- Lighting is a DESIGN issue





# Lighting Control

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- Time of use control is paramount
  - Manual switches rarely effective
  - Time-clocks tend to longer hours than necessary
  - Use occupancy sensors
    - Manual on, auto-off
    - Zone size <math><250\text{m}^2</math>
- Dimming
  - Good theory but often unsuccessful
  - Keep focussed on the time of use control!

## Office Equipment - Computers

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- ➔ Time of use control is paramount
  - ➔ Working week is less than a third of the hours in a week
  - ➔ Turn off!!
- ➔ Use low-power PCs (laptops and some desktops; thin client)
- ➔ Use power management settings
  - ➔ Screen savers do not save energy

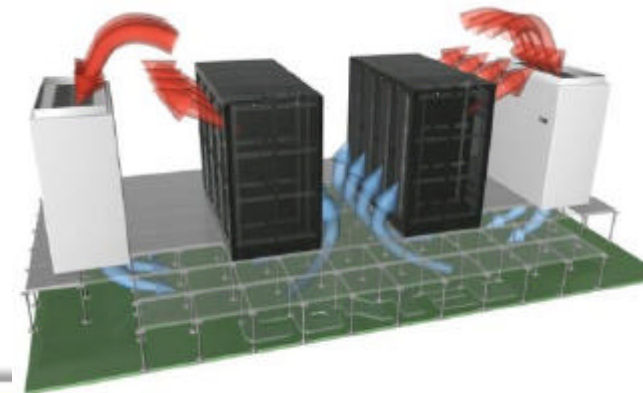
## Office Equipment - General

- ➔ Time of use control is paramount
  - ➔ Use power management settings
- ➔ Avoid excess equipment
  - ➔ Use central print stations, MFDs
- ➔ Kitchen equipment
  - ➔ Use 3+star fridges, etc
  - ➔ Time-clock boiling water/ chilled water units



## Office Equipment – Server Rooms

- ➔ Don't over-condition
  - ➔ ASHRAE air-on recommendations:
    - ➔ 18-28°C, <60% RH, 5.5°C<dewpoint<15°C
- ➔ Make sure air goes through not around the racks
  - ➔ “Hot aisle/cold aisle” approach
- ➔ Ensure that separate conditioners are not fighting
- ➔ Virtualise/modernise servers
- ➔ Remove old, underutilised servers



## Other Equipment – Lifts

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- ➔ Upgrade technology
  - ➔ Massive cost
  - ➔ Benefit can be >40%
- ➔ Tune operating parameters to match real-occupancy
- ➔ Don't over condition the lift motor room
- ➔ Upgrade the lights in the lift cars
- ➔ Turn off some lifts overnight (remarkably difficult)



## Other Equipment – Domestic Hot Water

- ➔ Convert electric to gas or heat pump
- ➔ Reduce tap flows
- ➔ Turn off circulation pump out of hours



## Conclusions

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- ➔ Wide range of possible upgrades for all technology
- ➔ In each case measures may be
  - ➔ Hardware – longer paybacks
  - ➔ Operational – shorter paybacks
- ➔ Remember:
  - ➔ Most buildings have many operational savings available
  - ➔ Improved efficiency frequently means better service

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# Questions?

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