

## Energy Efficiency in Commercial Buildings

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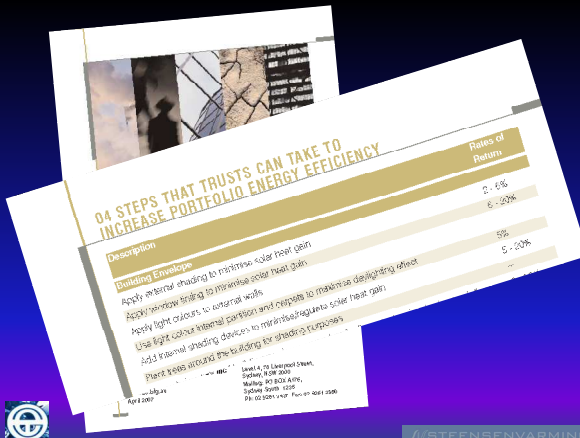
## Introduction

- Background
- Base Building Opportunities
  - Big Ticket Items
  - Low Hanging Fruit
- Opportunities in Tenancies
- Get Your Maintenance Programs Right

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## So what may be some of the energy saving opportunities with air conditioning systems?

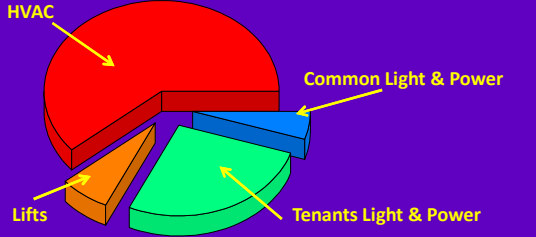
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Description	Rate of Return
Building Envelope	2 - 6%
Apply exterior shading to minimise solar heat gain	6 - 20%
Apply interior shading to external walls	5%
Apply light colour internal partition and ceilings to maximise daylighting effect	5 - 20%
Use light colour external surfaces to minimise solar heat gain	-
Use light colour internal surfaces to minimise solar heat gain	-
Add external shading devices to minimise solar heat gain	-
Plant trees around the building for shading purposes	-

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### Total Building Energy Consumption\*



\*Source: Designing buildings for energy efficiency - 6, Pappell 2008

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## Base Building Opportunities Big Ticket Items

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## New Air-conditioning Systems

- Chilled beams



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## Chilled Beams



Example of a chilled beam installation. (Picture courtesy of Trox Brothers Limited.)



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## Big Ticket Items

### New Air-conditioning Systems

- Chilled beams
- **Displacement**



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## Displacement Ventilation



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## Big Ticket Items

### New Air-conditioning Systems

- Chilled beams
- Displacement
- **Mixed Mode**



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## Mixed Mode Ventilation



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## Big Ticket Items

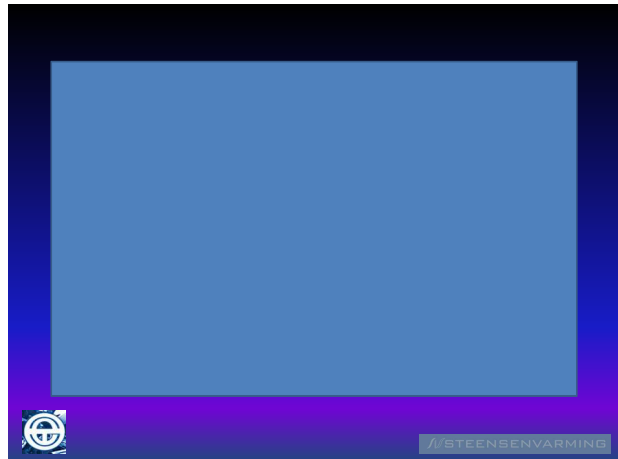
### New Air-conditioning Systems

- Chilled beams
- Displacement
- Mixed Mode

### High Efficiency Chillers



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## Cogeneration



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Cogeneration systems use an engine, in most cases gas fired, to drive a generator and produce electricity.



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Waste heat must be rejected from the engine and this heat is used to power an absorption chiller for producing chilled water.

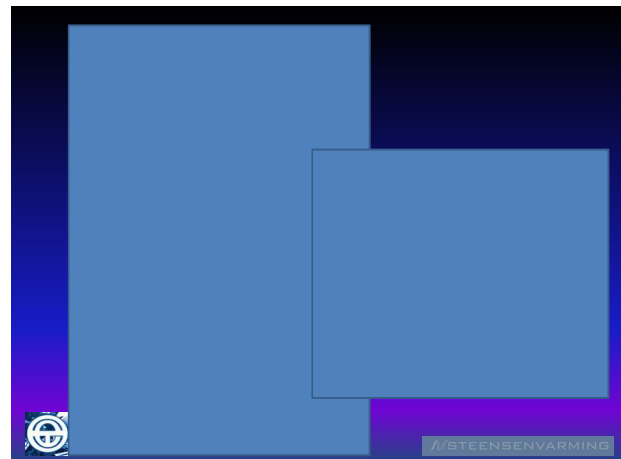
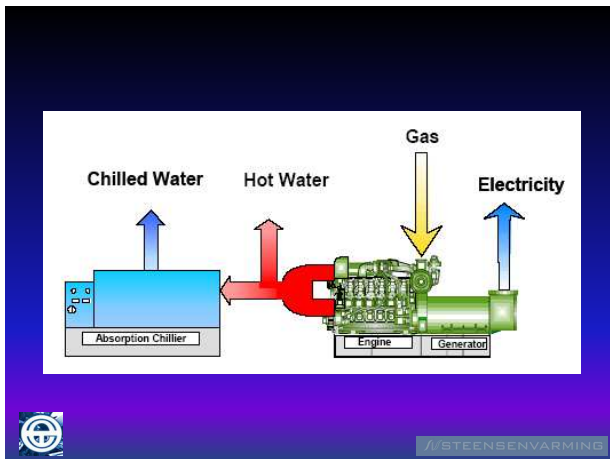


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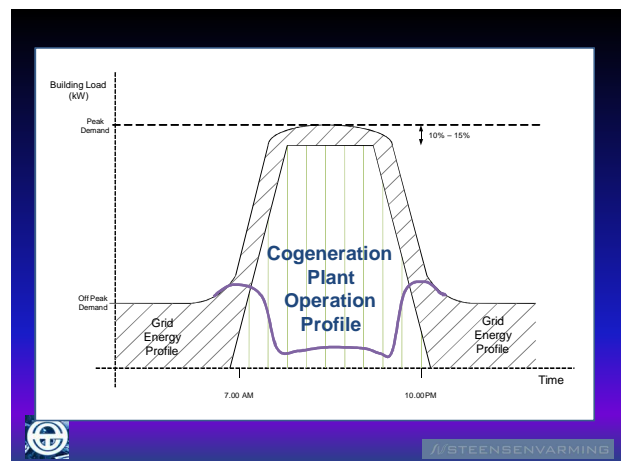
Significant energy savings are made from combining the heat from the engine with the power it produces – combined heat & power (CHP)



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- Can provide low cost cooling because you use a waste heat source,
- Chillers can be very reliable.
- Can boost cooling capacity without pushing the site over electrical load limits



## Base Building Opportunities

### Low hanging fruit

- Review room temperature Set points
- Review plant operating time against occupancy patterns
- Review operation and calibration of economy air cycles.
- Fine tune the building management system.

**Turn it off when it is not needed**



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**Use free cooling wherever possible**



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**Avoid re-heating eg through proper air balancing**



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**Better match energy consumption to actual requirements eg variable speed drives on pumps**



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**Make sure controls are working properly**



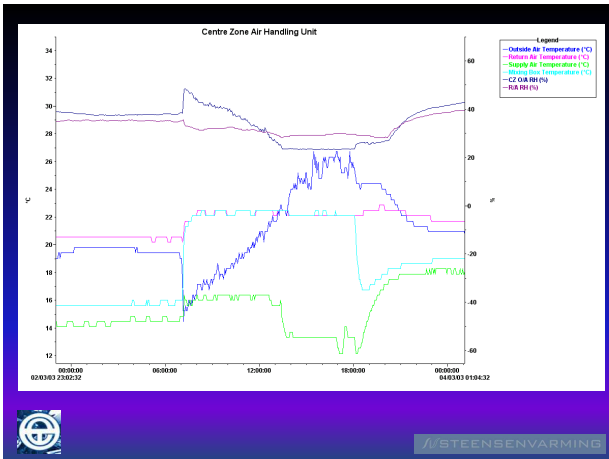
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**Some energy saving features of a BMS system, which are often not used or not properly set up include.**

- night purge
- floating chilled water temperatures
- ambient lockout temperature
- demand ventilation control



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# Opportunities in Tenancies

**Tenant power is generally consumed by...**

- Lighting
- 'Small' Power
- Supplementary A/C

**Lighting takes two main forms.**

**Day lighting**

**Artificial lighting**

**Day lighting is free but:**

- It is not consistent
- It is not always available
- Glare can be a significant issue
- It can come with a heat penalty

**When Considering Artificial lighting, designers take into consideration a number of factors including efficiency and colour rendition**

**In commercial office environments, fluorescent and low voltage halogen lighting is most prevalent.**



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**Fluorescent lighting has changed over the years. T12, T8, T5 and CF.**



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**When looking at the power consumed by fluorescent lighting, it is important to take into consideration the ballasts.**



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**How do you save lighting energy?**






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**It is important to get the basics right FIRST**



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**Very often spaces are over-lit**

-  Look at reducing the number of lights (better spacing)
-  Look at reducing the number of tubes
-  Look at replacing the luminaires



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Ask yourself - is the type of  
lighting appropriate?  
Are there alternatives?



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Do not be seduced by the  
controls technology.



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Rubbish In  
=  
Rubbish Out

If you have an inefficient lighting  
system at the start, and you add  
sophisticated controls, you end up  
with an inefficient *but sophisticated*  
lighting system.



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Office Equipment  
(Small Power)



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
#### Office equipment includes

-  Computers
-  Printers
-  Copiers
-  Fridges
-  Dishwashers
-  Mini-boilers
-  Desktop lights and fans



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#### How do you reduce office equipment energy consumption

-  Turn things off when not needed.
-  Enable 'energy star'
-  Don't be fooled by screen savers
-  Buy equipment that is inherently  
energy efficient



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Supplementary air conditioning is often found in:

- ✂ Meeting/training rooms, because occupancy levels might exceed 1 person per 10m<sup>2</sup>,
- ✂ Computer rooms, print rooms etc, because power loads can be very high, and the equipment may not tolerate high temperatures.
- ✂ Engineers offices, because they will be occupied 'out of hours'



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Computer Room Conditioners

- ✂ Usually found in computer or communications rooms
- ✂ Often water cooled and connected to the tenants condenser water circuit
- ✂ Often discharges air into a floor void
- ✂ May incorporate a humidifier



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No matter what form it takes, a supplementary air conditioner will consume energy, and will cost money to operate and maintain.



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**Supplementary Air  
Conditioning - What  
Should You Be Wary  
Of?**



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**The IT  
Department**



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**The IT  
Department**



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Unfortunately there is a doctrine within the IT industry that states computer rooms and communications rooms should be kept at 20 - 22°C. In not all cases is this doctrine true



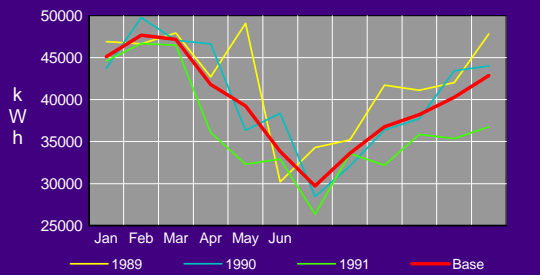
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# Get Your Maintenance Programs Right



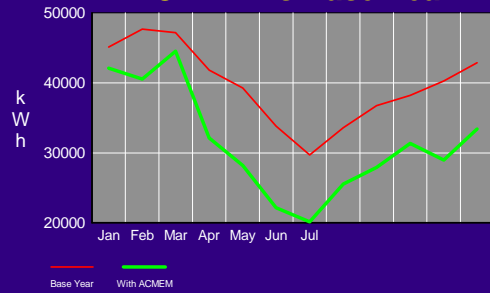
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## Establishing the Base Year Values



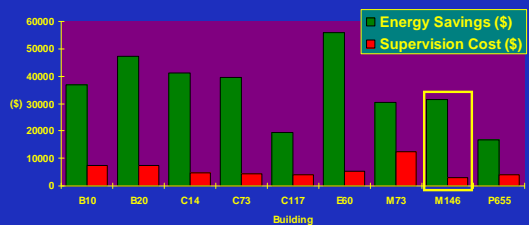
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## ACMEM Vs Base Year



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## Supervision Cost Vs Energy Savings



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## How To Ensure Proper Building Services Maintenance



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As a minimum a proper maintenance specification MUST Include...

- ✂ A program of works (stating what has to be done - and when)
- ✂ Instructions for the technician (concise and workable)
- ✂ A medium on which results can be reported



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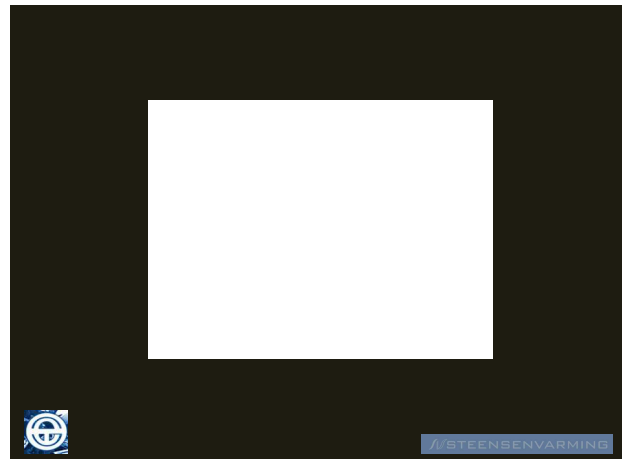
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### Summary

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