Reducing carbon emissions provides other benefits including reduced operating costs

John Penny MAIRAH QCxP

Why existing buildings?

- lots of existing buildings
- all have opportunities
- benefits range from less than a month to one year economic payback
- helps identify capital and rehab projects with economic payback from one to 20 years

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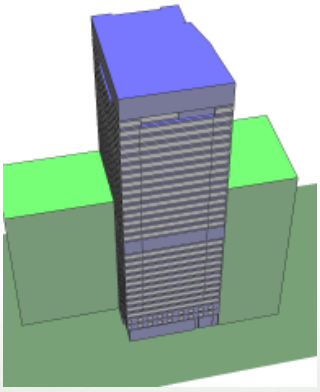
Case Study: 45 Clarence

Existing Building



Model

Where do we begin?

- Assessment/Pre-investigation
- Owner's Project Requirements

Pre Design Phase

Owner's Project Requirements

Goals

- Upgrade from 3.25 to 4.5 stars by mid 2012
- Retain A grade office
- Integrated project team
- Optimize what exists, without significant replacement
- Avoid redesign of conventional systems
- Back to basics scheme preferred
- Incentive from Green Building Funding

Pre Design Phase

Energy Efficiency Initiatives

Engineering Plant & Electronic Systems

- Heating, cooling and ventilation
- Building management & control
- Hot water
- Lighting systems
- Utilities metering

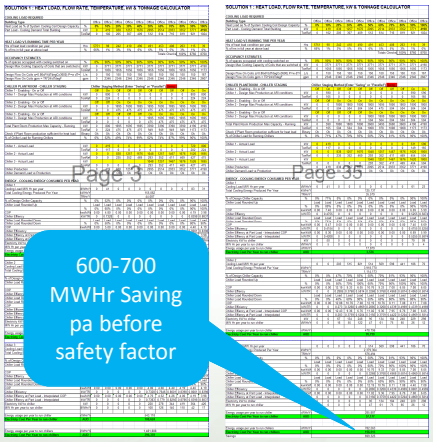
(Building envelope required only minor aesthetic upgrades)

Investigation Phase

Analysis of Options

Example of Options Analysed

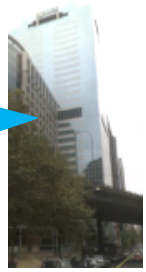
- 3 Existing Trane Chillers
- 2 Powerpax + 1 Existing
- 3 New Powerpax Seq'ce
- 3 New Trane Parallel
- 3 New Powerpax Parallel
- 3 New York High Eff
- By changing from 800 + 1695 + 1695 kW to 590 + 1800 +1800 kW Saved $50k cap-ex
- Existing COP 3.98 - 5.5
- New COP 6.05 -13.92



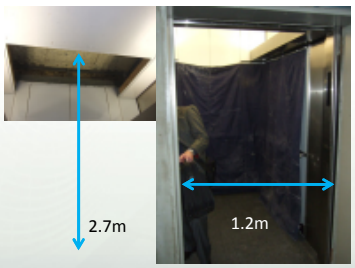
Detailed Analysis

Implementation

Understand limitations on site



Problematic access for crane access due to neighbouring building



Goods lift dimensions

Implementation

Operating System

- integrated project team
- quality focused commissioning process with three step verification
- prescriptive technical specification with functional requirements to achieve the owner's project requirements
- lesson learned: PM needed to be on site more frequently

Implementation

Engineering Initiatives

Heating, Cooling & Ventilation Plant

- single chiller replacement (later upgraded to all)
- variable speed drive replacements and additional units for pumping systems
- boiler replacement (later deleted)
- lift motor room A/C
- air handler new heating coils and rationalization of local reheating (later deleted)
- hydronic systems test and balancing
- repairs and maintenance of VAV air terminal unit (nearly 650 units)
- repairs to air handler economy & min OA dampers

Lighting systems

- office floor rezoning and switching (deferred)
- Foyer
- Lift lobbies
- Car park
- Toilets

Building Management & Control System

- workstation and software upgrade with extensive data logging and trending facilities
- main plant controller and network upgrade
- new CO2/VOC demand ventilation control
- upgrade air handler outdoor ventilation
- upgrade car park ventilation control
- retain working VAV air terminal unit controllers
- verify existing sensors & actuators

Other

- solar boosted hot water units
- sub metering of main switchboard, lift machinery and mechanical plant
- gas metering of hot water and heating water
- sub metering water consumption
- electrical power factor correction

Schedule Requirements

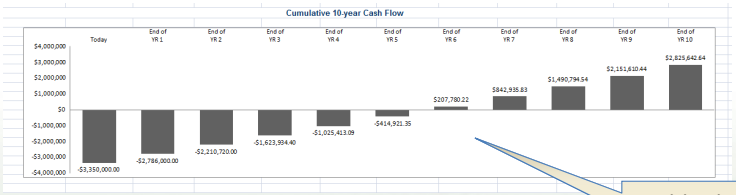
Activity	Finish Date
Assessment/Pre Investigation	Dec 2009
Strategic Improvement Plan	March 2010
Tender Specification & Drawings	June 2010
Implementation starts on site	Nov 2010
Implementation finishes on site	June 2011
Functional Performance Testing	July 2011
NABERS Energy Rating Assessment	May 201[illegible]

Very tight !

Cost & Benefits

Financial July 2012

Return on investment (ROI) from energy and operational savings is > 15%.



Positive in 6th year

Benefits

Energy Rating

Project goal was NABERS 4.5 stars

Delivered 5 stars in 1st year of operation with zero green energy

Carbon Emissions reduction

Goal of 37% was aggressive - delivered 43% carbon savings & energy savings of 50% in 1st year

Electrical Peak Demand Reduction

A saving of 39% over last 12 months - a true measure of deferring investment on the grid

Benefits

Occupant Comfort Index

Defined as the percentage of operating hours spent within a recommended temperature range. ASHRAE Standard 55-2004 recommends a range of 20-26°C. 45 Clarence set a target of 95% within 20-25°C. Temperature is measured for each zone and an overall index is provided for the whole building.

- Achieved 90% reduction in requests & issues from occupants
- Productivity benefits from these comfort levels are suggested to be many times the energy savings

Benefits

Occupant Comfort Report - July 2012

Name	Status	Comfort Index	Time High	Time Low
Total Building		98%	0.82%	0.91%

Zone Issues – July 2012

Name	Status	Comfort Index	Time High	Time Low
VAV.L03-E1		78%	0%	22%
VAV.L04-CW2		43%	57%	0%
VAV.L04-W3		86%	0%	14%
VAV.L11-CE3		28%	72%	0%
VAV.L11-N1		65%	0%	35%
VAV.L24-W3		0%	100%	0%
VAV.L25-CW5		0%	100%	0%
VAV.L25-N4		89%	11%	0%
VAV.L27-S1		90%	0%	10%
VAV.L28-CN2		0%	0%	100%
VAV.L28-CW2		85%	15%	0%
VAV.L28-W1		0%	0%	100%
VAV.L16-N3		0%	0%	100%

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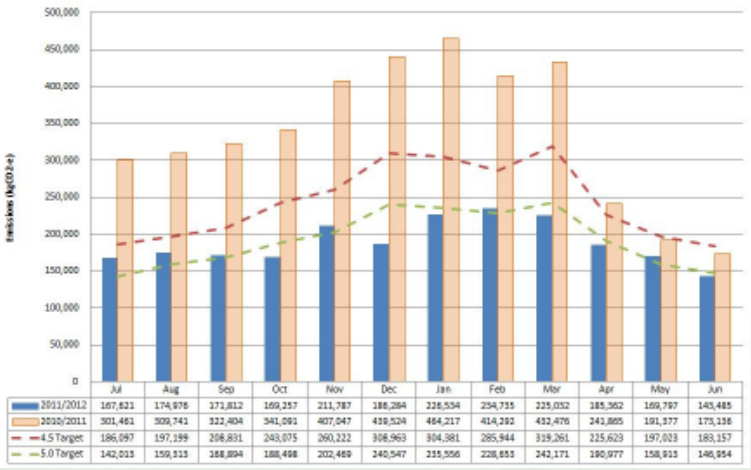
Carbon Emission Savings



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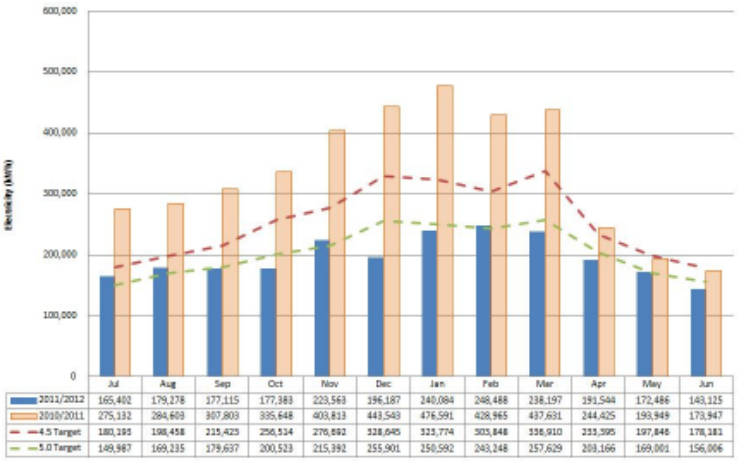
Electricity Savings



	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2011/2012	165,402	179,278	177,115	177,383	223,563	196,187	240,084	248,488	238,197	191,544	172,486	143,125
2010/2011	275,132	284,603	307,803	335,648	403,813	443,543	476,591	428,965	437,631	244,425	193,949	173,947
4.5 Target	180,195	198,458	215,425	256,514	276,692	328,645	323,774	303,848	336,910	233,395	197,846	178,181
5.0 Target	149,987	169,235	179,637	200,523	215,392	255,901	250,592	243,248	257,629	203,166	169,001	156,006

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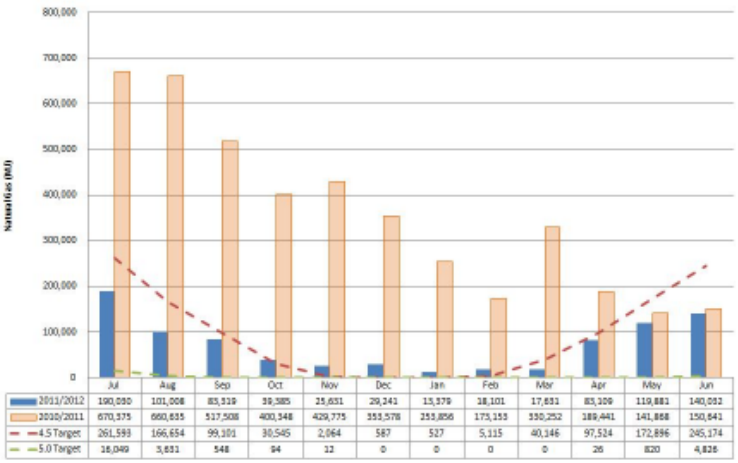
Gas and Heating Savings



	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2011/2012	190,050	101,008	83,519	39,585	25,651	29,241	15,379	18,101	17,631	83,109	119,881	140,052
2010/2011	670,375	660,635	517,508	400,348	429,775	353,578	253,856	175,153	330,252	189,441	141,868	150,641
4.5 Target	261,593	166,654	99,101	30,545	2,064	587	527	5,115	40,146	97,524	172,896	245,174
5.0 Target	18,049	3,631	548	94	12	0	0	0	0	26	820	4,826

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Continuous Improvement

Key Performance Indicators

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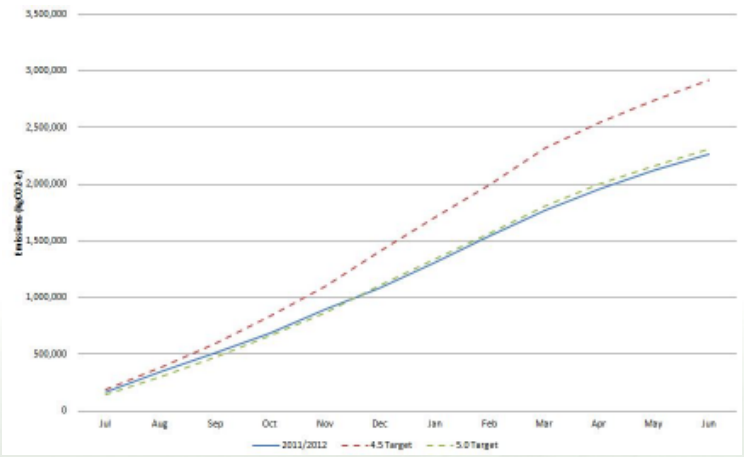
Performance Tracking



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Continuous Improvement

Current Proposals

- tenant supplementary A/C heat rejection
- extend system performance tracking
- peak electrical demand control

Acknowledgments

"A pleasing aspect of the project and key driver in its success, was the collaboration and respect shown amongst the key contractors, Arup's and the DEXUS team", Paul Wall DEXUS Property Group

DEXUS Property Group
Paul Wall - CapEx and Energy Manager
Craig Brighton - Project Manager
Robert MacKay – Senior Building Services
Stephen Beaver - Building Manager
ARUP – Project Manager, Engineer & Commissioning
Eric Serret – Project Manager
Kate McAlpine – Controls Specialist /Technical Project Manager
John Penny – Commissioning Authority
Jeffrey Van Zetten – Energy Modelling, Hydronic Test & Balancing

Haden – Mechanical Services
Ron Burke -Site Manager
Ivo Grego - Commissioning
Tom Astalosh - Engineering
Carlos Martinez - Maintenance

Allworx Electrical
Stephen Bruen, Project Manager
Graeme Simpson, Electrical Site Foreman
Dermot Minihan, Electrician
Ciaran Needham, Electrician
Jay Collet: Apprentice
Andrew Hill: Apprentice

Haden Sub-Contractors:
Austpipe
Terry's Electrical Services
Sika Services
Interchillers (Powerpax)
GnT Insulations
Corellian (Riggin and demolishion)

Greenstar Automation
Zelko Rezo
Ian Adams
Graham Lee
Robert Velk (Controls Overview)

A champion team will always win over a team of champions

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