



High Performance Green Buildings: the Future of Facility Management

Workshop Summary Report

Report prepared for: RoFMA / RoGBC

Date: 23 February 2010

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For further information on this report please contact:

David Clark

Tel: +44 (0)161 244 5660

Email: d.clark@cundall.com

Cundall Manchester

Portland Tower

Portland Street

Manchester M1 3AH

Prepared by	Project Partner	Verified by	Revision	Date
David Clark	David Clark		-	March 2010

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1. Introduction

In February 2009 in Bucharest, the Romanian Facility Management Association (ROFMA) organized together with the Romania Green Building Council (RoGBC), the first event dedicated to Green Buildings from a Facilities Management point of view.

The workshop, “High Performance Green Buildings: the Future of Facilities Management” attracted over forty professionals in the Romanian Facilities Management sector from leading companies demonstrating strong interest in the subject.

ROFMA and RoGBC engaged CUNDALL Engineering’s David Clark to prepare and deliver the comprehensive curriculum providing instruction, best-in-class case studies, and interactive exercise for the participants. The workshop included:

- the impacts of the existing EU legislation and green building rating tools on Facility Management
- Steps to Low Carbon buildings and the role of facility managers, and
- developing a Building Improvement Plan and tools needed to reduce energy and environmental impact for existing buildings.

Both of our organizations greatly appreciated the dedication, competence and enthusiasm of Mr. Clark and the provision of CUNDALL’s expertise for the benefit of our respective missions to professionalize the Facilities Management sector and to transform the construction and buildings sector toward greater energy efficiency and environmental responsibility.

We are confident readers of this report will find the information as useful as we did.

Cristian Vasiliu
Executive Manager
Romania Facility Management Association

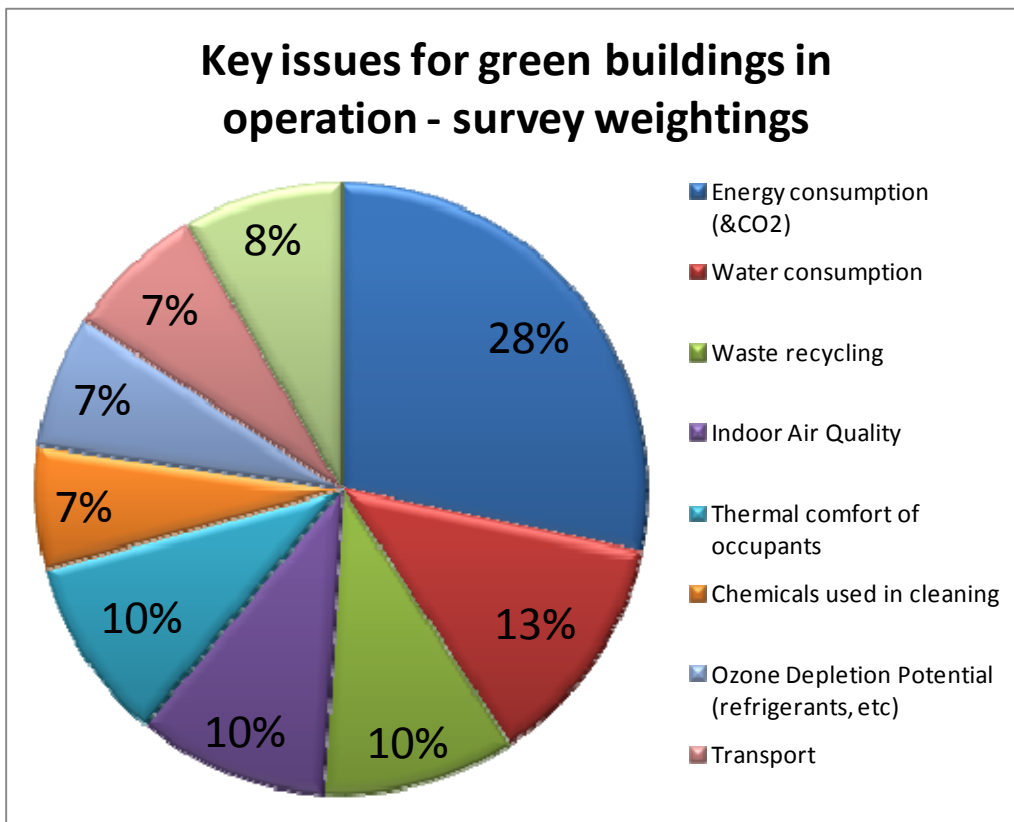
Steven Borncamp
President
Romania Green Building Council

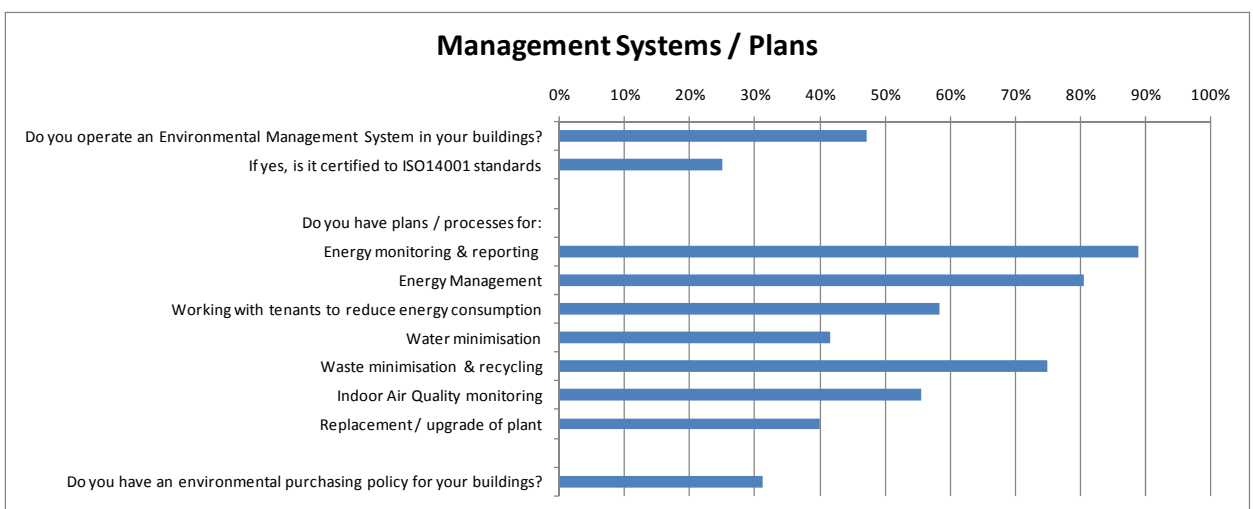
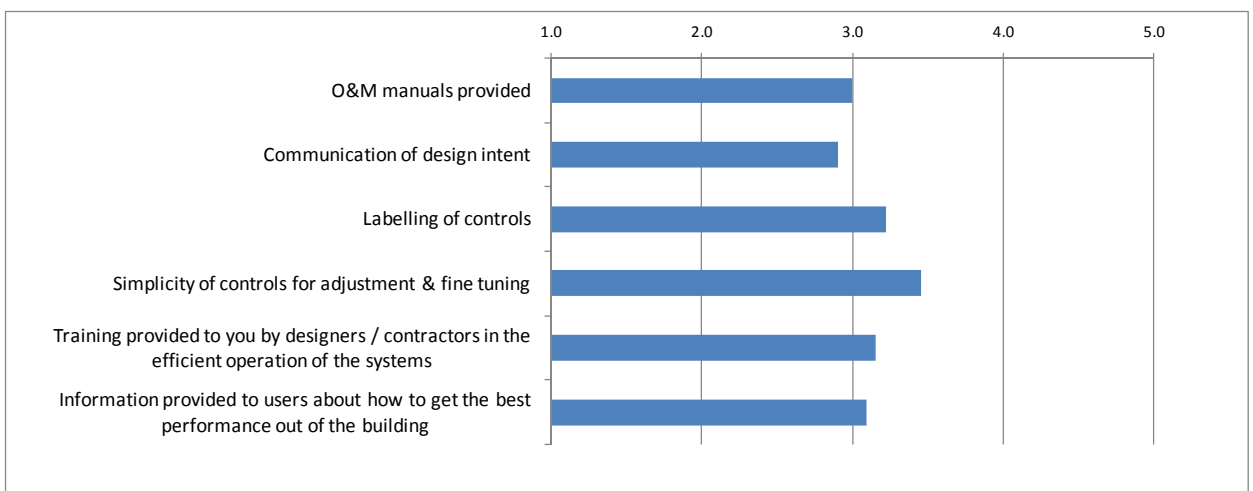
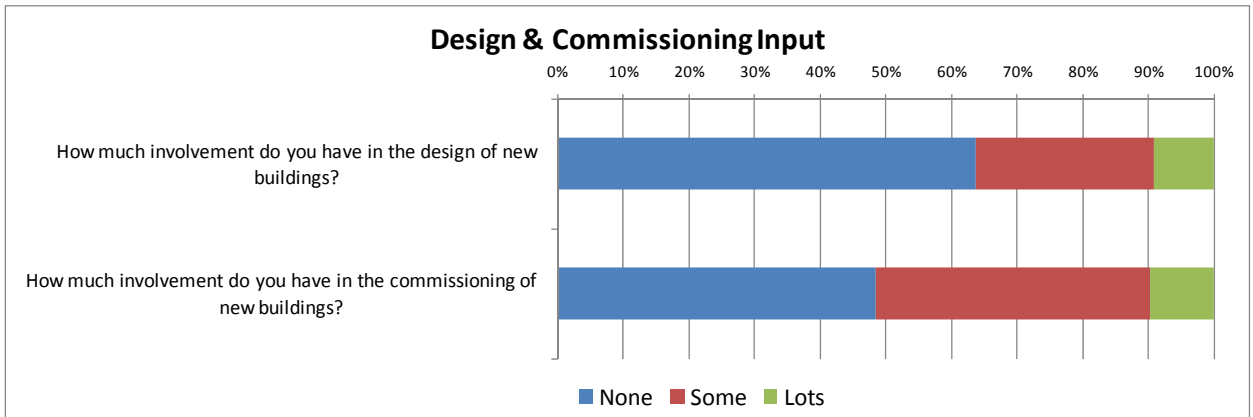
2. Survey Results

A survey was undertaken during the workshop to get feedback from the participants on:

- Key issues for green buildings in operation
- How well buildings are handed over to Facility Managers
- Extent of Management Systems in place for buildings in Romania

A copy of the survey form and the full responses to the survey are included in Appendix A.





3. Group Discussions

Towards the end of the workshop the participants were split into three groups and asked to prepare responses to the following questions:

- What tools would help the Romanian FM industry reduce the energy & environmental impact of buildings?
- What are the easy wins that can be implemented in Romanian buildings this year?

A summary of the responses are given below:

- Existing Energy Efficiency Legislation (e.g. Law 372/2005) needs to be enforced to be effective
- Training and awareness in energy efficiency and green buildings required for
 - Facility Managers
 - Building Users
- Improve energy / water monitoring systems
- Simple Performance Benchmarks (e.g. energy, water) needed specific to Romania
- Transparent public reporting of building performance will influence behaviour
- Government incentives to encourage greener development (e.g. tax benefits)
- Involve Facility Managers during design stages of projects (learn lessons from actual operation and include these in design)
- Waste management is important
- Develop greener cleaner processes (less toxic chemicals)
- Communicate / collaborate more with tenants – work together to save energy (e.g. switch off campaigns, shared incentives)
- Keep it simple – the more complicated the building, the less likely it is to work properly

More detail on the responses are included in Appendix B.

Appendices

A. Survey

A1. Survey Form

Key issues for green buildings in operation

You have 100 points to spend. Please allocate these points against the following issues:

ISSUE	POINTS
Energy consumption (&CO2)	
Water consumption	
Waste recycling	
Indoor Air Quality	
Thermal comfort of occupants	
Chemicals used in cleaning	
Ozone Depletion Potential (refrigerants, etc)	
Transport	
Ecology	
TOTAL	100

Any comments?

Building Handover to FM team

How much involvement do you have in the design of new buildings?

How much involvement do you have in the commissioning of new buildings?

On a scale of 1 (poor) to 5 (excellent) how would you rate the quality of the following:

O&M manuals provided	
Communication of design intent	
Labelling of controls	
Simplicity of controls for adjustment & fine tuning	
Training provided to you by designers / contractors in the efficient operation of the systems	
Information provided to users about how to get the best performance out of the building	

Management Systems / Plans

Do you operate an Environmental Management System in your buildings?

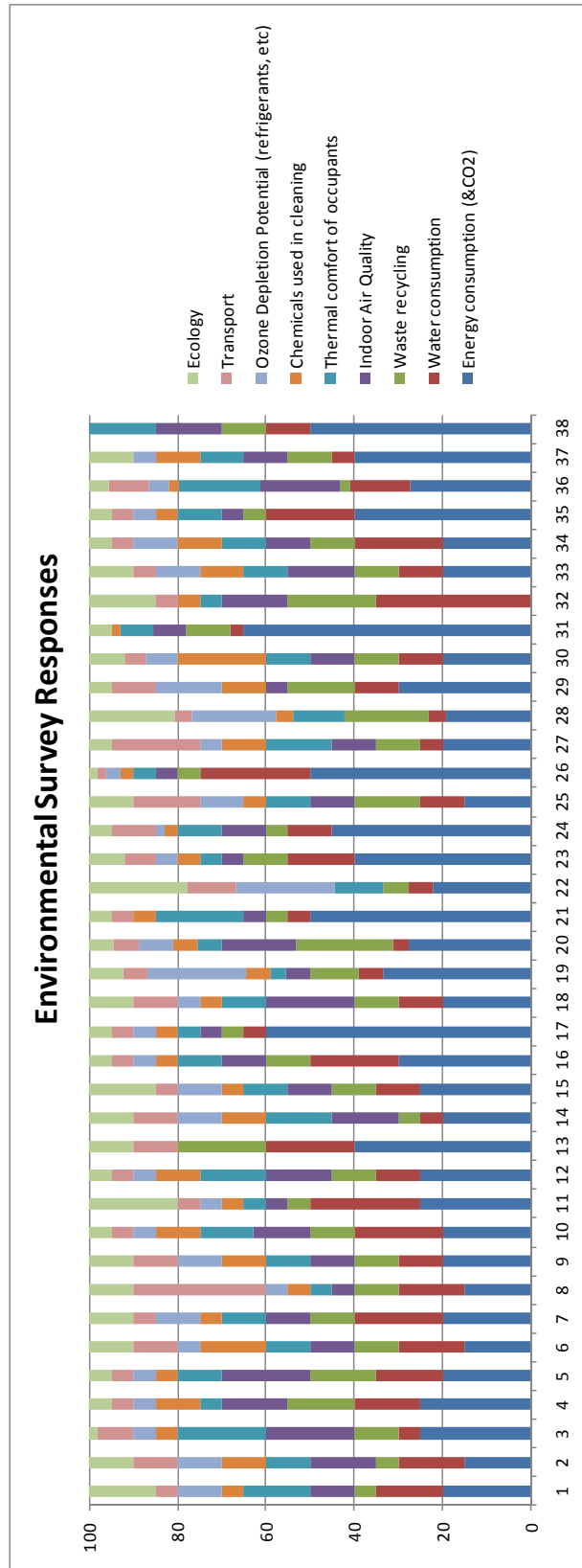
If yes, is it certified to ISO14001 standards:

Do you plans / processes for:

	Yes / No
Energy monitoring & reporting	
Energy Management	
Working with tenants to reduce energy consumption	
Water minimisation	
Waste minimisation & recycling	
Indoor Air Quality monitoring	
Replacement / upgrade of plant	

Do you have an environmental purchasing policy for your buildings?

A2. Responses



SURVEY INPUTS 23 FEB 2010																																						
ISSUE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Energy consumption (kCO2)	20	15	25	25	20	15	20	15	20	20	25	25	40	20	25	30	60	20	33	28	50	22	40	45	15	50	20	19	30	20	65	20	20	40	27	40	50	
Water consumption	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Waste recycling	5	10	15	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Indoor Air Quality	10	15	20	15	20	10	10	5	10	13	5	15	15	10	10	5	20	6	17	5	0	5	10	10	5	10	0	5	10	7.5	15	15	10	5	18	10	15	
Thermal comfort of occupants	15	10	20	5	10	10	10	5	10	10	5	15	15	10	10	5	10	5	6	20	11	5	15	12	10	5	15	12	10	7.5	5	10	10	10	18	10	15	
Chemicals used in cleaning	5	10	5	10	5	10	5	5	10	5	10	5	10	5	10	5	5	5	6	5	0	5	3	5	3	5	3	10	4	10	20	2	5	10	5	2	10	0
Ozone Depletion Potential (refrigerants, etc)	10	10	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
Energy	15	10	2	5	2	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
TOTAL	1075	475	365	369	245	288	319	360																														
<p>Management Systems/Plans</p> <p>Do you operate an Environmental Management System in your buildings? Yes: Y No: N Is it certified to ISO 14001 standards Yes: Y No: N</p> <p>Do you have plans / processes for: Energy monitoring & reporting Energy Management Working with tenants to reduce energy consumption Water minimisation Waste minimisation & recycling Indoor Air Quality monitoring Replacement / upgrade of plant</p> <p>Do you have an environmental purchasing policy for your buildings? Yes: Y No: N</p>																																						

B. Workshop Discussions

B1. Tools needed

Group 1

- Environmental awareness & training
- Specialized wasted recycling companies needed
- Energy saving programs – targets, actions, plans, investment
- Usage of ecological and environmentally friendly materials
- Improved monitoring of utilities (energy / water)

Group 2

- BMS – keep it simple
- Limiting control of the tenants over the building systems.
- System that allow to switch on and off in the weekends.
- A standard for energy measurement according to the exterior conditions.
- Government enforcing of legislation (e.g. EPC)
- Government incentives (e.g. smaller tax for technology upgrading)
- Educate tenants about temperature / comfort and energy consumption
- Public visibility of building performance – voluntary, transparent
- Training / certification program
- Benchmarking data needed

Group 3

- Romanian legislation 325/2005 in accordance with EU legislation
- Government incentives / penalties to improve performance of buildings
- Training for FM's and tenant's administrative personal
- Display energy certificates in front of buildings - visible place, public, mandatory
- FM involved in design

B2. Easy Wins

Group 1

- Training for energy saving and efficiency – cheap (time not equipment)
- Implement “Switch off policy”
- Stimulate people to do waste separation
- Optimising of HVAC – e.g. increase setpoint by 1°C

Group 2

- Tenant Guide to Building
- Building User Guide for FM
- Communication strategy to building users
- Simple labels to educate (e.g. *switching off the light is reducing greenhouse gas emissions which contribute to climate change – it’s not about being cheap*)
- Waste management
- Develop operating procedures
- Start measuring energy / water performance and use data to report performance and monitor trends
- Do cleaning during the day to reduce time lights left on at night
- Competitive benchmarking for buildings

Group 3

- Thermal insulation for walls, roofs
- smart submetering for electricity, water gas
- Fixing faulty dampers, valves, etc
- Recycling more visible for waste and rain water
- Solar panels for hot water

C. Workshop Attendees

Company	First Name	Surname	Position
ABCRO Romania SRL	Aleodor	Tudorache	Manager
	Laurentiu	Sadacliev	Ass. Manager
AIV Administrare de Cladiri SRL	Alina	Macedon	Executive Director
ARCHIBUS SOLUTION CENTER ROMANIA	Tudor	Trita	Managing Director
BUILDING SUPPORT SERVICES	Lucian	Anghel	Chairman of the Board, Managing Director
	Roxana	Bodo	Deputy Managing Director
	Silvia	Tancof	Operational Director
	Adrian	Balasu	Sales and Marketing Manager
	Eugen	Stoenescu	Head of Facility & Property Management
CONJECT	Daniel	Iuga	
CONSTRUCTION & MAINTENANCE CONSULTING	Sergiu	Budau	Director
CORAL CONSTRUCT	Richard	Mocko	Facility and Business Development Manager
	Mihai	Simionescu	Technical Manager
	Marius	Constantin	Technical Manager
CUNDALL	Alec	Stewart	Partner
	David	Clark	Partner
	Vassilios	Giannakos	Principal Engineer
EFG EUROBANK PROPERTY SERVICES S.A.	Dimitra	Marini	General Manager
	Alexandru	Pocatilu	Head of Dept.
	Gabriel	Bondrila	Engineer
IBP REAL ESTATE	Catalin	Zafiu	Executive manager

OMV PETROM SA	Andreea	Rujinski	jr. Project Manager
	Marian	Staicu	Project Manager
	Mircea	Dobre	Director P-Facility Services, Corporate Real Estate Management Finance
	Christoph	Platzer	Director
	Gabriel	Vaduva	Head of FM Coordination P-Facility Services
	Gavril	Nistor	Facility Manager
OVE ARUP & PARTNERS	Finbar	Murphy	MEP Leader
PAV ADMINISTRARE IMOBILIAR SRL	Mihai	Dosanu	FM Manager
SALESIANER MIETTEX SRL	Adrian	Chiorean	Key Account Manager
	Aida	Petcu	Key Account Manager
SCHNEIDER ELECTRIC ROMANIA	Monica	Bucurescu	Inginer vanzari BMS
	Dan	Secheres	Director EE Services
	Niculai	Papugiu	Inginer vanzari contractori
SECURITAS	Mircea	Matei	Sales Director
	Sorin	Coman	Area Manager
SPECIALIST INSULATION LTD	Paul	Groves	Business Development
	Ralph	Doyle	Marketing
MICROSOFT ROMANIA	Radu	Fertea	Facility Manager
MT & T PROPERTY MANAGEMENT	Tudor	Ilie	Building Manager
UTI FACILITY MANAGEMENT SA	Gabriel	Bambache	Managing Director
	Marian	Dimitriu	Business Development Manager

WE CARE MANAGEMENT SRL	Alina	Nica	Real Estate Manager
	Adina	Tiparu	Real Estate Manager
ROFMA	Cristian	Vasiliu	Executive Manager
ROGBC	Steven	Borncamp	President & CEO
CA IMMOBILIEN	Florin	Zamfir	Facility Manager
SANOMA HEARST ROMANIA Revista Casa si Gradina	Adela	Parvu	Chief Editor
	Sabina	Usurelu	Garden Editor

D. Presentation Slides

ROFMA
Romanian Facility Management Association

ROMANIA GREEN BUILDING COUNCIL

WORKSHOP
Administrarea Cladirilor Verzi de inalta performanta
Viitorul in Facility Management
High Performance Green Buildings:
the Future of Facility Management

23.02.2010
Bucharest, Romania

Sponsor principal: 

Sponsor:   



Introduction **CUNDALL**

- ROFMA – Cristian Vasiliu
- RoGBC – Steven Borncamp
- Facilitator – David Clark (Cundall)

Purpose of workshop **CUNDALL**

- Green design is about good intentions
BUT
- The actual performance of buildings depends on how they are used and managed
- Green Buildings from the Facility Management point of view
 - Green design & technologies
 - Legislation & rating tools
 - Bridging gap between intent and performance
 - Planning for improvements

Agenda **CUNDALL**

9.30 Introduction

9.45 The next generation of green buildings

10.15 EU legislation & green building rating tools

10.30 Survey – “what defines a green building from an FM perspective?”

10.50 Steps to Low Carbon buildings – and the role of FM

11.15 **BREAK (30 mins)**

11.45 The gap between design intent and performance

12.10 Group Breakout session - tools & easy wins

12.40 Group Presentations & Discussion

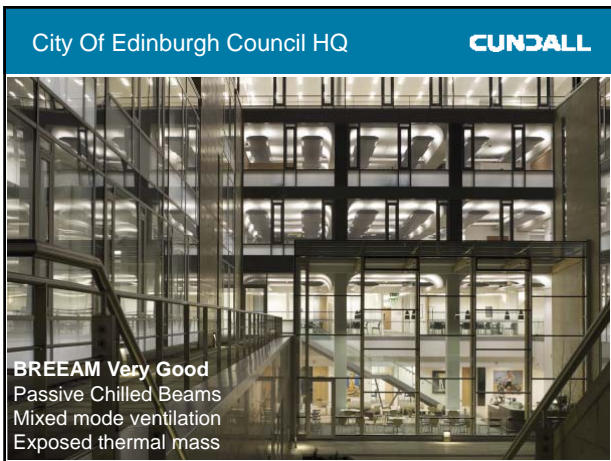
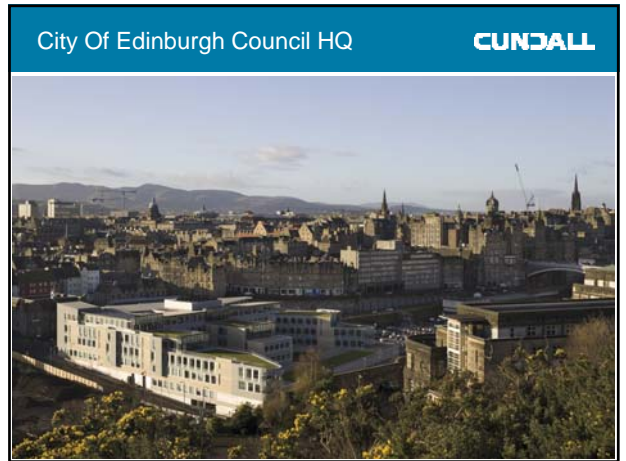
13.00 Preparing a Building Improvement Plan

13.25 Wrap-up

13.30 **FINISH**

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Examples of Green Buildings & Technologies

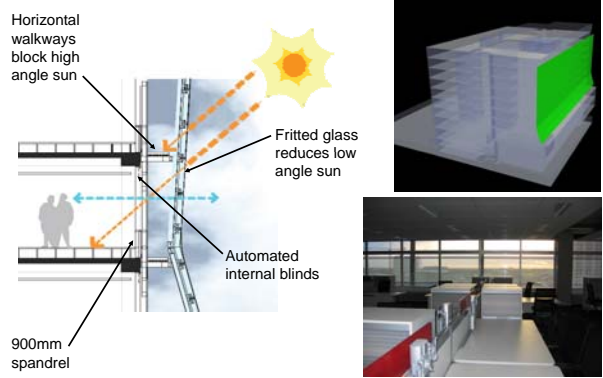


VS1, Adelaide **CUNJALL**



Key issues:
 West facade is main face of building
 West & North have views
 Displacement ventilation – high IEQ required
 6 star Green Star – contractual requirement

VS1, Adelaide **CUNJALL**

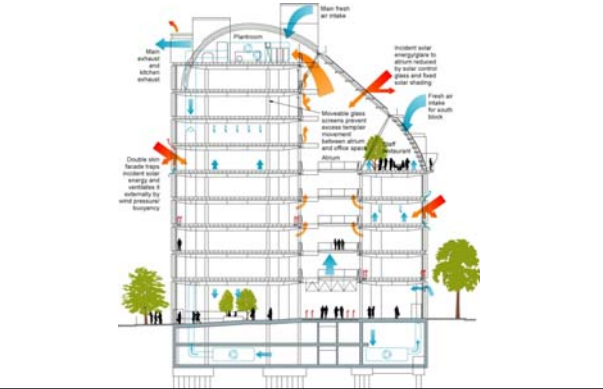


Horizontal walkways block high angle sun
 Fritted glass reduces low angle sun
 Automated internal blinds
 900mm spandrel

Wellcome Trust, London **CUNJALL**



Wellcome Trust, London **CUNJALL**



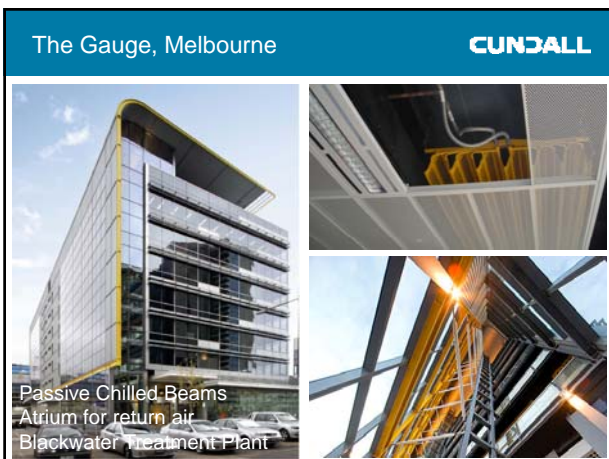
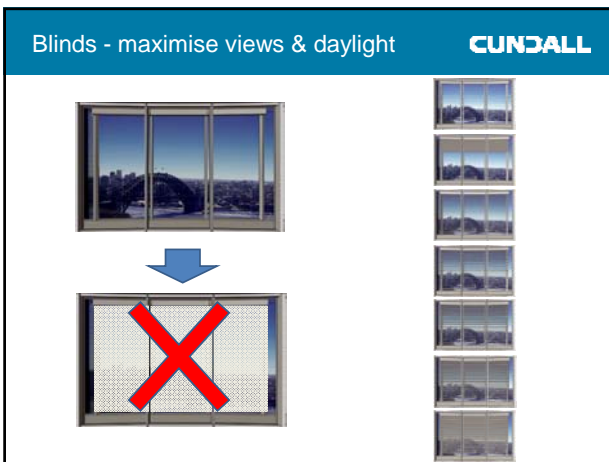
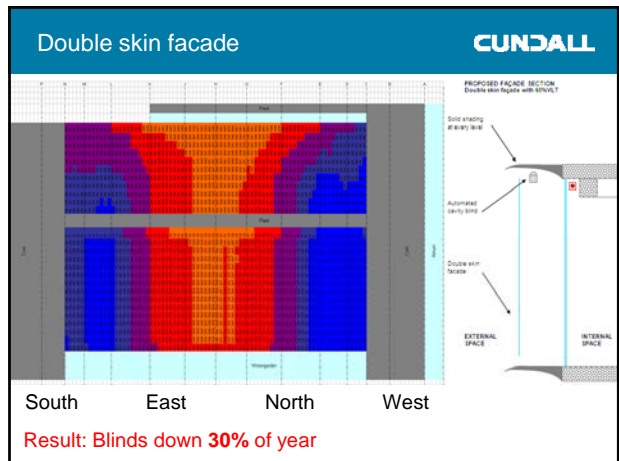
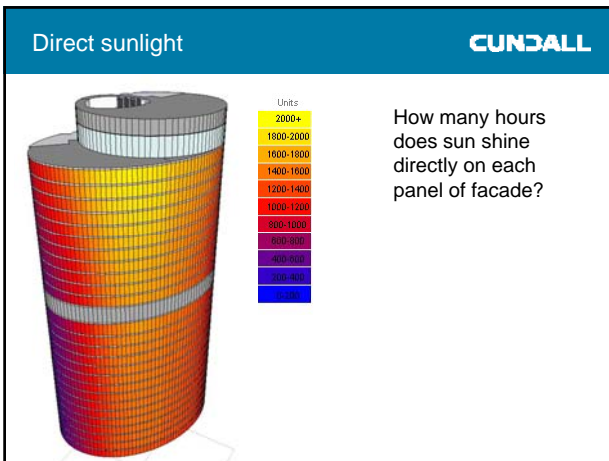
Main exhaust and kitchen exhaust
 Double skin facade from insulated glazing unit (IGU) with a cavity to reduce solar heat gain and improve transparency
 Plantroom
 Main fresh air intake
 Incident solar energy is allowed to enter building by solar control glass and high solar absorptance
 Fresh air intake for south block

Wellcome Trust, London **CUNJALL**



1 Bligh Street, Sydney **CUNJALL**





Queen Anne's Gate, London

CUNDALL



Queen Anne's Gate, London

CUNDALL



Multi Service Beam

CUNDALL

Active Chilled Beam
Lighting
Fire



Cadbury HQ, Bournville

CUNDALL



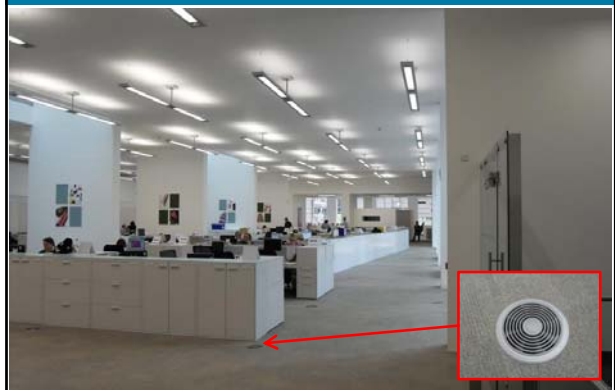
Cadbury HQ, Bournville

CUNDALL



Cadbury HQ, Bournville

CUNDALL




DALI lighting system **CUNDALL**



The image shows a DALI lighting system. On the left is a white, rectangular light fixture mounted on a wall. On the right, a person's hands are shown holding a small, white, rectangular DALI dimmer switch, demonstrating its use.

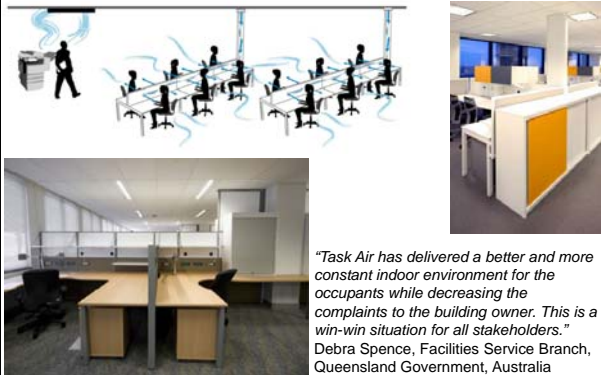
Task Air Workstation **CUNDALL**



The diagram illustrates the Task Air Workstation. It shows a modern office workstation with a desk, chair, and storage units. A red circle highlights a circular air outlet on the desk. A red line connects this outlet to a larger circular air outlet on the wall. A blue arrow points down from the wall outlet to the workstation, indicating the air supply. Text labels include "Local user adjustable conditioned air" and "Air supplied through blade into the workstation".

Innovation of the Year - Building Services Awards 2009

Task Air – new & existing buildings **CUNDALL**



The image shows Task Air in new and existing buildings. On the left, a diagram illustrates the Task Air system with people sitting at desks, connected by blue lines representing air flow. On the right, a photograph shows a modern office workstation with a Task Air unit. Below the photograph is a quote:

"Task Air has delivered a better and more constant indoor environment for the occupants while decreasing the complaints to the building owner. This is a win-win situation for all stakeholders."
Debra Spence, Facilities Service Branch, Queensland Government, Australia

CUNDALL

EU Legislation

EPBD-2 **CUNDALL**

- Energy Performance of Buildings Directive
 - First issued in 2002
 - Member states to reduce energy in buildings by 20% by 2020
 - Benchmarks set by member states
 - Building regs to gradually get tougher
 - Energy performance certificates (design or operation)
 - Updated in Nov 2010

Law 372/2005 **CUNDALL**

- Based on EPBD - 2002
- Became law on 1 Jan 2007
- Aim is to promote energy efficiency in buildings
- Key requirements
 - Minimum energy standards for new buildings
 - Energy Performance Certificates
 - Inspections of boilers & A/C
 - Improvements during repairs / refurbishment
- Enforcement?

Energy Performance Certificates **CUNDALL**

Certificat de performanță energetică

Performanța energetică a clădirii

Sistemul de certificare: Metodologia de calcul al Performanței Energetice a Clădirilor elaborată în aplicarea Legii 372/2005

Notare energetică: 59,2

Clădirea certificată: Clădirea de referință

Clasă energetică: B

Clasă energetică de referință: E

Consum anual specific de energie [kWh/m²an]: 430 / 180

Indice de emisii echivalent CO₂ [kg_{CO2}/m²an]: 85 / 40

Consum anual specific de energie [kWh/m²an] pentru:	Clasă energetică Clădirea certificată	Clasă energetică Clădirea de referință
Încălzire:	D	B
Apă caldă de consum:	E	C
Condiționare:	-	-
Ventilație mecanică:	-	-
Burnet aer condiționat:	E	C
Consum anual specific de energie din surse regenerabile [kWh/m²an]:	0	0

Law 372/2005

When:
1 Jan 2007 - construction, sale or lease of buildings
1 Jan 2010 on sale or lease of residences (now postponed)

How:
New: Energy modelling
Existing: Energy audit?

Valid for 10 years!

Enforcement:
Limited?

Energy Targets in Romania **CUNDALL**

- Buildings 1.6x less efficient than EU average
- Residential
 - Heating, hot water & lighting
 - Typical: 200kWh/m2
 - Target: 100kWh/m2
- Commercial
 - ?

RATING	kWh/m2/year
A	< 125
B	< 200
C	< 290
D	< 408
E	< 566
F	< 820
G	> 820

Law 372/2005 **CUNDALL**

- Article 11 – Existing Buildings
 - In existing buildings, with a useful floor area over 1000 m2 on running repairs, their energy performance should be improved to meet the requirements of methodology, as far as possible from the point technically, functionally and economically.
 - How is this measured?
 - How will it be enforced?
- Article 15 & 17 - Inspections
 - boilers 20-100 kW - every 5 years
 - boilers > 100 kW - every 2 years (for gas every 4 years)
 - air conditioning systems > 12 kW - every 5 years.

EPBD-2 – new requirements **CUNDALL**

- Refurbishment must result in installation of best rated component replacements
- Member States to report on the introduction of financial instruments designed to stimulate energy efficiency investments
- All building codes to include a critical path culminating in only "nearly zero energy buildings" being built by end of 2020 (end of 2018 for public authority buildings)
- Energy Performance Certificates to be permanently displayed in all buildings**, commercial as well as public, over 500 sq metres visited by the public (250 sq metres for public buildings in 2015)
- Mutual recognition across the EU of training programmes and of certified installation personnel and inspectors
- Public sector buildings must set "leading examples"; governments must "encourage" full implementation of all energy performance certificate improvement recommendations in public sector buildings
- Stricter enforcement and compliance oversight
- Inspections to cover entire systems, not just components of a system
- Mandatory requirement to inform building tenants of the refurbishment improvements options, as well as the certificate rating

EPC & DEC – design v operation **CUNDALL**

Energy Performance Certificate

- mandatory on sale, lease or refurb
- based on energy modelling

Display Energy Certificate

- not mandatory yet (except public bldgs > 1000m2)
- based on actual energy use

UK – EPC / energy in building regs **CUNDALL**

Timeline: 1995, 2002, 2006, 2010, 2019

Energy ratings: G (Over 150), F (126-150), E (101-125), D (76-100), C (51-75), B (26-50), A (0-25), A+ (0-25)

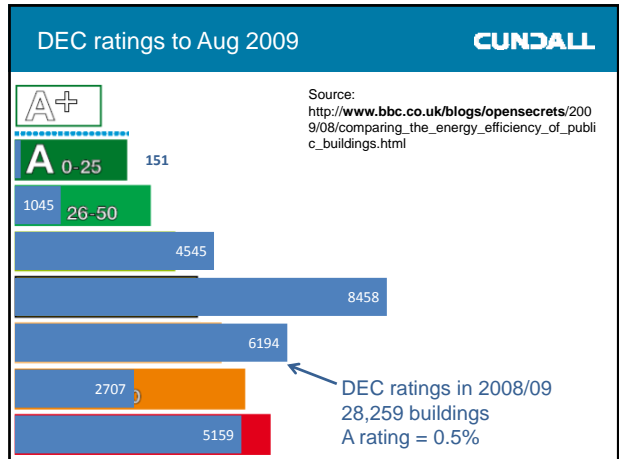
Key milestones: BREEAM 06 Excellent, BREEAM 08 Outstanding, Zero Carbon, Natural vent, Mech vent, Naturally ventilated, Mech vent, gas heating, Naturally ventilated, Mech vent, gas heating

Energy consumption: 55 kg CO₂/m²

Excludes small power

DEC = reality, EPC = perception **CUNDALL**



- DEC includes all power, EPC doesn't
- DEC based on actual energy use not modelling
- Voluntary commitment to DEC's by a growing number of property owners
- Gives clearer statement of performance
- Push from industry to become mandatory



BREEAM v LEED

Rating Tools (Design / Build) **CUNDALL**

- **LEED**
 - Various building types
 - 1 project certified in Romania
- **BREEAM Europe**
 - Various building types
 - Bespoke versions can be tailored to suit
 - 1 project certified in Romania
 - Numerous projects registered


Lakeview, Bucharest CUNDALL

- BREEAM Very Good
- Aug 2009
- AIG Lincoln



Issues covered by both tools CUNDALL

- Management
- Health & Wellbeing
- Energy
- Transport
- Water
- Materials
- Waste
- Land Use & Ecology
- Pollution

NOTE: LEED uses 5 categories (Sustainable Site, Water, Energy & Atmosphere, Materials & Resources, Indoor Environment Quality)

BREEAM v LEED CUNDALL


- Both design / construction based tools
- Rate design intent
- Commissioning / handover important
- Different criteria, methodologies, certification processes – but roughly comparable
- Key difference – BREEAM uses local standards, LEED uses US standards

Building Operation Ratings? CUNDALL

- Various tools for energy
 - NABERS (australia)
 - DEC (uk)
- NABERS also looks at water, waste and IEQ
- BREEAM-in-use tool released in UK in 2009
 - On-line software to be upgraded
 - Not available in Europe yet

BREEAM-in-Use CUNDALL

- Three types of rating
 - The Building (Asset Rating)
 - The operation of the building (Building Management Rating)
 - How clients are managing their activities within the building (Organisational Rating)
- Each rating is separate



<http://www.breeam.org/inuse>

Issues assessed CUNDALL

- **Management:** overall management policy, commissioning site management and procedural issues;
- **Energy use:** operational energy and carbon dioxide (CO2) issues plus DEC, EPC and EMS.
- **Health and well-being:** indoor and external issues affecting health and well-being
- **Life safety:** property protection and false alarm management
- **Pollution:** air and water pollution issues
- **Transport:** transport-related CO2 and location-related factors such as staff travel
- **Ecology:** ecological value conservation and enhancement of the site
- **Materials:** environmental implication of building materials used, including lifecycle impacts
- **Water:** consumption and water efficiency



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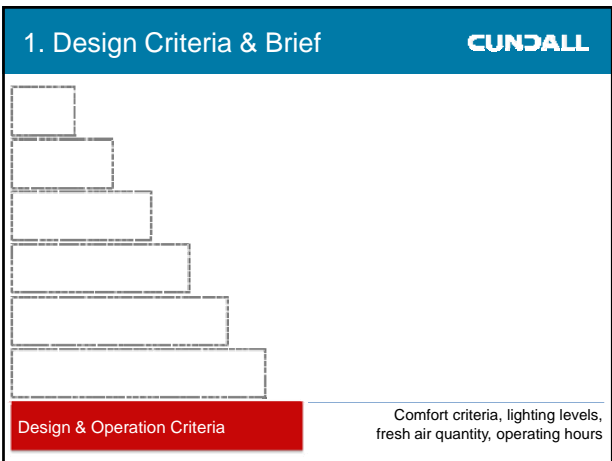
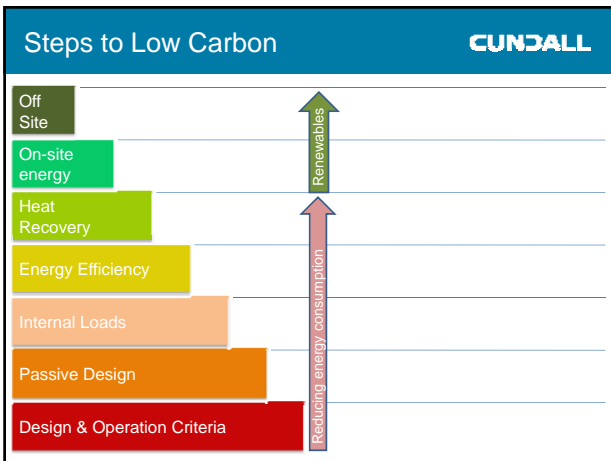
SURVEY

- CUNDALL**
- Survey
- “What defines a green building from an FM perspective?”
 - Survey form to complete
 - 100 points to spend against issues
 - Before starting – are there any issues missing?
 - Please hand in forms

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Steps to Low Carbon

- CUNDALL**
- Three key considerations
- People
 - Behaviour
 - Expectations
 - Design
 - Daylight
 - Thermal
 - Ventilation
 - Resources
 - Technology
 - Energy efficiency
 - Controls
 - Renewables
- 
- 



Define comfort criteria

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VS1, Adelaide
6 Star Green Star



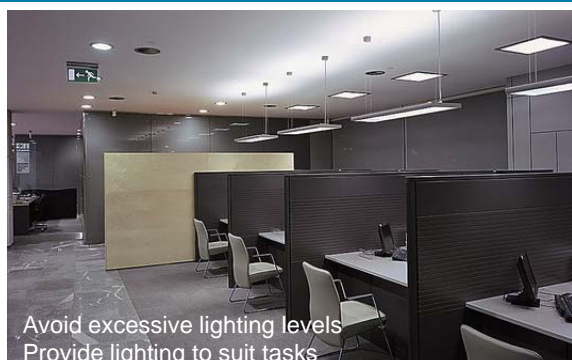
Setpoint Changes

Green Lease: design temp 20°C – 26°C

Trade off: 100% outside air & user control of air grilles

Lighting design

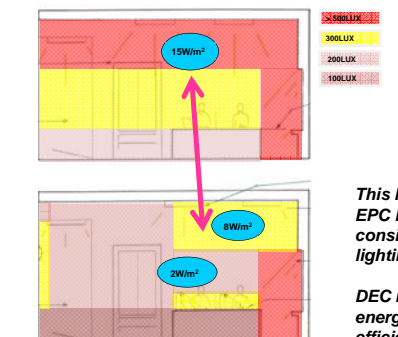
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Avoid excessive lighting levels
Provide lighting to suit tasks

Too much light

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Reduction of 8% CO₂


This has little impact on an EPC Rating as it only considers the "efficiency" of lighting not quantity.

DEC rating measures actual energy so includes quantity, efficiency and hours of switched on

Zoning & monitoring operation

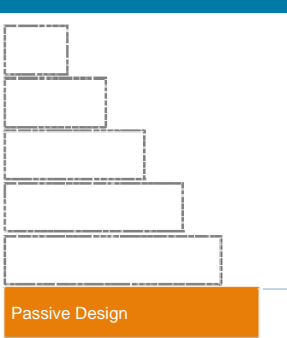
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- How to save energy – turn it off when not needed
- Zoning to suit different uses (lighting / AC)
- Lease arrangements – users pay for out of hours?
- Energy monitoring systems
- Energy management plan



2. Passive Design

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Passive Design

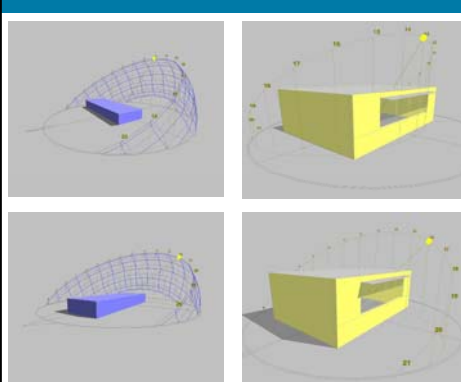
Design & Operation Criteria

Form: daylight & natural ventilation
Fabric: insulation, facade, thermal mass

Comfort criteria, lighting levels, fresh air quantity, operating hours

Built Form – orientation

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North South Orientation
Effective External Shading

East West Orientation
Difficult to Shade

Climate & orientation tools

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Orientation, Overshadowing, Sun path analysis, Location, Micro climate Analysis, Pedestrian Comfort Analysis

Facade design

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- Impacts
 - Energy (HVAC, lighting)
 - Comfort
 - Daylight / Views / Glare
 - Aesthetics
 - Cost (capital / maintenance)
- Issues
 - Area, type & location of glass
 - Shading
 - U-value / permeability
 - Natural ventilation

Facade management

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- Who controls openings?
 - Automated
 - Manual
- Who controls blinds?
 - Automated
 - Manual
- Example
 - Wellcome Trust – vented double facade
 - Cleaners open vents in summer, close in winter

3. Internal Loads

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Internal Loads: Lighting & Equipment (W/m2), Controls – turn off

Passive Design: Form: daylight & natural ventilation, Fabric: insulation, facade, thermal mass

Design & Operation Criteria: Comfort criteria, lighting levels, fresh air quantity, operating hours

Efficient lighting

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Task lights, Modelling lighting options

61W light fitting, 62W but 30% more light output

Improving Technologies
GaN LED – 10x cheaper (available in 2011?)

Not all light fittings are the same!

Cundall Office Energy Survey

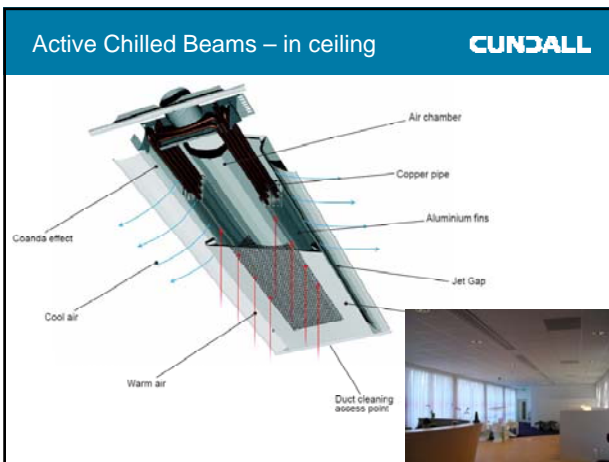
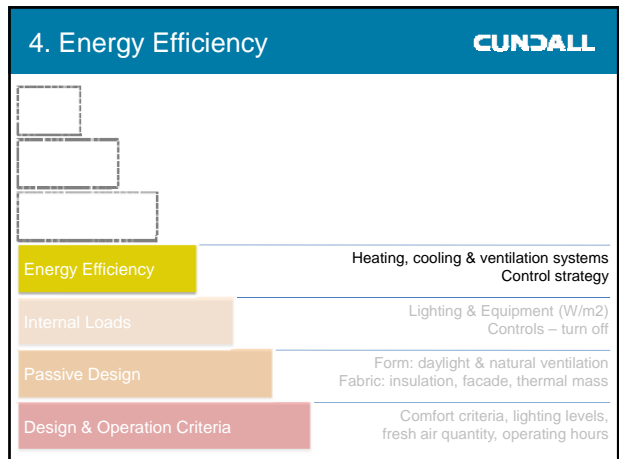
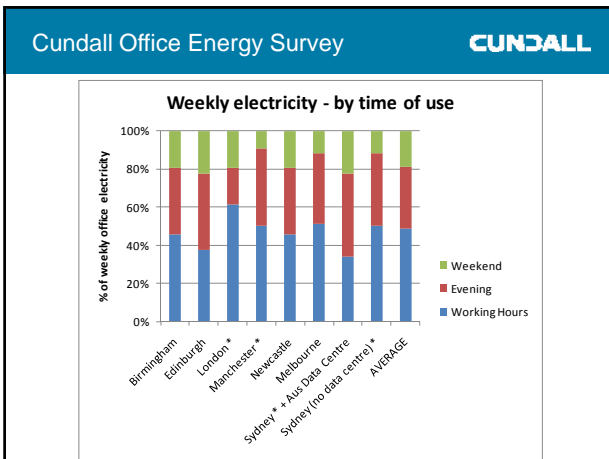
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Weekly Electricity Use - by area

kWh per week / m2

Legend: Working Hours (blue), Evening (red), Weekend (green)

Area	Working Hours	Evening	Weekend	Total
Birmingham	0.8	0.2	0.1	1.1
Edinburgh	0.8	0.4	0.2	1.4
London*	0.8	0.4	0.2	1.4
Manchester*	0.8	0.4	0.2	1.4
Newcastle	0.8	0.4	0.2	1.4
Melbourne	0.8	0.4	0.2	1.4
Sydney** + Aus Data Centre	0.8	0.4	0.2	1.4
Sydney (no data centre)**	0.8	0.4	0.2	1.4
AVERAGE	0.8	0.4	0.2	1.4



How passive beams work **CUNDALL**

Click on image for movie

Passive Beam - exposed **CUNDALL**

City of Edinburgh Council HQ

Displacement **CUNDALL**

Cadburys, Birmingham
BCO & Civic Trust Awards 2009

Chilled ceiling & Underfloor Air **CUNDALL**

Wellcome Trust HQ, London
BREEAM Excellent & numerous awards

Central Plant - rough CO2 breakdown **CUNDALL**

- Boilers (20%)
- Chillers (20%)
- Pumps & Fans (20%)
- Issues
 - Hours
 - Efficiency
 - Correct operation
 - Heating fighting cooling?
 - Dampers / Valves stuck?
 - Setpoints?
 - Staging at part loads?

Breakdown of Annual Carbon Emissions

Category	Percentage
Heating	27%
Hot Water	15%
Cooling	19%
Fans & Pumps	22%
Small Power	10%
Lighting	7%

5. Heat Recovery **CUNDALL**

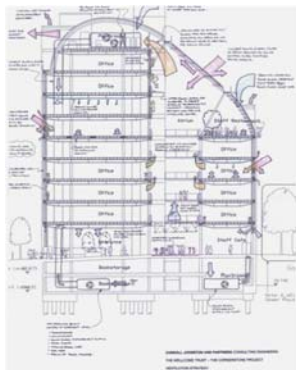
Strategy	Contribution
Heat Recovery	Air to air, waste heat from chillers, Aquifer Thermal Storage
Energy Efficiency	Heating, cooling & ventilation systems, Control strategy
Internal Loads	Lighting & Equipment (W/m2), Controls - turn off
Passive Design	Form: daylight & natural ventilation, Fabric: insulation, facade, thermal mass
Design & Operation Criteria	Comfort criteria, lighting levels, fresh air quantity, operating hours

Atrium heat recovery

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Wellcome Trust HQ



Aquifer Thermal Storage

CUNDALL



6. On-site renewables

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On-site energy	biomass, solar, wind, micro hydro gas CHP, geothermal
Heat Recovery	Air to air, waste heat from chillers Aquifer Thermal Storage
Energy Efficiency	Heating, cooling & ventilation systems Control strategy
Internal Loads	Lighting & Equipment (W/m2) Controls – turn off
Passive Design	Form: daylight & natural ventilation Fabric: insulation, facade, thermal mass
Design & Operation Criteria	Comfort criteria, lighting levels, fresh air quantity, operating hours

On-Site Energy Systems

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Increasing maintenance

Photovoltaics Solar Hot Water Wind Turbines

Biomass Boiler Gas CHP GSHP

7. Off Site Energy

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Off site	Invest in off-site renewable systems District Systems
On-site energy	biomass, solar, wind, micro hydro gas CHP, geothermal
Heat Recovery	Air to air, waste heat from chillers Aquifer Thermal Storage
Energy Efficiency	Heating, cooling & ventilation systems Control strategy
Internal Loads	Lighting & Equipment (W/m2) Controls – turn off
Passive Design	Form: daylight & natural ventilation Fabric: insulation, facade, thermal mass
Design & Operation Criteria	Comfort criteria, lighting levels, fresh air quantity, operating hours

District Heating (biomass)

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Biomass & solar thermal district heating
Ry, Denmark

Off-site renewables **CUNDALL**



Large wind turbines where it is windy **Solar panels where it is sunny**

Steps to low carbon **CUNDALL**

Off Site	Invest in off-site renewable systems District Systems
On-site energy	biomass, solar, wind, micro hydro gas CHP, geothermal
Heat Recovery	Air to air, waste heat from chillers Aquifer Thermal Storage
Energy Efficiency	Heating, cooling & ventilation systems Control strategy
Internal Loads	Lighting & Equipment (W/m2) Controls – turn off
Passive Design	Form: daylight & natural ventilation Fabric: insulation, facade, thermal mass
Design & Operation Criteria	Comfort criteria, lighting levels, fresh air quantity, operating hours

↑ Renewables
↑ Reducing energy consumption

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Design Intent v Performance

Reality v Intent **CUNDALL**

- Actual performance often does not achieve design intent
- Many, many reasons
 - Design / modelling errors
 - Changes during construction
 - Poor commissioning
 - Training of FM at handover of building
 - System too complicated
 - Gradual changes to BMS
 - Dampers, valves, etc get stuck
 - Changes to how building used

Understanding the problem **CUNDALL**

- This is why reporting of actual energy consumption is so important
 - Overall energy benchmarks
 - Sub-metering to find out where it is being used
- If you don't know you have a problem then you can't fix it
- Case Study
 - Corporate HQ building in UK

Incentive to review energy in 2010 **CUNDALL**

- The CRC Energy Efficiency scheme starts in April 2010
- It affects about 4000 businesses in UK
- Have to buy and sell carbon allowances
- Performance published in a league table
- Clients have started to take an interest in how much energy they are using
- Its more about reputation than cost!
- Other drivers – CSR policy, etc

EPC v DEC **CUNDALL**

Based on A/C only – no nat vent (C rating with)

Major difference – why?

Issues **CUNDALL**

- Key Issues
 - Natural ventilation disabled
 - Partitions to perimeter offices reduce night purge
 - Building running 24/7
 - DEC includes small power & IT equipment
 - Electricity consumption 3 x reference building
 - Insufficient sub-metering
- Solutions under discussion
 - Recommission systems & BMS
 - Reactivate nat vent?
 - Prepare Building user guide
 - Install sub metering & carbon dashboard

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Workshop Session

Workshop Session **CUNDALL**

- Answer two questions:
 1. What tools would help the Romanian FM industry reduce the energy & environmental impact of buildings?
 2. What are the easy wins that can be implemented in Romanian buildings this year?
- 30 minutes in groups
- 15 mins present back to group

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Preparing a Building Improvement Plan

Building Improvement Plans **CUNDALL**

- Why improve the building?
 - Attract / retain tenants
 - Reduce operating costs
 - Future proof against future legislation (toxic assets)
 - Marketing / PR
 - Corporate values
- How to improve building?
 - Small adjustments to existing plant
 - Minor refurbishment
 - Major refurbishment

Process **CUNDALL**

- Identify problems
 - Benchmark energy consumption
 - Maintenance / reliability issues
 - Feedback from occupants
 - Feedback from letting agents
- Inspect / audit the building
- Develop potential solutions
 - Fix defects
 - Identify opportunities to upgrade plant at end of life (ref EPBD-2)
 - Prepare costed plan for minor/major refurbishment

Case Studies **CUNDALL**

- Fixing Defects & Minor Upgrades
 - CIBSE Journal Feb 2010 – Eland House Case Study
- Building Refurbishment
 - 55 St Andrews Place, Melbourne



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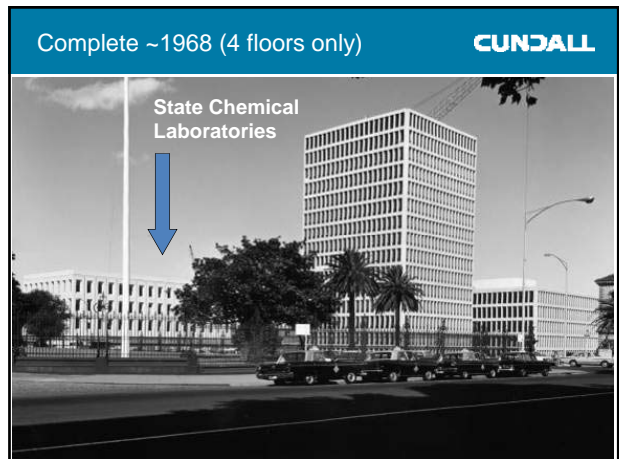
55 St Andrews Place, Melbourne



About the building **CUNDALL**

- Treasury Precinct, Melbourne
- Owned & occupied by Victorian Government
- 6,000m2 of Net Lettable Area
- 4 storey with car park under





Problems **CUNDALL**

- Drafts
- Stuffy
- Control system problems
- Heavily tinted glass gets hot & cracks
- No shading
- Limited daylight
- System undersized after Level 4 added
- 1 star energy rating

Glazing problems **CUNDALL**

Ground Floor Levels 1 to 3 Level 4

Air intake problems **CUNDALL**

Exhaust fumes enter air intakes

ESD Improvement Plan **CUNDALL**

- Take a 1 star building to 4 stars and fix other problems!
- Engaged Cundall in Sep 2005 to develop a Building Improvement Plan
- Cundall then engaged
 - Architects
 - Engineers
 - QS
- Involved Facility Manager & Services Maintenance Contractor from Day 1 – they know the building!

Improvement Plan **CUNDALL**

- Typical approach to existing buildings is to tackle services, internal materials and fittings

```

    graph TD
      Resources((Resources)) --> ESD_Response((ESD Response))
      Services((Services)) --> ESD_Response
      ESD_Response --> Resources
      ESD_Response --> Services
  
```

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Improvement Plan

- Our approach was to go back to the start and reconsider same issues as for a new building
- Philosophy:
 - Improve daylight
 - Improve comfort
 - Reduce fabric loads
 - Retain what we can

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Analysis - daylight

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Analysis – energy & comfort

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Energy analysis by end use

	Current Estimated Usage		Proposed Upgrades		PCA Energy Guidelines	
	Fuel		Reduction	Target	Best Practice	Current Difference
Tenant Lighting	elec	16 W/m ² 323 MJ/m ²	60%	129 MJ/m ²	154 MJ/m ²	209%
Tenant Power	elec	29 W/m ² 403 MJ/m ²	75%	101 MJ/m ²	94 MJ/m ²	431%
Ventilation Systems	elec	7 W/m ² 198 MJ/m ²	50%	99 MJ/m ²	110 MJ/m ²	164%
Cooling	elec	5 W/m ² 101 MJ/m ²	35%	66 MJ/m ²	69 MJ/m ²	145%
Heating	gas	25 W/m ² 554 MJ/m ²	60%	176 MJ/m ²	186 MJ/m ²	239%
Lifts	elec	2 W/m ² 50 MJ/m ²	0%	50 MJ/m ²	33 MJ/m ²	152%
DHW	gas	1 W/m ² 24 MJ/m ²	35%	16 MJ/m ²	16 MJ/m ²	131%
Other House L&P	elec	3 W/m ² 67 MJ/m ²	35%	44 MJ/m ²	33 MJ/m ²	203%
Total		1,613 MJ/m²		687 MJ/m²	714 MJ/m²	
Total Light & Power	elec	1,082 MJ/m ²		479 MJ/m ²	493 MJ/m ²	228%
Total Heating Fuel	gas	528 MJ/m ²		207 MJ/m ²	221 MJ/m ²	221%
Total Electricity & Gas		1,611 MJ/m²		687 MJ/m²	714 MJ/m²	226%
Tenancy	elec	726 MJ/m ²		230 MJ/m ²	248 MJ/m ²	179
Base Building	elec	357 MJ/m ²		249 MJ/m ²	245 MJ/m ²	189
	gas	528 MJ/m ²		207 MJ/m ²	221 MJ/m ²	146
Actual Operating Hours		112 ^h Hr/yr		5,600 Hr/yr		
Target Operating Hours		55 ^h Hr/yr		2,750 Hr/yr		

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Improvement Plan Options

- Option 1:
 - Measures to achieve at least 4 Star Green Star and ABGR (NABERS Energy) ratings
- Option 2:
 - Other measures that achieve 4 Star rating and improve the health, well-being, spatial efficiency and productivity of the building.
- Option 3:
 - Measures that achieve a benchmark building in fulfilling the triple bottom line (TBL) objectives of the Victorian Government Office Accommodation Guidelines.

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Option 3 was adopted

- 4 star Green Star
- 4.5 star ABGR base building
- Budget of \$4.3 million
- New tenant not known

Design process

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- Different approach – green building consultant as Principal!
- Dynamic action plan replaced:
 - Minutes
 - Cost Plan
 - Programme
 - Brief
 - Green_Plan
- Meeting rotated between offices
- **Facility Manager part of design team**
- Everyone owned the design



Key solutions

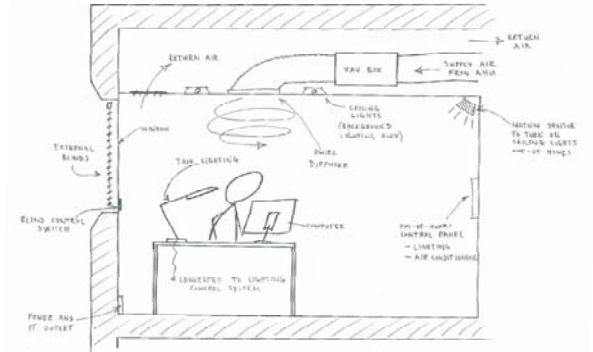
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- External automated blinds and clear glazing
- Swirl diffusers and recommission VAV boxes
- 160 lux ceiling & Task Lighting
- Relocate air intake



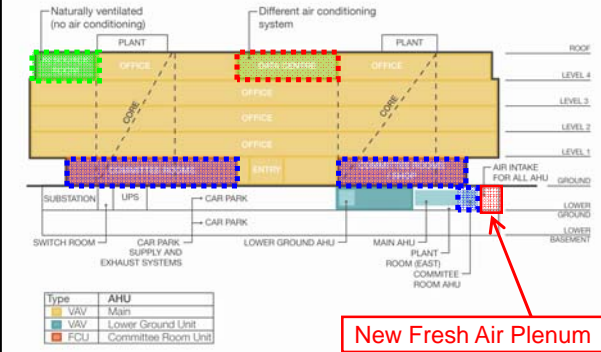
Key solutions

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Modified HVAC

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Type	AHU
■	VAV Main
■	VAV Lower Ground Unit
■	FCU Committee Room Unit


New Fresh Air Plenum

Fresh air supply to the building

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Old air intake turned into exhaust grille for new ground floor AHU

New air plenum created in lower ground



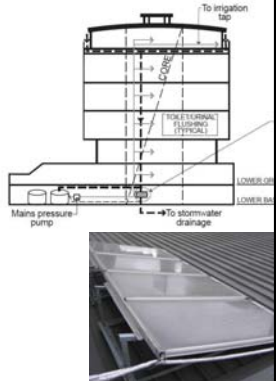
New air intake for new & existing AHUs

Old air intake grille replaced with glazing

Other initiatives

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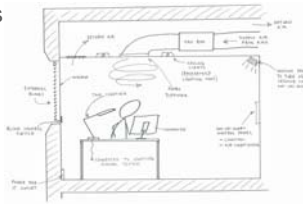

- Rainwater harvesting for toilet flushing & planter box irrigation
- New water efficient taps & showers
- Solar Hot Water system retained
- Cycling facilities added
- Eco materials used for base build & fitout



Building User Guide - users

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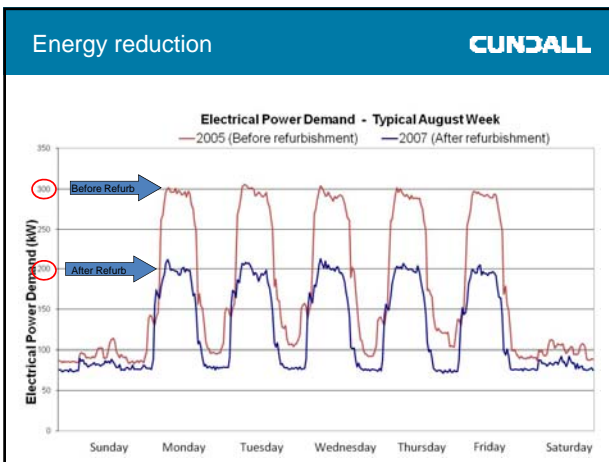
- Quick guide to controls
 - Blinds
 - Lighting
 - HVAC
- Waste recycling
- Green travel
 - Public transport
 - Cycling facilities
- Overview of improvements

Building User Guide - FM

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- Description of building systems
 - Simple diagrams
 - Design philosophy
 - Key operational issues
- Energy metering & monitoring
 - Meters & reporting systems
 - Benchmarks
- Environmental Management
- Refurbishment / Fit-out considerations
- Purchasing guidelines

Costs & Ratings

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- Cost of upgrade = A\$790/m²
- Cost of fitout = A\$525/m²
- **Total cost = A\$1,315/m²**
- 4 star Green Star
- 1st green star as-built rated refurbishment project in Australia
- Sustainable Refurbishment of the Year 2007 (UK)

