

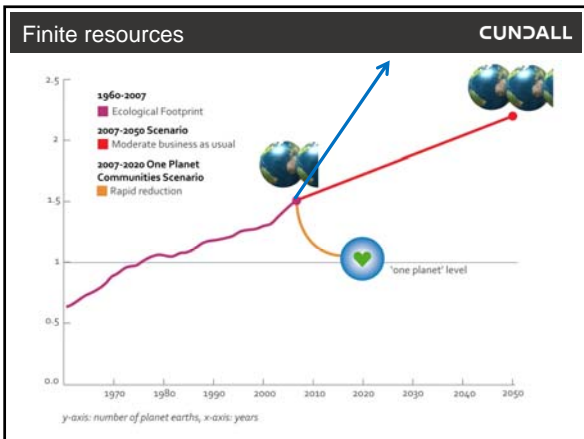
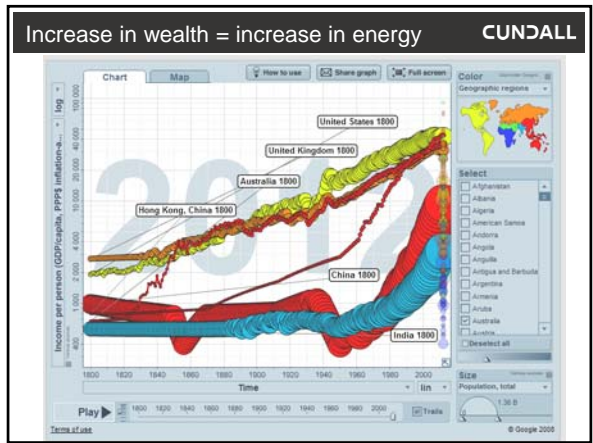
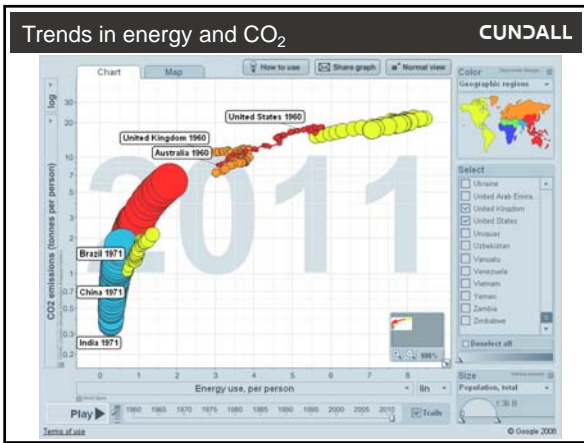
CUNDALL

What colour is your building?

David Clark
d.clark@cundall.com
www.cundall.com

CUNDALL

Energy Trends



CUNDALL

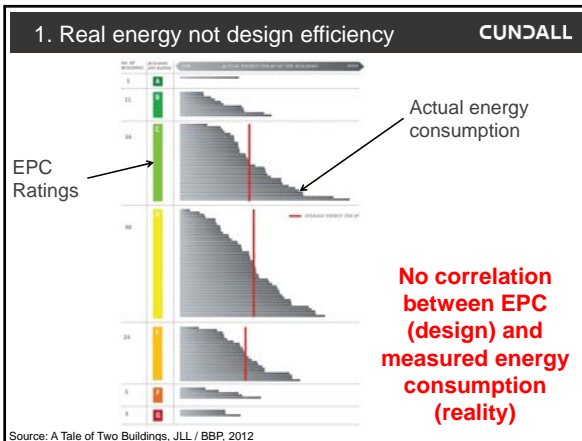
Key Messages

However beautiful the strategy, you should occasionally look at the results.

Winston Churchill

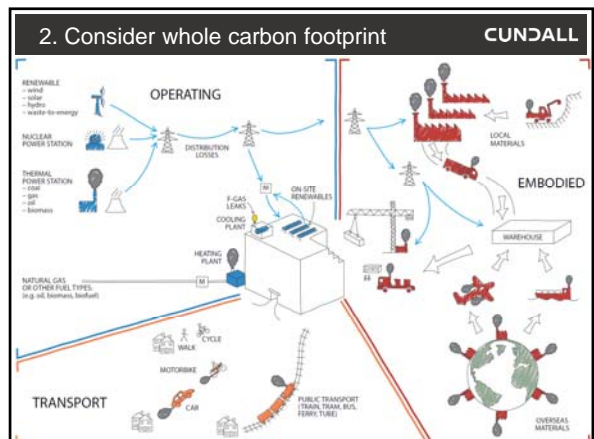
An ounce of performance is worth pounds of promises.

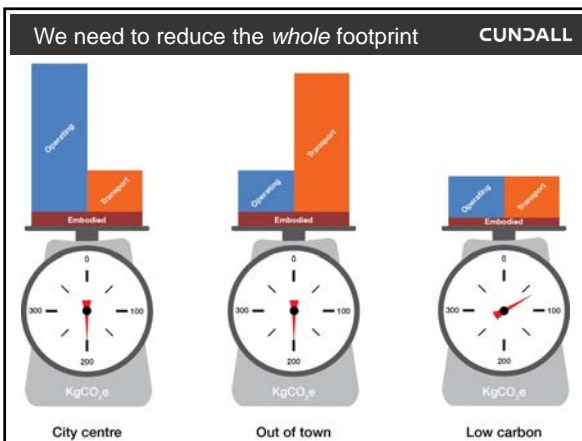
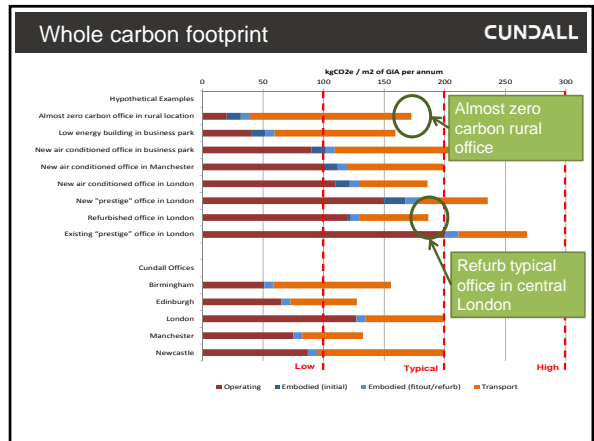
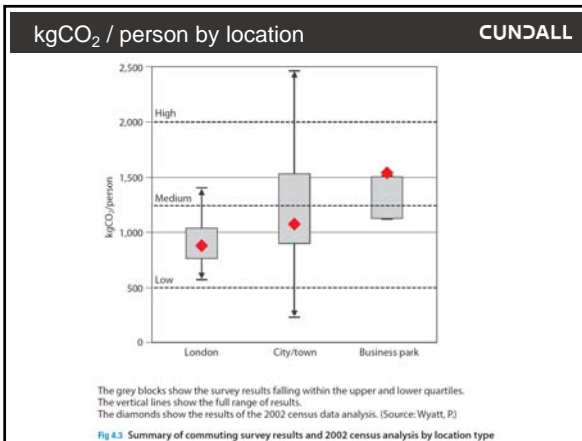
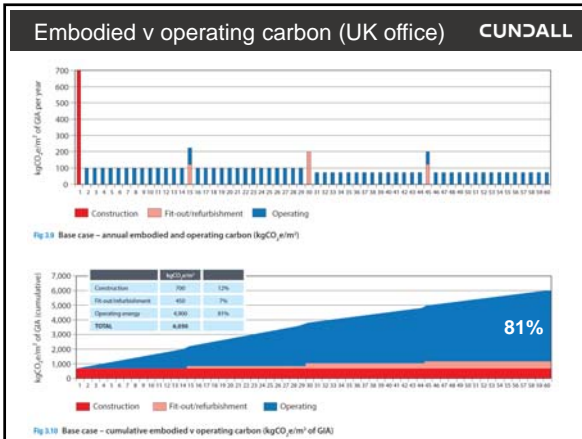
Mae West



2. Make energy visible CUNDALL

- Reputation can be a bigger driver than energy cost
- Put actual performance on display in every foyer
- Make energy database freely available on line
- Landlords to report monthly energy consumption to tenants

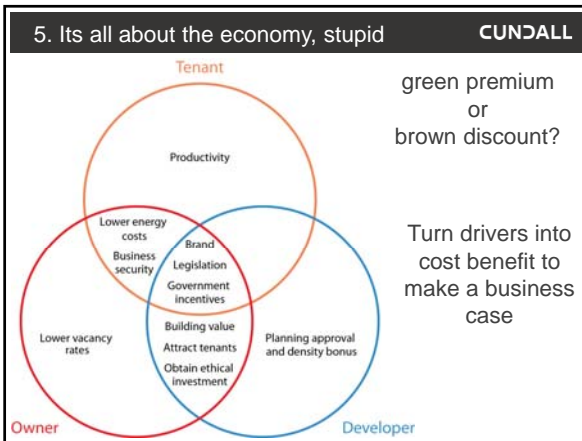
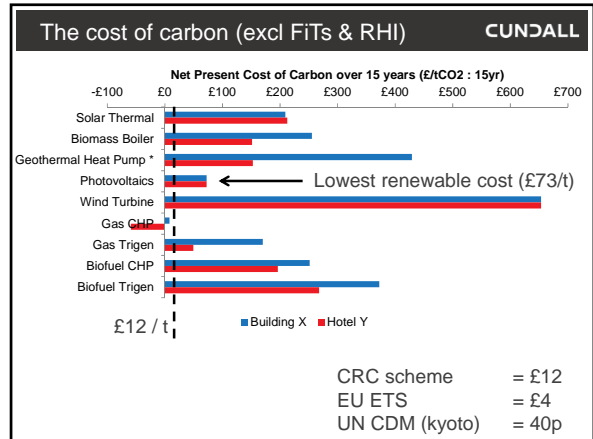
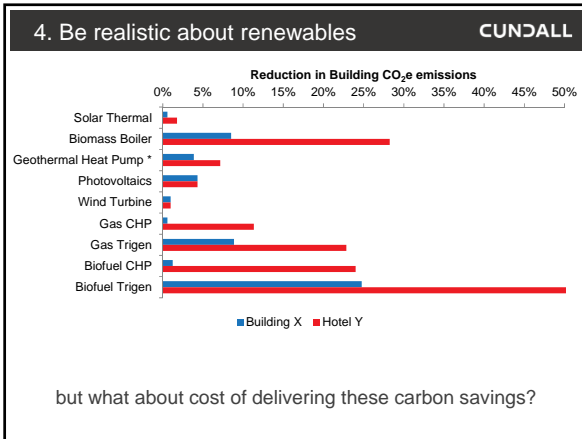




3. Its easy to save energy & carbon CUNDALL

Keep it simple
Size it right
Do it well

Follow it through
Tune it up
Capture the feedback
Continuously improve



10 things that building services engineers can do

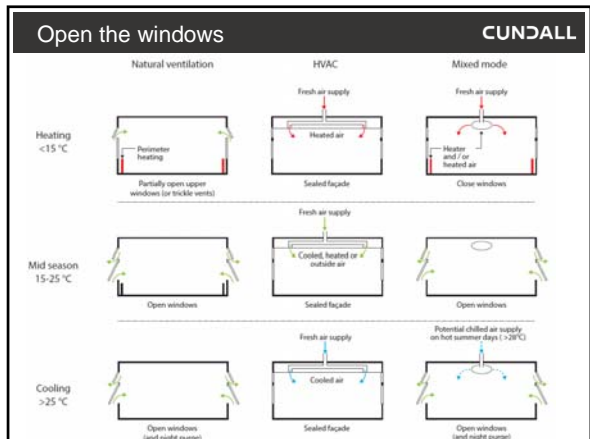
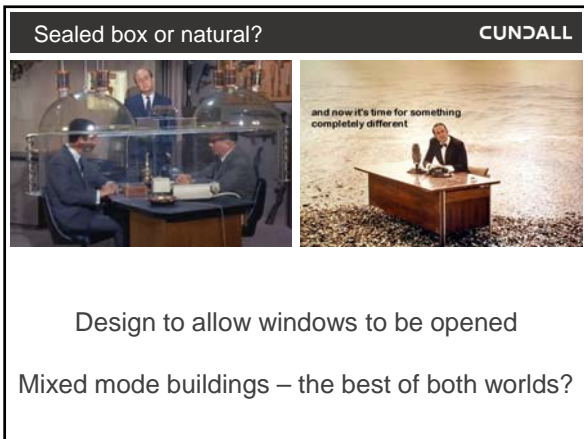
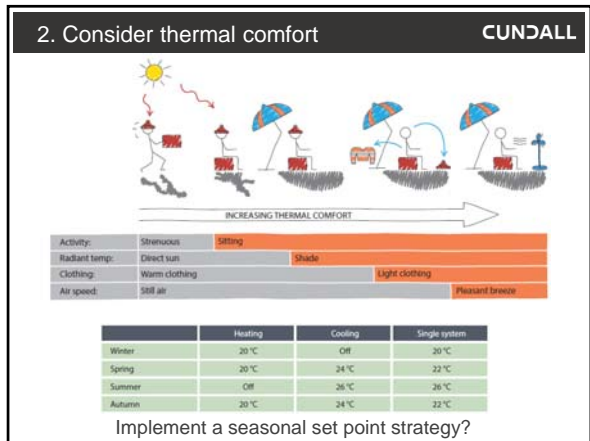
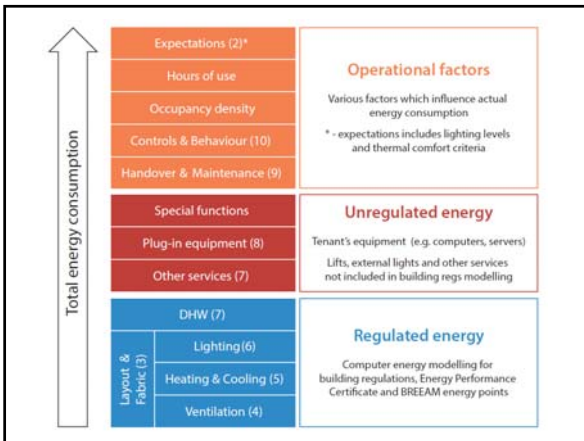
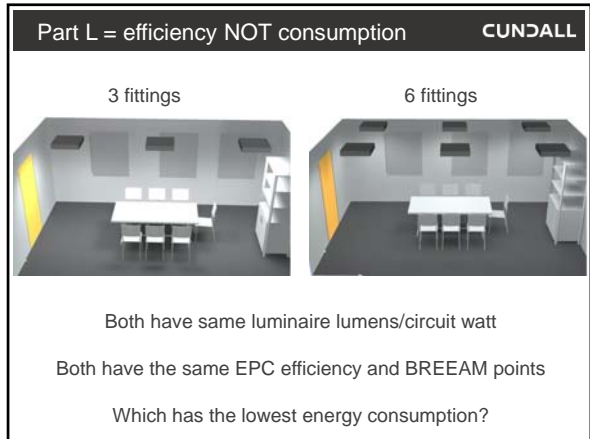
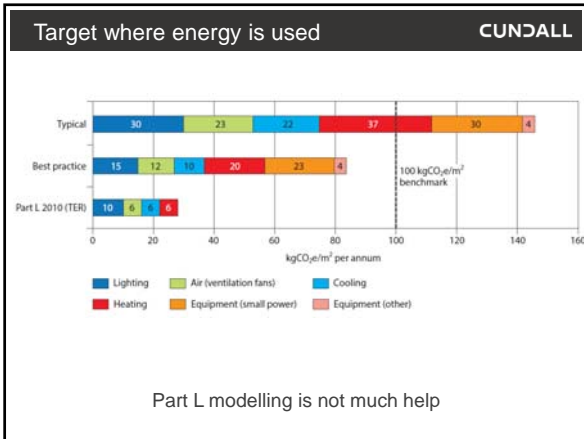
CUNDALL

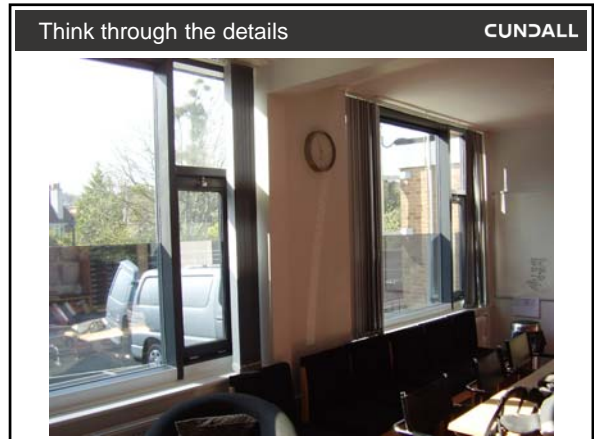
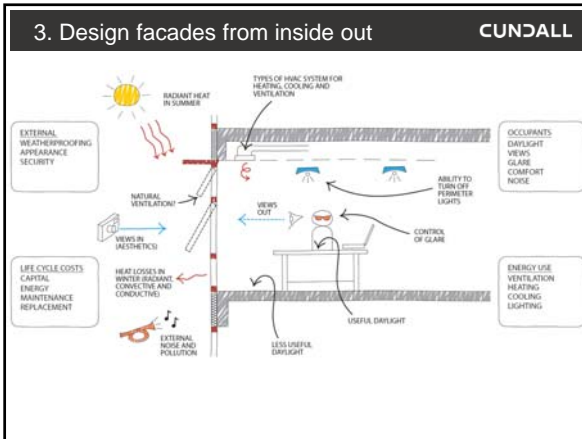
Normal people... believe that if it ain't broke, don't fix it.

Engineers believe that if it ain't broke, it doesn't have enough features yet.

Scott Adams (Dilbert)

- ### 1. Understand where energy is used
- CUNDALL
-
- Lighting
 - Equipment
 - Air (ventilation)
 - Cooling
 - Heating

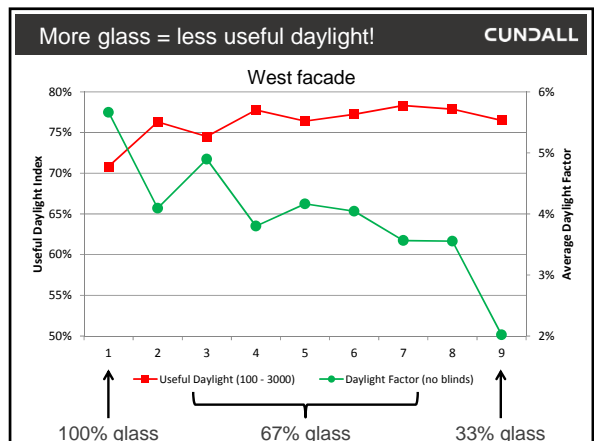
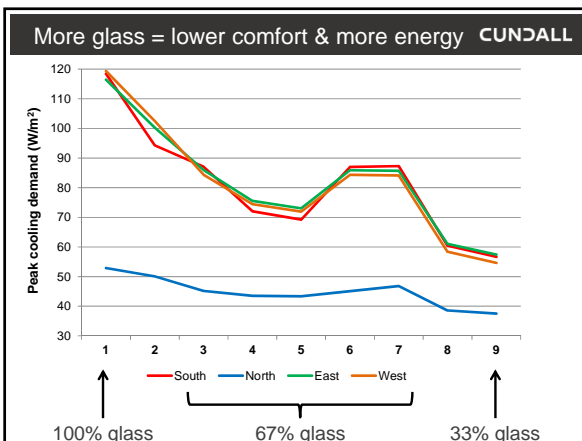
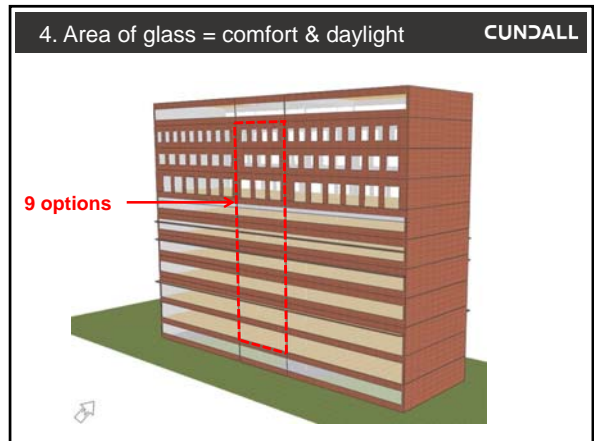




but consequences are

CUNDALL

- **Lots of glass**
 - High solar gain leading to thermal discomfort
 - Glare
- **Blinds closed**
 - No daylight anymore
 - Lights switched on (energy used & heat generated)
 - Blinds block natural ventilation air flows
 - Solar gain still enters space
 - Overheating & higher energy consumption



5. Light the task not the floor CUNDALL

ZONE	AREA	UNIFORMITY	MIN LUX LEVELS	
			SCREEN	READING
Task (T)	0.5m x 0.5m		300	500
Surround (S)	1.5m x 1.5m	0.4	120	200
Background (B)		0.1	30	50

Design lighting levels for office based tasks (from BS 12464:1 – 2011)

Lower capital cost and lower energy CUNDALL

	Method of lighting	Workstation lux level	Background Lux level	W/m ²	kWh/m ²	Cost per 1000m ²
1	Blanket	500	500	12	31	£3,100
2	Blanket	350	350	8	21	£2,100
3	Task	300	200	5	13	£1,300
4	Task	300	50	2	5	£500

6. Controls – keep simple when possible CUNDALL

DALI Control System (Digital Addressable Lighting Interface)

Alternative DALI control?

Make it easy to do the right thing CUNDALL

Air Con System

STOP: Do you really need to turn this on?

Winter
set the temperature to 19°C
set the mode to

Summer
Open the windows and don't turn the A/C on if it is really warm (not often in Manchester) then set the temperature to 25°C
set the mode to

Spring / Autumn
Doesn't need to be on often.
Use for occasional heating. No cooling required

Turn off at 5pm.
Please don't leave on overnight!

7. Tune the building CUNDALL

Soft Landings Framework to be mandatory on government projects from 2016

Turn stuff off when its not needed CUNDALL

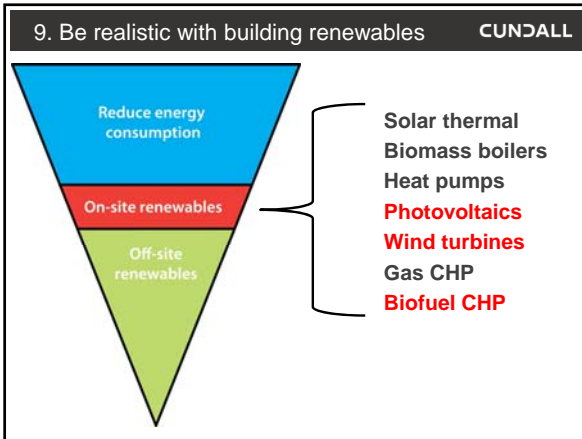
Monday to Friday

16 – 22 May 2011 – almost constant electricity consumption at night and weekends

15 – 21 Aug 2011 – consumption at night reduced but system still running at weekend

17 – 23 Oct 2011 – AHU turned off at night and weekends

66% reduction in hours = 60% reduction in energy



PV on London office building **CUNDALL**

10 storeys, 10,000m²

105kgCO₂e/m² of GIA

466m² of PV panels

No overshadowing

How much carbon does this save?

4.5kgCO₂e/m² of GIA

4% of carbon

Zero carbon office? **CUNDALL**

15,000m² of PV panels = 105kgCO₂e/m²

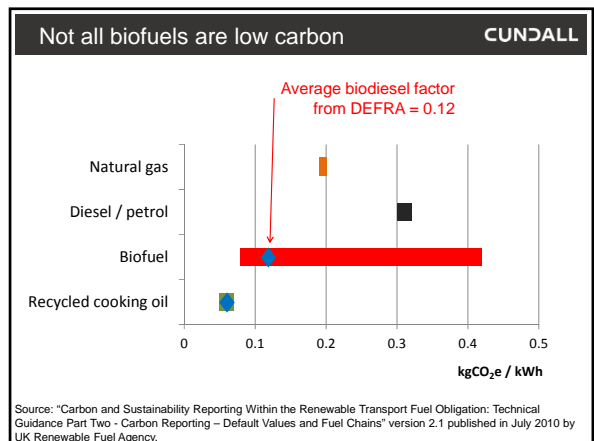
1.5m² of panel per 1m² of floor

Micro Urban Wind Turbines **CUNDALL**

Wind turbines **CUNDALL**

1% reduction
100 year payback

1% reduction
300 year payback



Biofuel in buildings v vehicles CUNDALL

Recycled oil = 0.05kgCO₂e/kWh
1 litre = 10kWh
70p/litre
£7 for 10 litres

	CHP	Truck
CO ₂ e saving	23kgCO ₂ e	27kgCO ₂ e
Extra fuel cost	45% +£2.25	0% £0
Capital cost	Lots	Zero

Biofuel works better in transport

Why waste it in buildings?

Don't get distracted by gimmicks CUNDALL

Olympic games trial one million people generated
"72 million joules of energy"

This equates to **20 kWh** saving £2 in electricity

Example
1,000 people x 260 days = 0.61 kWh per year.
6p per year cost saving
One 50W halogen lamp for 12 hours / year

8.5 Ws per footfall

Do the maths!

10. Consider embodied carbon? CUNDALL

Fig 3.4 Example breakdown of construction embodied carbon in a new office building

More data and research needed
Main focus should still be operating energy

Where to find more info

Warning:
Gratuitous advertising feature

What Colour is Your Building CUNDALL

Full colour
Lots of diagrams
264 pages

Foreword by Sir David King

Lots of industry endorsements

Only £30 from RIBA Bookshops & Amazon

All author's royalties go to charity (60%) and R&D (40%)

Appendices are free to download CUNDALL

- A Energy, CO₂ and climate change
- B CO₂e emission factors
- C **Energy consumption data**
- D Operating energy rating methodology
- E Embodied carbon data
- F Transport carbon data
- G Whole carbon footprint benchmarking
- H **Reducing operating carbon**
- I **Renewable energy resources and calculations**
- J Materials data
- K Travel planning
- L **Financial incentives**
- M Energy breakdown for Building X and Hotel Y

www.whatcolourisyourbuilding.com

CUNDALL

Information papers are also free

1. Security of energy supply
2. Adapting buildings to climate change
3. Fuel mix in grid electricity
4. CO₂e emissions from biomass & biofuels
5. Emission factors for black carbon
6. CO₂e emissions due to office waste
7. Analysis of display energy certificates 2008–10
8. US office energy data
9. Design energy rating data
10. Area and age of UK office stock
11. Comparison of building energy benchmark to total UK energy
12. Embodied carbon case studies for office buildings
13. Embodied carbon standards
14. Land use efficiency – city centre versus rural
15. Whole carbon footprint in rating tools
16. Heating degree days
17. Thermal comfort standards
18. Types of blinds for offices
19. Facade modelling – daylight and thermal performance
20. Ventilation rates in offices – mechanical and natural
21. Overview of HVAC systems in office buildings
22. Chiller energy efficiency
23. Solar hot water types & efficiencies
24. Photovoltaic panel types and efficiencies
25. Biomass and biofuel sources
26. Wind speed data
27. Wind turbine performance
28. CHP types and efficiencies
29. CHP calculations
30. UK Government incentives for renewable energy
31. Embodied carbon of steel versus concrete buildings
32. Corporate attitudes to sustainability
33. Productivity in office buildings
34. The green premium – is it real?
35. The rising cost of energy and carbon
36. Useful daylight index

www.wholecarbonfootprint.com

CUNDALL

Whole carbon benchmarking tool

- Free
- Easy to use
- Benchmarks office operating, embodied and transport carbon
- Default values provided

CUNDALL

What Colour is Your Building

WHAT COLOUR
is YOUR BUILDING?

David H. Clark

Measuring and reducing the energy and carbon footprint of buildings

Build Publishing

Any questions?

David Clark
d.clark@cundall.com
www.cundall.com