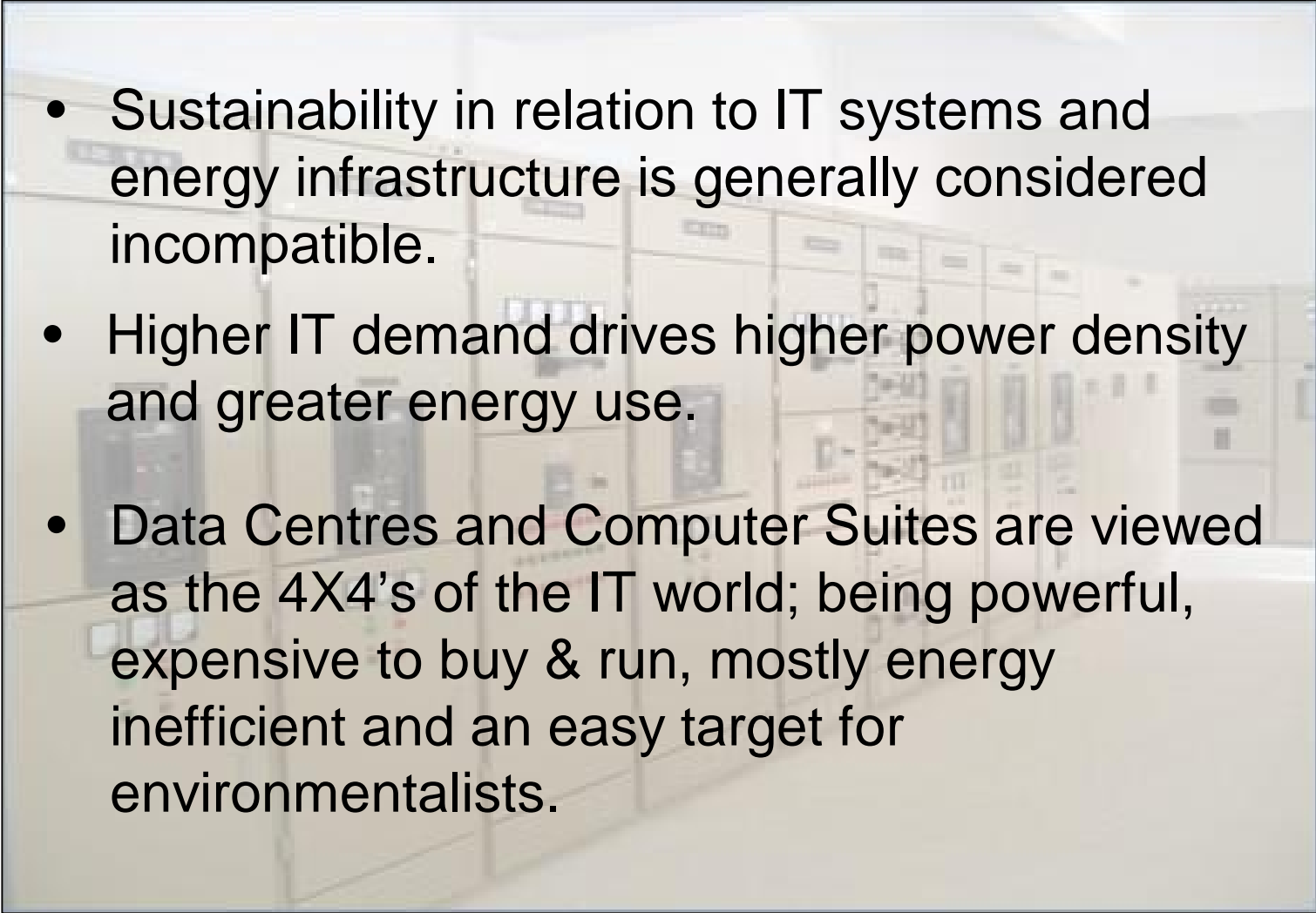




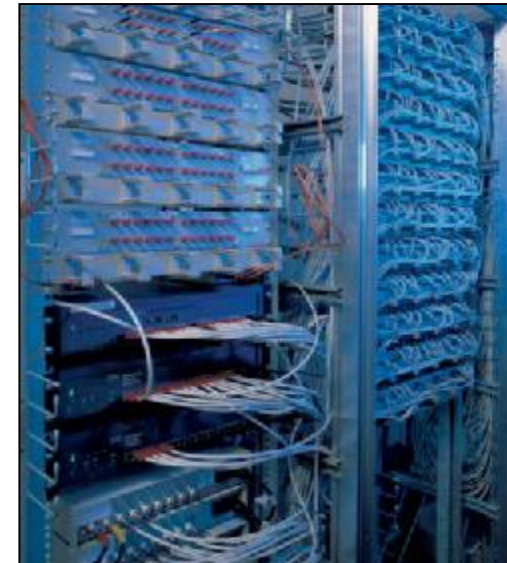
**The Impact of Technologies on
Sustainability Business Cases**

This session looks at the economics of sustainability with discussions relating to Data Centres and improving technology efficiencies, costs and benefits of efficient and emerging technologies, and the social side of sustainability

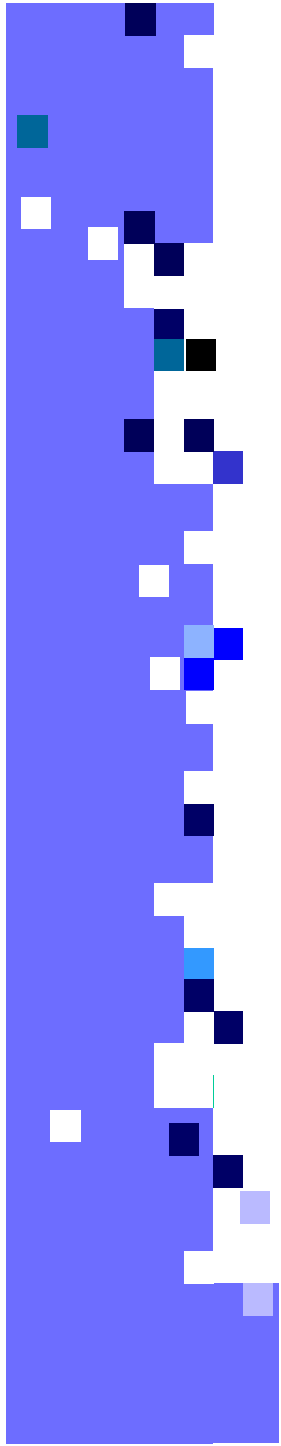
The Power struggle

- 
- Sustainability in relation to IT systems and energy infrastructure is generally considered incompatible.
 - Higher IT demand drives higher power density and greater energy use.
 - Data Centres and Computer Suites are viewed as the 4X4's of the IT world; being powerful, expensive to buy & run, mostly energy inefficient and an easy target for environmentalists.

The Price of IT?








Construct I.T.
For Business
enabling process change



The average data centre runs at around 5th of its capacity, the majority operating at only 10-15%, therefore vast amounts of power are being wasted.

So what's the problem?

- Applications are getting faster.
- Power density is increasing.
- Running out of power before running out of space.
- Energy Costs are rising.
- Energy infrastructure costs have become a larger element of the total cost of ownership.
- Part L excludes process energy use from compliance.
- Energy costs usually managed separately to IT equipment costs, therefore little attention paid to power consumption of IT installations.

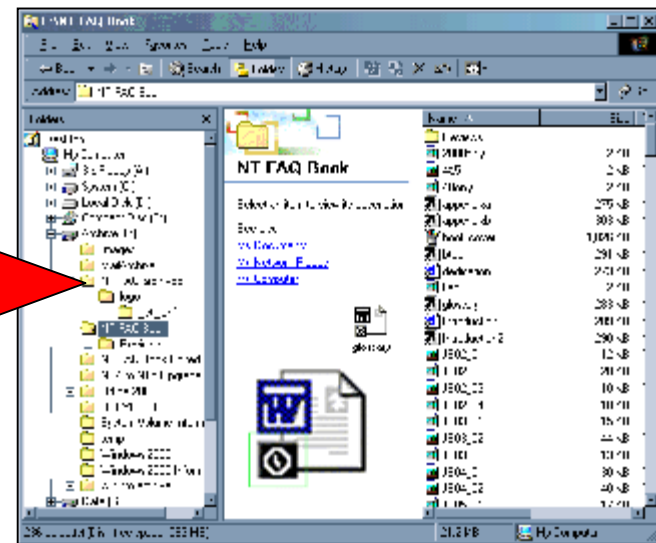
Energy consumption in data centres, as high as 50 kilowatts per rack, currently growing at the rate of 25 per cent per annum.

For every 1 kW of energy consumed by a server, roughly 1kW is also required to provide cooling by air systems .

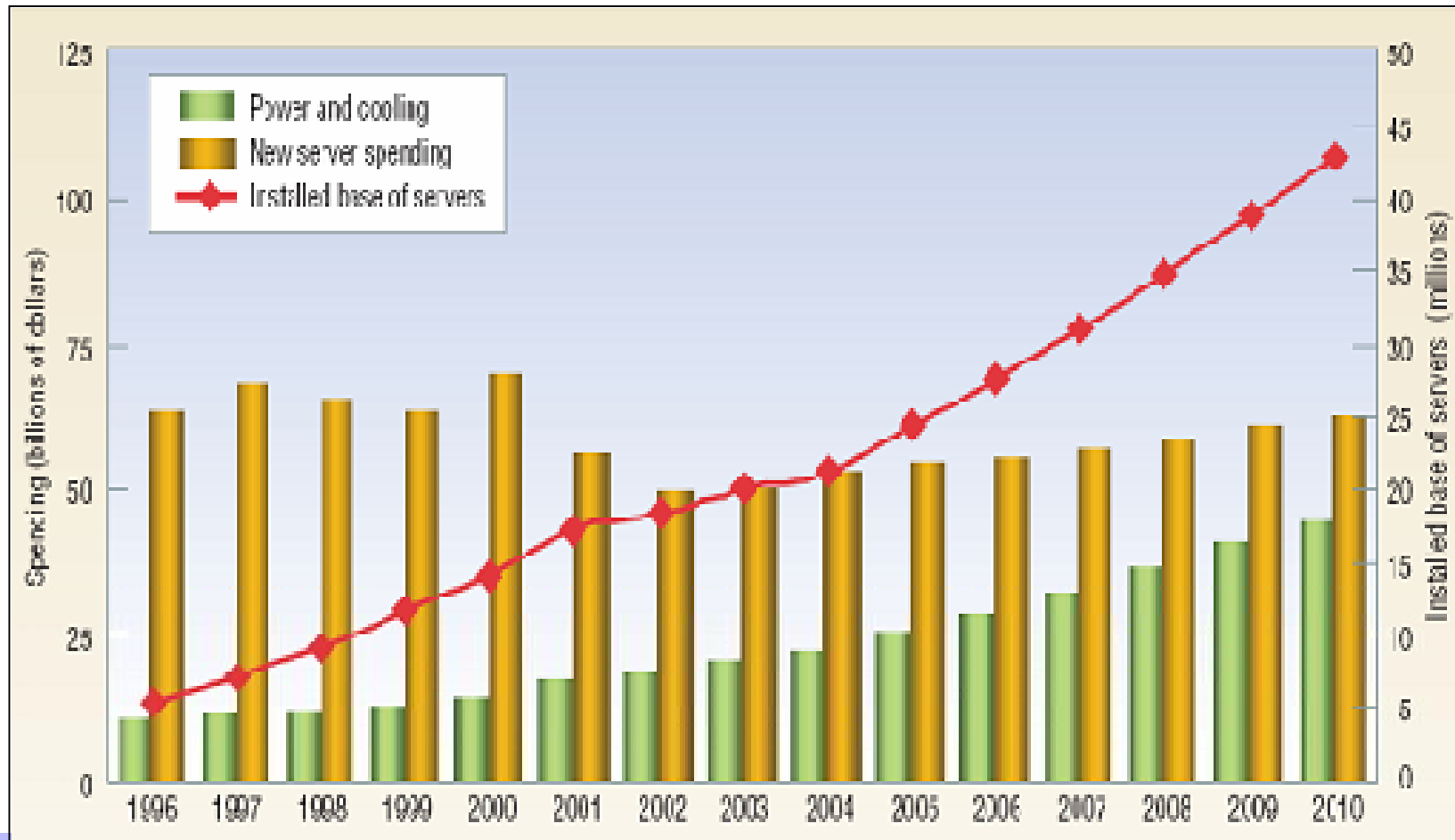
Data centres account for circa 12% of power consumption in the UK.

Reduce, Reuse, Recycle!

- The quest for the paper-less office, electronic paper management / archiving and reducing paper usage will demand greater storage capacity on servers increasing the numbers of servers required and the energy loads.



The Scale Of The Problem



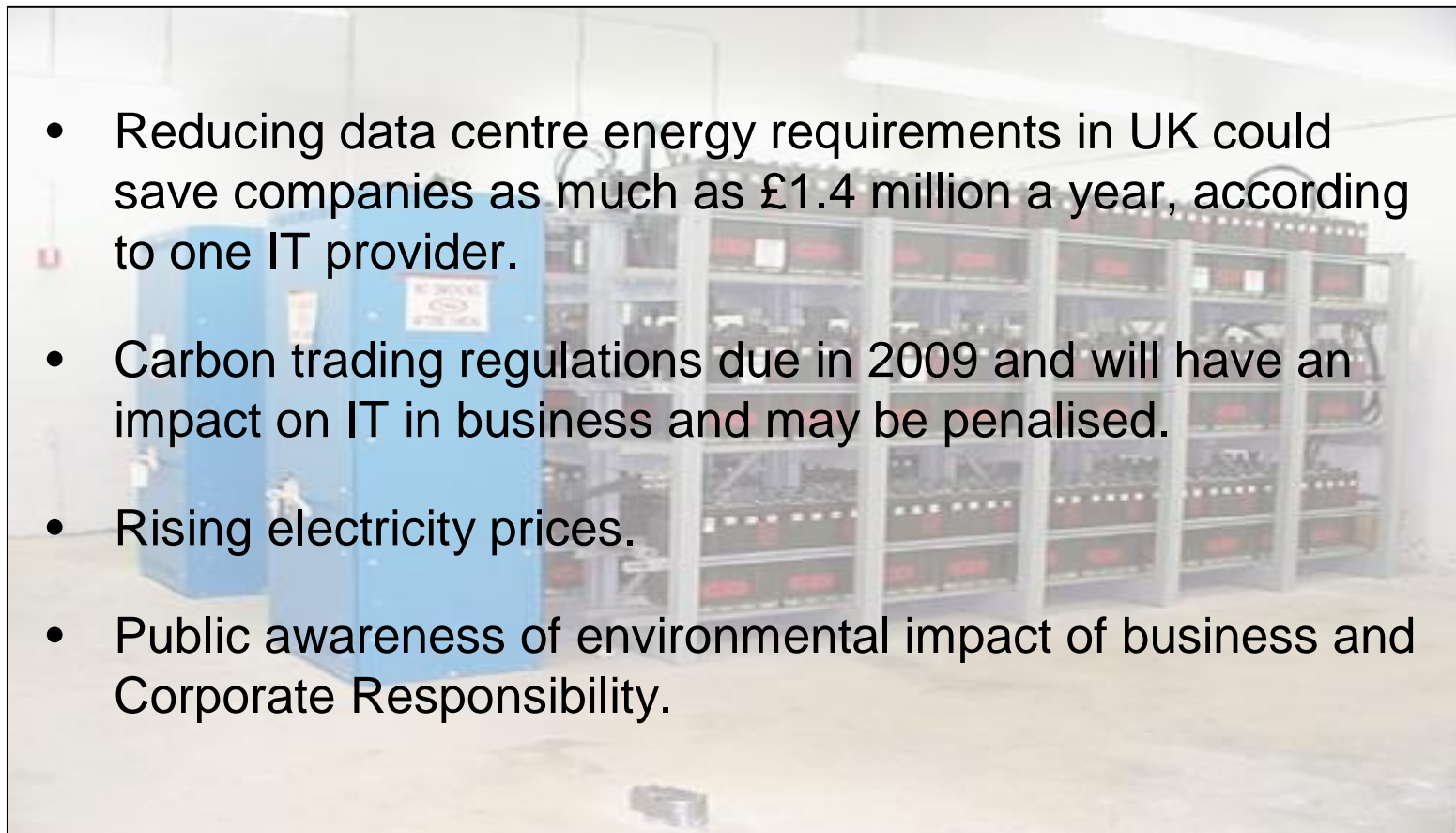
This chart shows the cost of powering and cooling servers has increased during the last decade and will increase steadily during the next few years, according to market research firm IDC.

So what's holding us back?

Despite the opportunities for energy saving and sustainability benefits, economic barriers and business risk tend to impede adoption, ie:

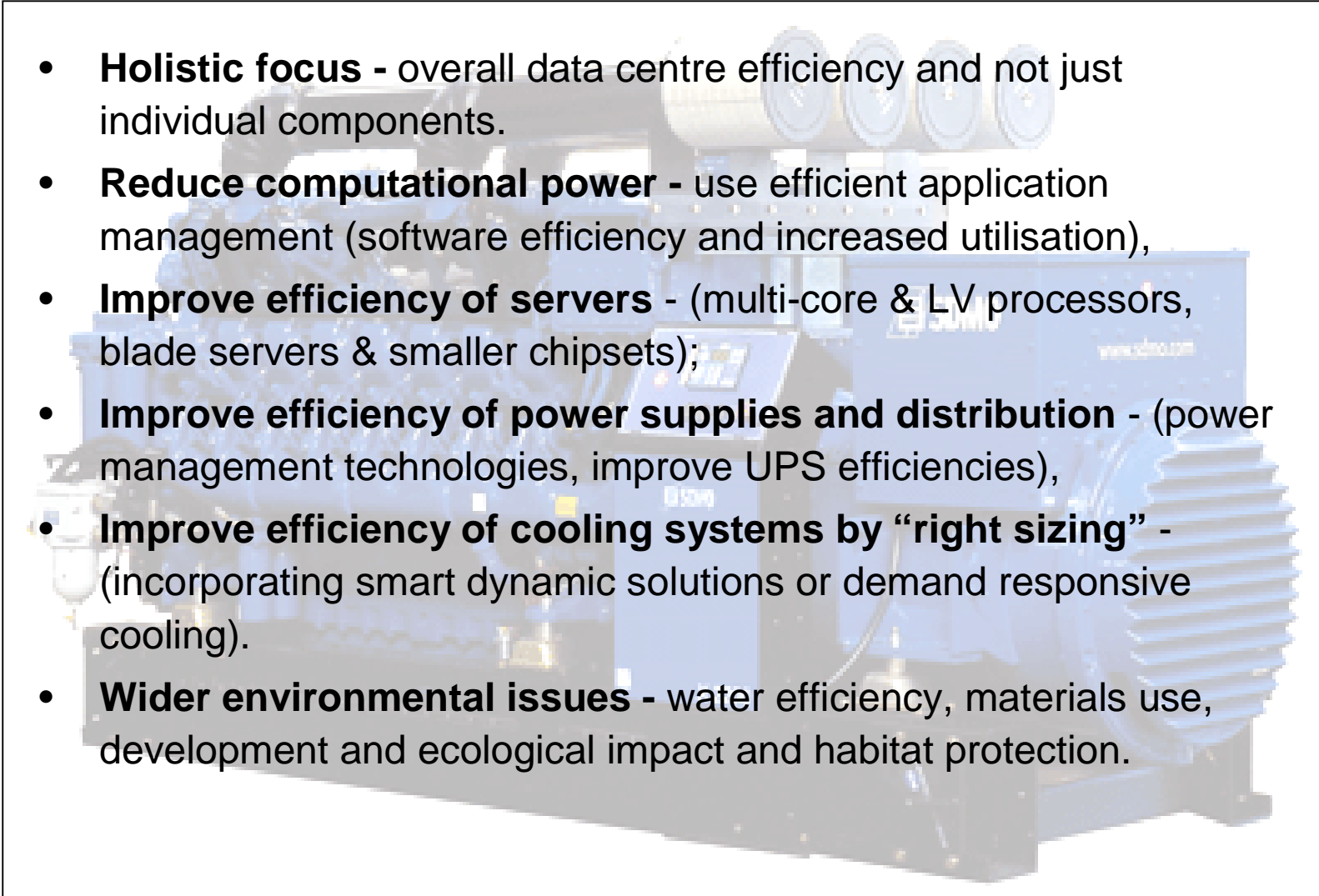
- Untried / untested / unfamiliar technologies and applications on the market?.
- Disruptive impact upon business operations?
- Is it worth the cost and disruption to the business?
- Difficulties in optimising data centres in rapidly changing technological environment?
- Lack of expertise in-house?
- Resilience / Tiers?

Carrots and Sticks



- Reducing data centre energy requirements in UK could save companies as much as £1.4 million a year, according to one IT provider.
- Carbon trading regulations due in 2009 and will have an impact on IT in business and may be penalised.
- Rising electricity prices.
- Public awareness of environmental impact of business and Corporate Responsibility.

What strategies can be implemented to benefit sustainability objectives?

- 
- **Holistic focus** - overall data centre efficiency and not just individual components.
 - **Reduce computational power** - use efficient application management (software efficiency and increased utilisation),
 - **Improve efficiency of servers** - (multi-core & LV processors, blade servers & smaller chipsets);
 - **Improve efficiency of power supplies and distribution** - (power management technologies, improve UPS efficiencies),
 - **Improve efficiency of cooling systems by “right sizing”** - (incorporating smart dynamic solutions or demand responsive cooling).
 - **Wider environmental issues** - water efficiency, materials use, development and ecological impact and habitat protection.

Specific Strategies - Examples

Server virtualization – increases utilisation rates thus reduce server numbers and hence power requirements but heat load increases.

Servers specification - high efficiency and high power factor power supplies e.g. meeting the 80PLUS specification (www.80plus.org)

Switch off - Power down when servers not in use.

Racks - Do not overload, Air cooled racks typically only handle 2 to 4 kW heat load and ensure front and rear doors are fully ventilated to at least 60%. Put hot equipment near the bottom of the rack

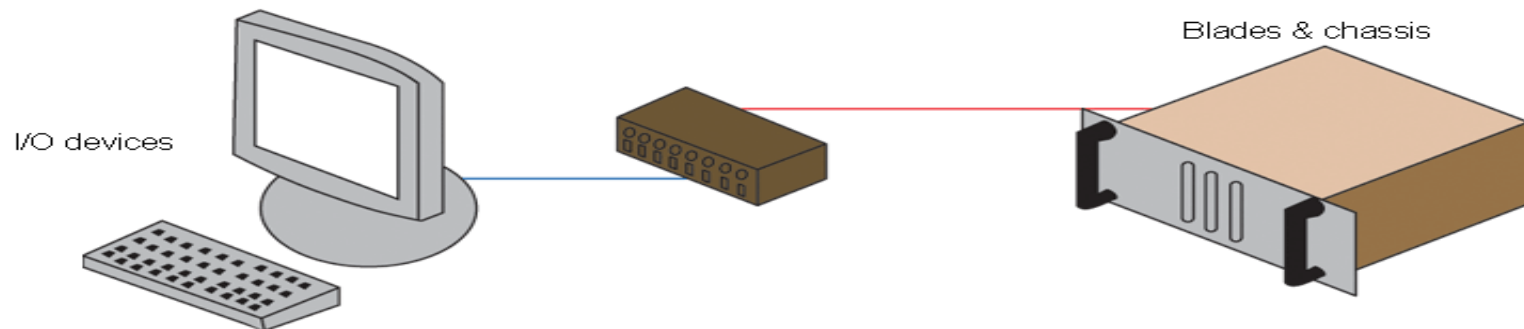
Improved cooling - Direct cooled cabinets efficiency is far greater than air cooled.

Raised floors – under floor plenums sealed to prevent cold air wastage, cable runs must not restrict air flows, floor grilles placed only in the cold aisle and in front of the racks.

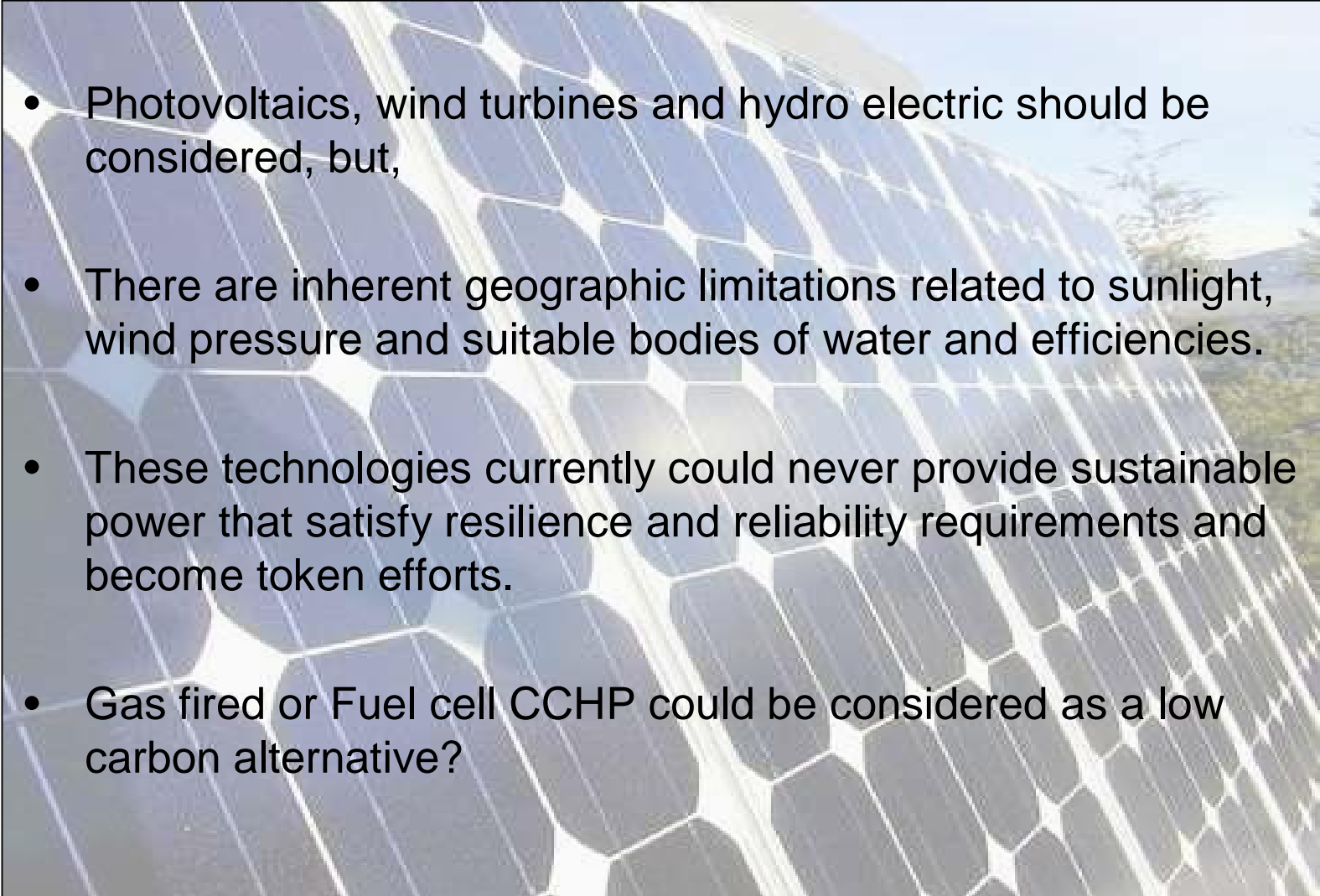
Lights out - in Technical spaces and provide energy efficient lamps.

Blade PCs

- Blade PC technology can deliver as much as 50% energy cost savings for commercial buildings with high IT usage and can contribute towards improved EPC ratings.
- Blade PCs take CPUs off user's desks by transferring the same functionality to rack mountable circuit boards thus relocating heat generating and power hungry components to controlled environment such as server rooms or data centre.
- Blade PCs cut desktop computer heat loads thus reducing cooling to off-set heat gains in office environments. Reduced cooling loads lead to smaller central plant and room terminal sizes and reduces capital, running costs and carbon emissions. Although heat from CPUs could be considered a useful gain in winter!



Is Renewable Energy the solution?

- 
- Photovoltaics, wind turbines and hydro electric should be considered, but,
 - There are inherent geographic limitations related to sunlight, wind pressure and suitable bodies of water and efficiencies.
 - These technologies currently could never provide sustainable power that satisfy resilience and reliability requirements and become token efforts.
 - Gas fired or Fuel cell CCHP could be considered as a low carbon alternative?

A look at what a bank is doing?

Barclays introducing technology that is expected to significantly reduce energy consumption and carbon emissions associated with a new major data centre in Gloucester.

Using a Dynamic Smart Cooling (DSC) will enable Barclays to save up to 13.4% of total energy used for this data centre. These energy saving measures will significantly reduce its carbon footprint by approx 7,470 tonnes of CO2 per year.

Several world-wide energy-efficiency measures include power optimised servers, Blade systems and Thermal Logic technology and virtualisation-based consolidation.

These initiatives have already achieved a range from 18 percent energy savings per server to 40 percent energy savings per data centre for Barclays technology services around the globe.

A look at what a Telecoms provider is doing?

BT have introduced virtualisation, consolidation and decommissioning, to reduce the number of servers taking power in the data centres and help take away the source of the heat loads - therefore reducing any cooling and associated environmental needs.

They are also looking at the efficiencies of data centre mechanical and electrical equipment by measuring the PUE (Power Usage Effectiveness) values for all the data centre's in the UK – to identify which sites have the greatest inefficiencies in the M&E infrastructure.

BT are looking to reuse waste heat from their data centres and are also using ground water cooling to subsidise the cooling requirement at a data centre located in Italy.

Environmental Assessment tools

- **EPEAT** evaluates desktop personal computers, notebook personal computers and personal computer monitors in relation to 51 total environmental criteria, 23 required criteria and 28 optional criteria. To qualify for registration as an EPEAT product, the product must conform to all the required criteria.
- Products ranked in EPEAT according to three tiers of environmental performance:
Bronze - Meets all 23 required criteria
Silver - Meets all 23 required criteria plus at least 50% of the optional criteria
Gold - Meets all 23 required criteria plus at least 75% of the optional criteria

EPEAT Criteria for IT products:

- 4.1 Reduction/elimination of environmentally sensitive materials
- 4.2 Materials selection
- 4.3 Design for end of life
- 4.4 Product longevity/life cycle extension
- 4.5 Energy conservation
- 4.6 End of life management
- 4.7 Corporate performance
- 4.8 Packaging



Electronic Product Environmental Assessment Tool

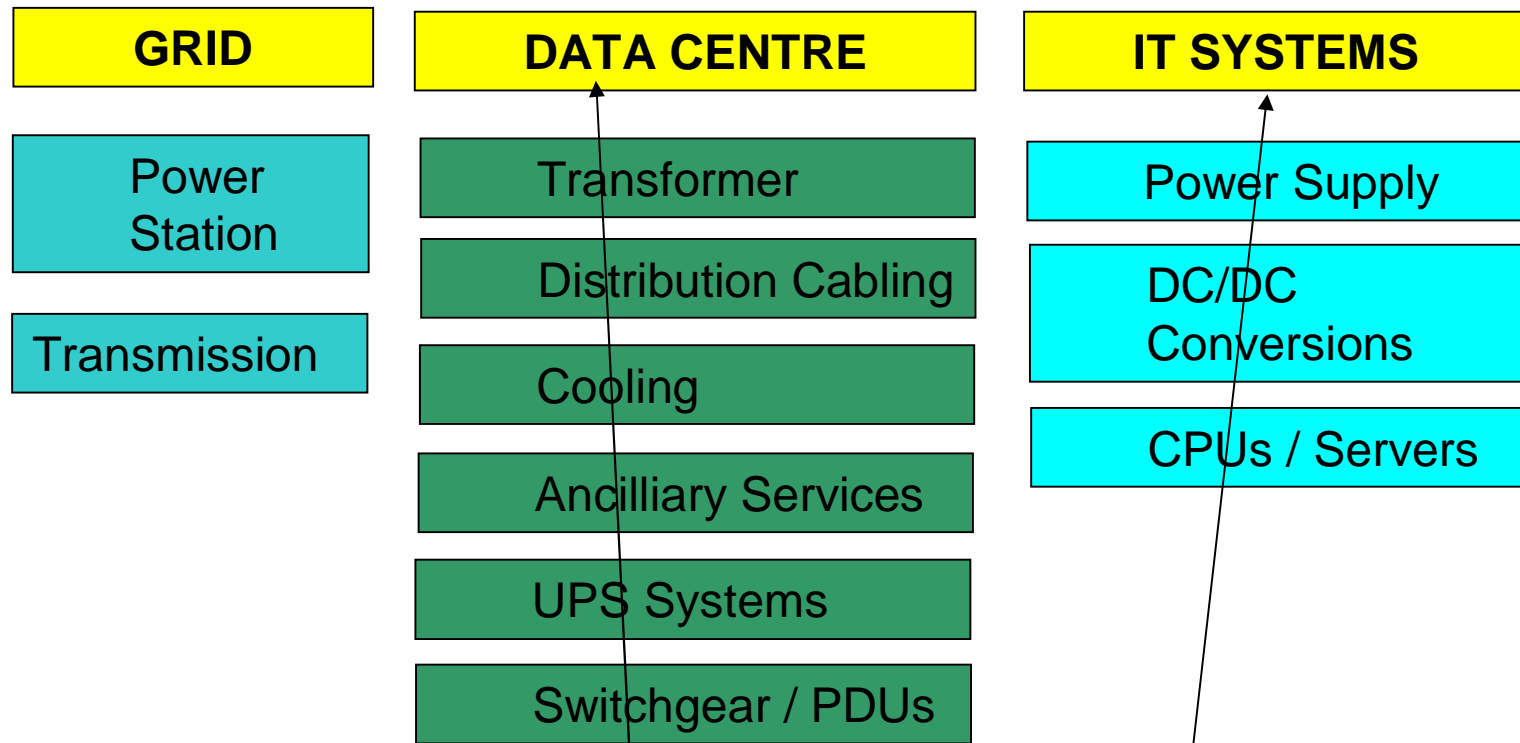
Green Electronics Made Easy

LEED Environmental Assessment Tool

- Leadership in Energy and Environmental Design (LEED), a standard set out by the US Green Building Council.
- LEED is not designed for data centres; however some US clients are undertaking assessments anyway to align all buildings in portfolio with corporate CO₂ measurement and reporting targets.
- LEED assesses the following:
 - **Sustainable Sites**
 - **Water Efficiency**
 - **Energy & Atmosphere**
 - **Materials & Resources**
 - **Indoor Environmental Quality**
 - **Innovation in Design**

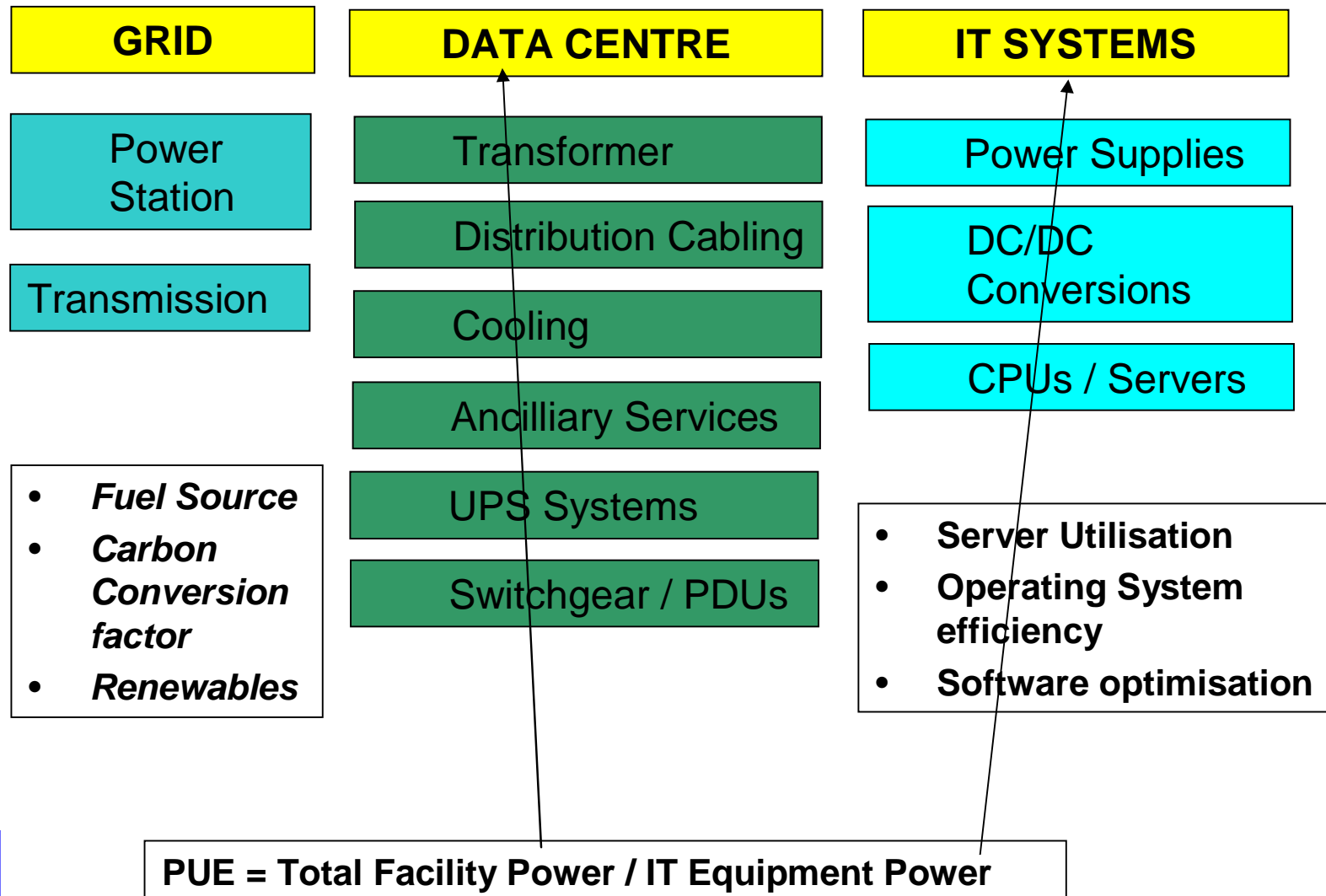


Power Utilisation



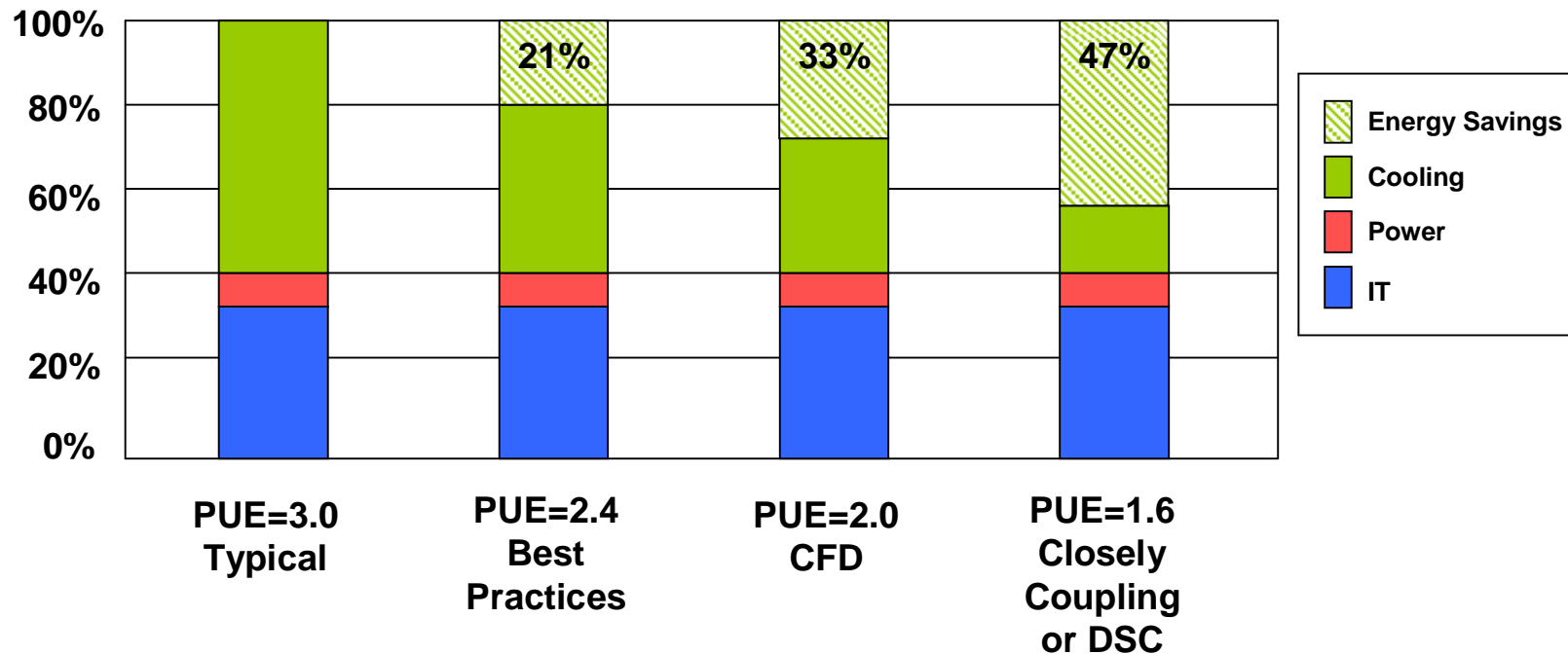
$$\text{PUE} = \text{Total Facility Power} / \text{IT Equipment Power}$$

Power Utilisation (PUE)



Improving PUE Yields a More Efficient Data Centre

Energy Savings Potential for Many Data Centres



Power usage effectiveness (PUE) used in the industry characterise a data centre with a single value

Malone, C., C. Belady, "Metrics to characterize Data Center & IT Equipment Energy Use," Proceedings of 2006 Digital Power Forum, Richardson, TX (September 2006)

Case Study of a LEED Assessment



LEED Checklist

- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality
- Innovation in Design

Project Totals (pre-certification estimates)

Certified: 26-32 points, **Silver:** 33-38 points, **Gold:** 39-51 points, **Platinum:** 52-69 points

Case Study of a LEED Assessment

Yes	Potential	Nb			
9	5	0	Sustainable Sites		
			14 Points		
Y			Prereq 1	Construction Activity Pollution Prevention	Required
1			Credit 1	Site Selection	1
1			Credit 2	Development Density & Community Connectivity	1
	1		Credit 3	Brownfield Redevelopment	1
1			Credit 4.1	Alternative Transportation, Public Transportation Access	1
	1		Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
	1		Credit 4.3	Alternative Transportation, Low-Emitting & Fuel-Efficient Vehicles	1
1			Credit 4.4	Alternative Transportation, Parking Capacity	1
	1		Credit 5.1	Site Development, Protect or Restore Habitat	1
	1		Credit 5.2	Site Development, Maximise Open Space	1
1			Credit 6.1	Stormwater Design, Quantity Control	1
1			Credit 6.2	Stormwater Design, Quality Control	1
1			Credit 7.1	Heat Island Effect, Non-Roof	1
1			Credit 7.2	Heat Island Effect, Roof	1
1			Credit 8	Light Pollution Reduction	1

Case Study of a LEED Assessment

Yes	Potential	No			
4	0	1	Water Efficiency		5 Points
1			Credit 1.1	Water Efficient Landscaping , Reduce by 50%	1
1			Credit 1.2	Water Efficient Landscaping , No Potable Use or No Irrigation	1
1			Credit 2	Innovative Wastwater Technologies	1
1			Credit 3.1	Water Use Reduction , 20% Reduction	1
		1	Credit 3.2	Water Use Reduction , 30% Reduction	1

Case Study of a LEED Assessment

Yes	Potential	No			
5	1	1	Energy & Atmosphere		17 Points
Y			Prereq 1	Fundamental Commissioning of the Building Energy Systems	Required
?			Prereq 2	Minimum Energy Performance	Required
Y			Prereq 3	Fundamental Refrigerant Management	Required
2			Credit 1	Optimise Energy Performance	1 to 10
				10.5% New Buildings or 3.5% Existing Building Renovations	1
				2 14% New Buildings or 7% Existing Building Renovations	2
				17.5% New Buildings or 10.5% Existing Building Renovations	3
				21% New Buildings or 14% Existing Building Renovations	4
				24.5% New Buildings or 17.5% Existing Building Renovations	5
				28% New Buildings or 21% Existing Building Renovations	6
				31.5% New Buildings or 24.5% Existing Building Renovations	7
				35% New Buildings or 28% Existing Building Renovations	8
				38.5% New Buildings or 31.5% Existing Building Renovations	9
				42% New Buildings or 35% Existing Building Renovations	10
		1	Credit 2	On-Site Renewable Energy	1 to 3
				2.5% Renewable Energy	1
				7.5% Renewable Energy	2
				12.5% Renewable Energy	3
1			Credit 3	Enhanced Commissioning	1
1			Credit 4	Enhanced Refrigerant Management	1
1			Credit 5	Measurement & Verification	1
	1		Credit 6	Green Power	1

Case Study of a LEED Assessment

Yes	Potential	Nb			
4	4	5	Materials & Resources		13 Points
Y			Prereq 1	Storage & Collection of Recyclables	Required
	1		Credit 1.1	Building Reuse , Maintain 75% of Existing Walls, Floors & Roof	1
	1		Credit 1.2	Building Reuse , Maintain 100% of Existing Walls, Floors & Roof	1
	1		Credit 1.3	Building Reuse , Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	Construction Waste Management , Divert 50% from Disposal	1
1			Credit 2.2	Construction Waste Management , Divert 75% from Disposal	1
		1	Credit 3.1	Materials Reuse , 5%	1
		1	Credit 3.2	Materials Reuse , 10%	1
		1	Credit 4.1	Recycled Content , 10% (post-consumer + 1/2 pre-consumer)	1
		1	Credit 4.2	Recycled Content , 20% (post-consumer + 1/2 pre-consumer)	1
1			Credit 5.1	Regional Materials , 10% Extracted, Processed & Manufactured Region	1
	1		Credit 5.2	Regional Materials , 20% Extracted, Processed & Manufactured Region	1
		1	Credit 6	Rapidly Renewable Materials	1
1			Credit 7	Certified Wood	1

Case Study of a LEED Assessment

Yes	Potential	No			
8	7	0	Indoor Environmental Quality		15 Points
Y			Prereq 1	Minimum IAQ Performance	Required
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
1			Credit 1	Outdoor Air Delivery Monitoring	1
	1		Credit 2	Increased Ventilation	1
1			Credit 3.1	Construction IAQ Management Plan, During Construction	1
1			Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
1			Credit 4.2	Low-Emitting Materials, Paints & Coatings	1
1			Credit 4.3	Low-Emitting Materials, Carpet Systems	1
	1		Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1			Credit 5	Indoor Chemical & Pollutant Source Control	1
1			Credit 6.1	Controllability of Systems, Lighting	1
	1		Credit 6.2	Controllability of System, Thermal Comfort	1
	1		Credit 7.1	Thermal Comfort, Design	1
	1		Credit 7.2	Thermal Comfort, Verification	1
	1		Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
	1		Credit 8.2	Daylight & Views, Views for 90% of spaces	1

Case Study of a LEED Assessment

Yes	Potential	No			
1	2	0	Innovation & Design Process		5 Points
	1		Credit 1.1	Innovation in Design: Provide Specific Title	1
	1		Credit 1.2	Innovation in Design: Provide Specific Title	1
			Credit 1.3	Innovation in Design: Provide Specific Title	1
			Credit 1.4	Innovation in Design: Provide Specific Title	1
1			Credit 2	LEED Accredited Professional	1

Yes	Potential	No			
31	19	7	Project Totals (pre-certification estimates)		69 Points
Certified: 26-32 points, Silver: 33-38 points, Gold: 39-51 points, Platinim: 52-69 points					

Case Study of a LEED Assessment

Yes	Potential	No			
1	2	0	Innovation & Design Process		5 Points
	1		Credit 1.1	Innovation in Design: Provide Specific Title	1
	1		Credit 1.2	Innovation in Design: Provide Specific Title	1
			Credit 1.3	Innovation in Design: Provide Specific Title	1
			Credit 1.4	Innovation in Design: Provide Specific Title	1
1			Credit 2	LEED Accredited Professional	1

Yes	Potential	No			
31	19	7	Project Totals (pre-certification estimates)		69 Points
Certified: 26-32 points, Silver: 33-38 points, Gold: 39-51 points, Platinim: 52-69 points					

Does your computer suite or data centre
mitigate energy use and environmental
issues?



Thank you for listening
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International Management &
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