

SUSTAINABILITY TRACK

Session 5



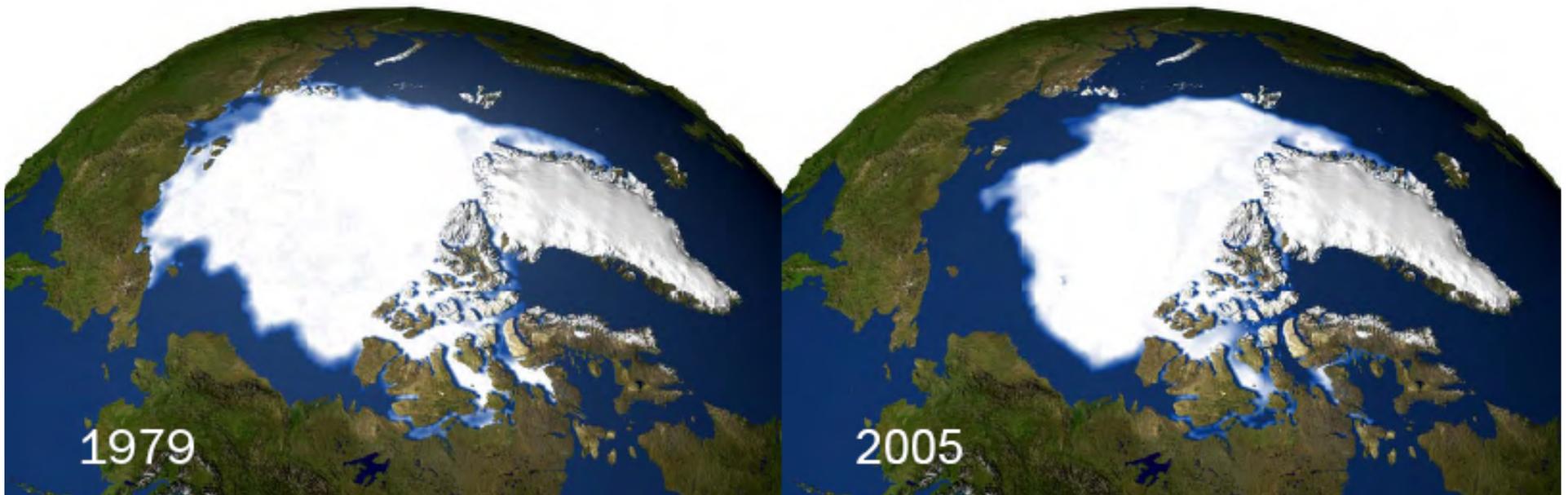
Phoenix, AZ
August 3-6, 2008

**GovEnergy 2008 Session 5:
“Sustainable Technologies”**



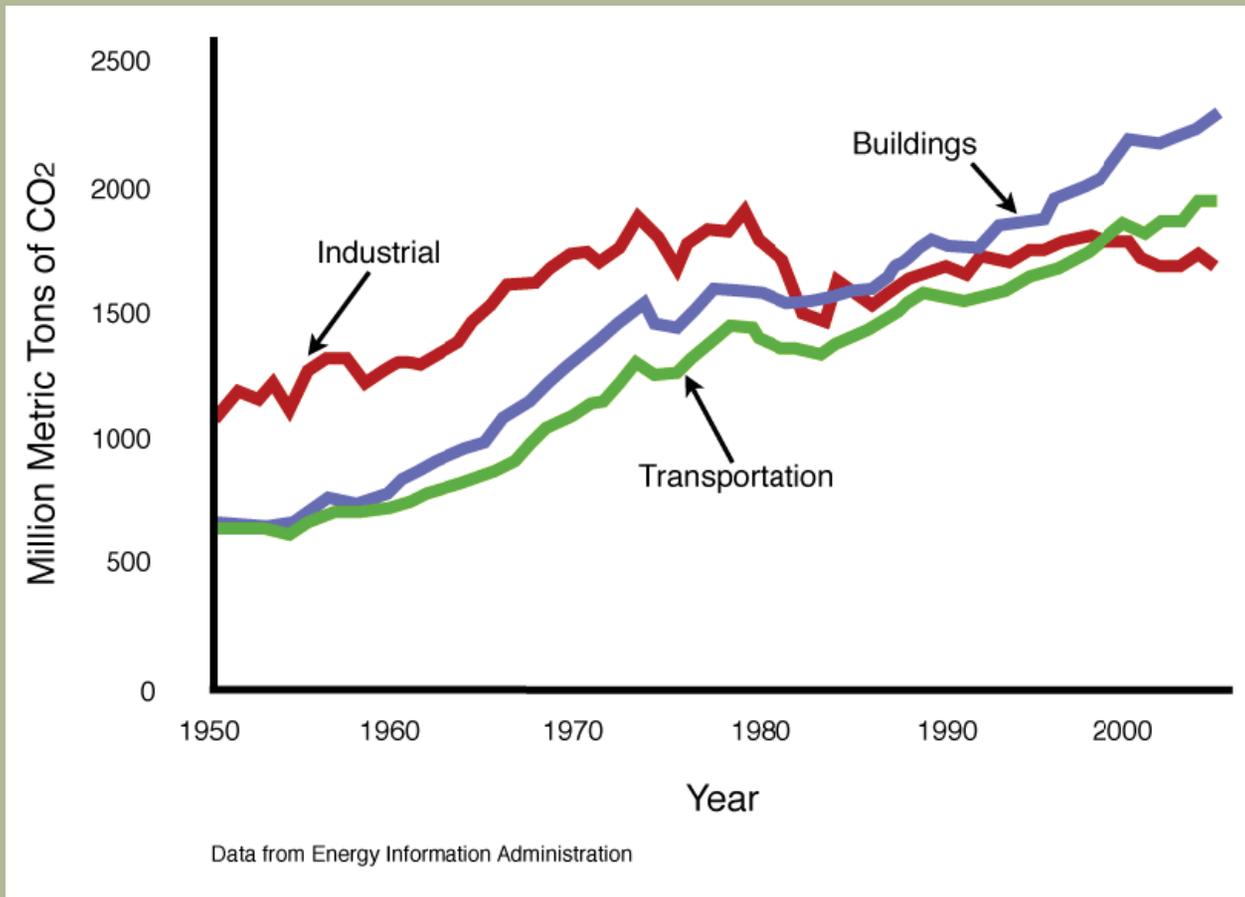
**Kevin Powell
Public Buildings Service
General Services Administration**

Planet: Cataclysmic Change



A 60% reduction in carbon output is needed to break this cycle.

What about buildings?



US Building Impacts



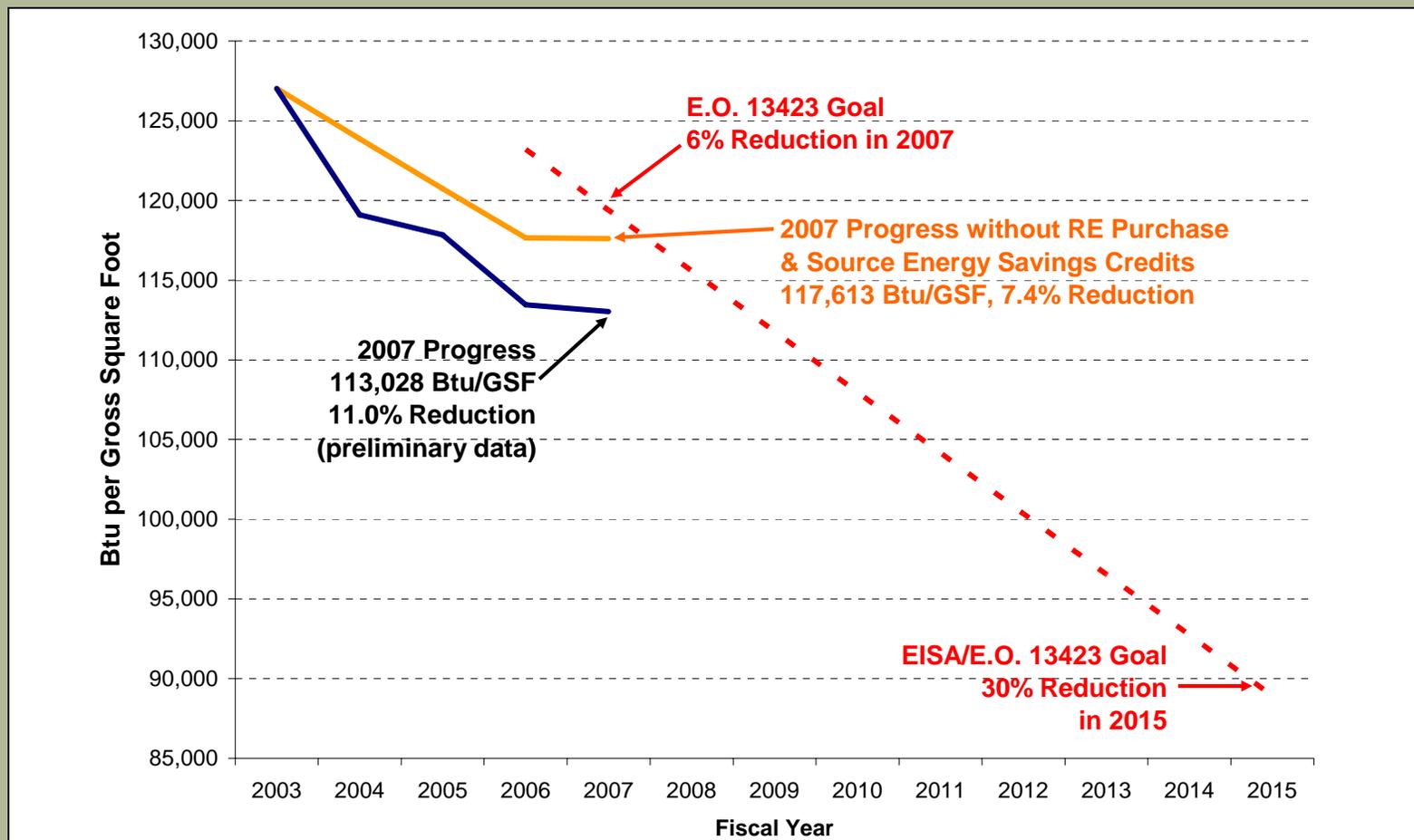
**World Energy Consumption:
+62%
276 QBtu by 2030**



**Global business as usual: to meet our energy needs
11,000 new power plants by 2030**



EISA/EO 13423, All Federal Facilities

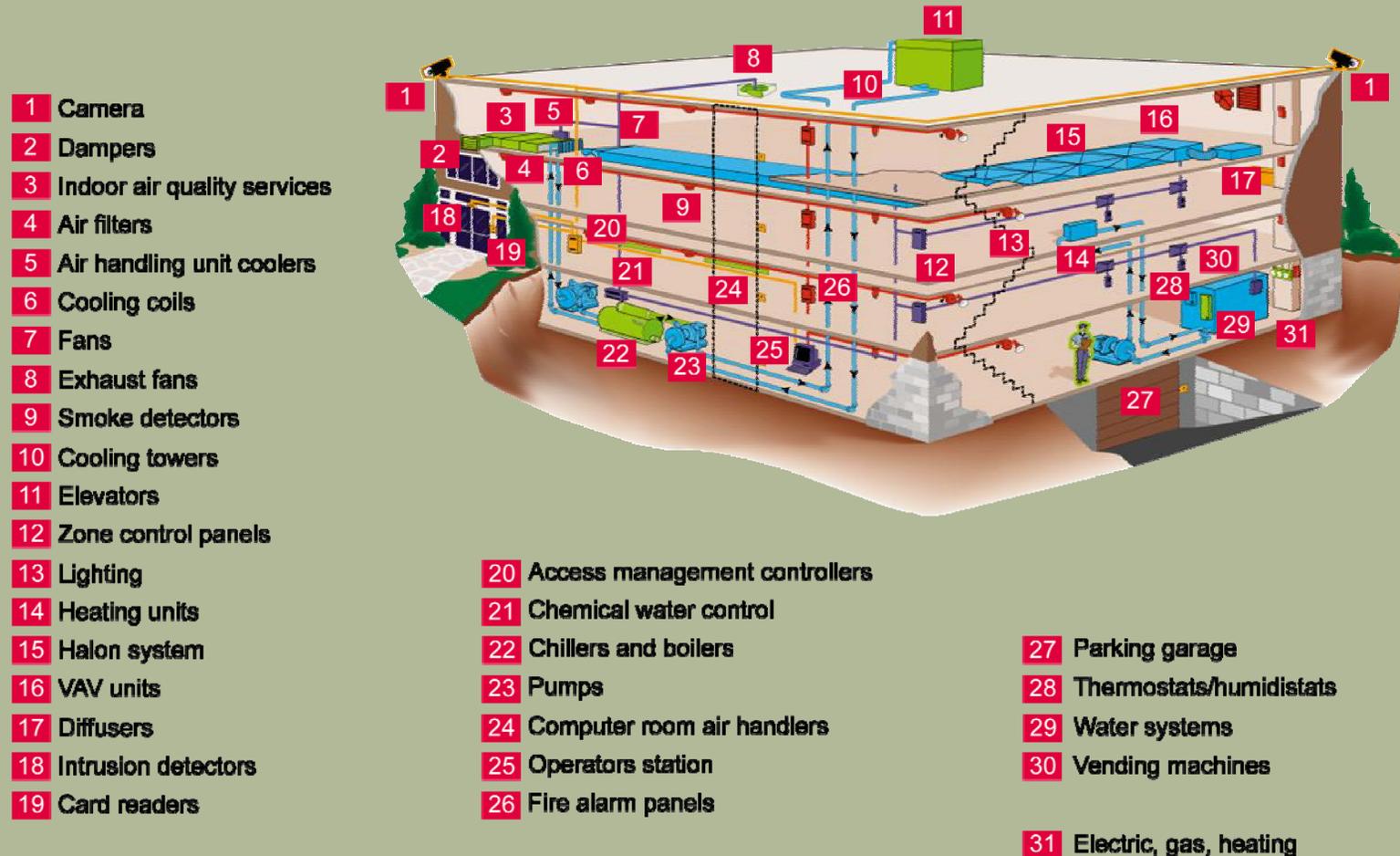


U.S. Customs and Border Protection Land Ports of Entry

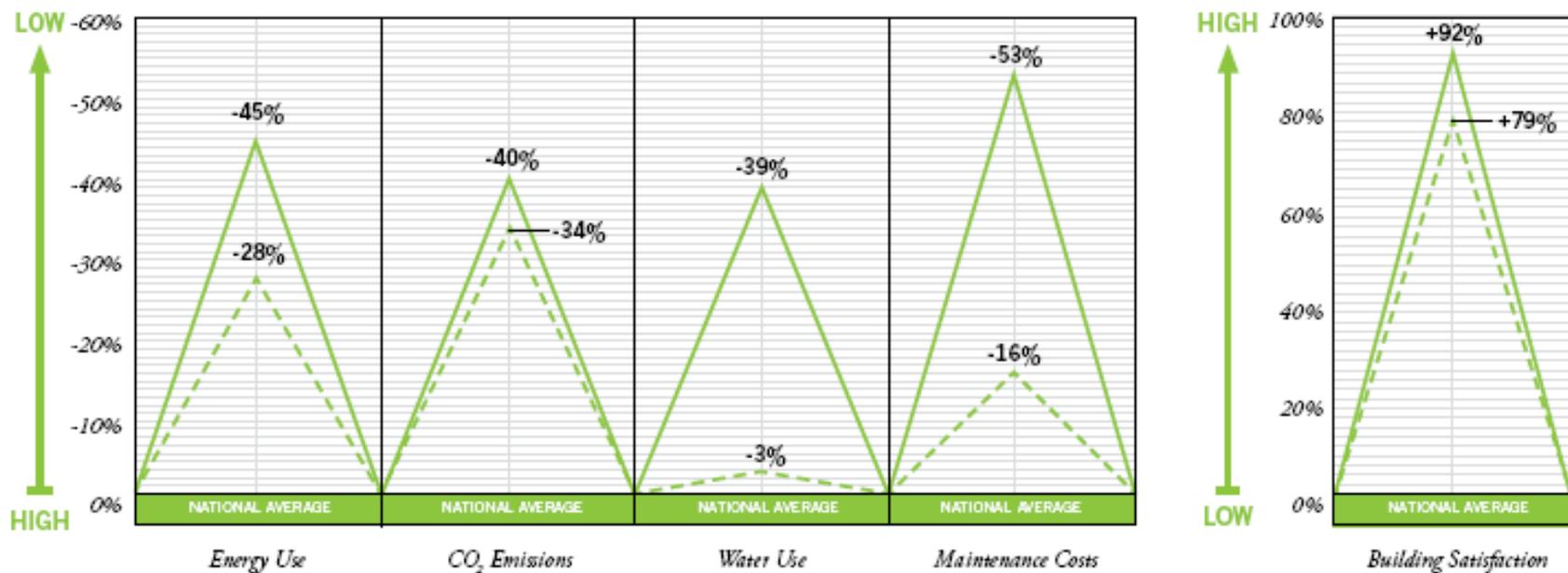


- Renewable Energy Assessment
- Lighting Assessment
- Wind Power Study

Devices in buildings are becoming ever richer sources of data



Post Occupancy Evaluation: Are green buildings better?



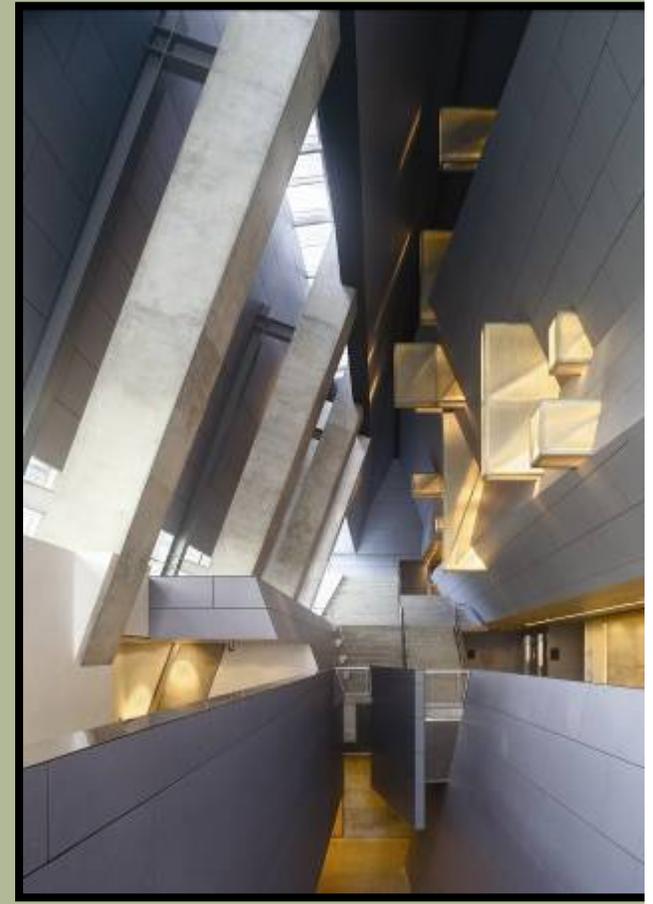
THE TOP PERFORMING BUILDINGS IN EACH METRIC DELIVER SIGNIFICANTLY BETTER RESULTS THAN THE NATIONAL AVERAGE.

TOP THIRD OF STUDIED BUILDINGS

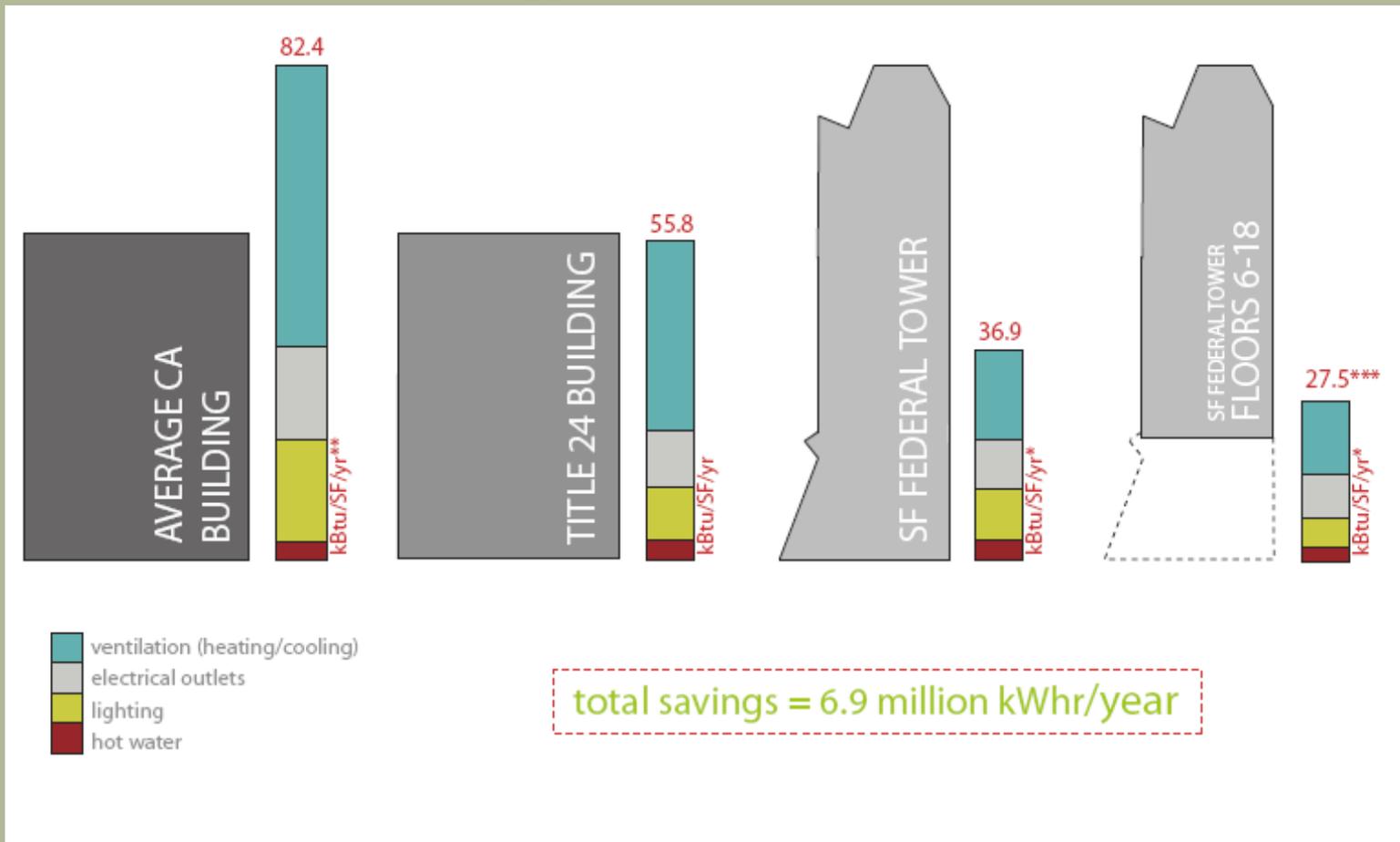
MIDDLE THIRD OF STUDIED BUILDINGS

San Francisco Federal Building

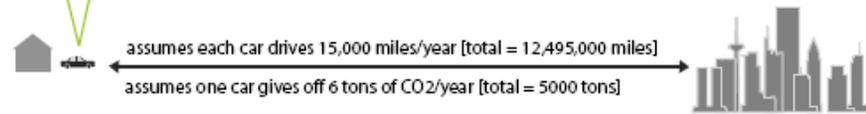
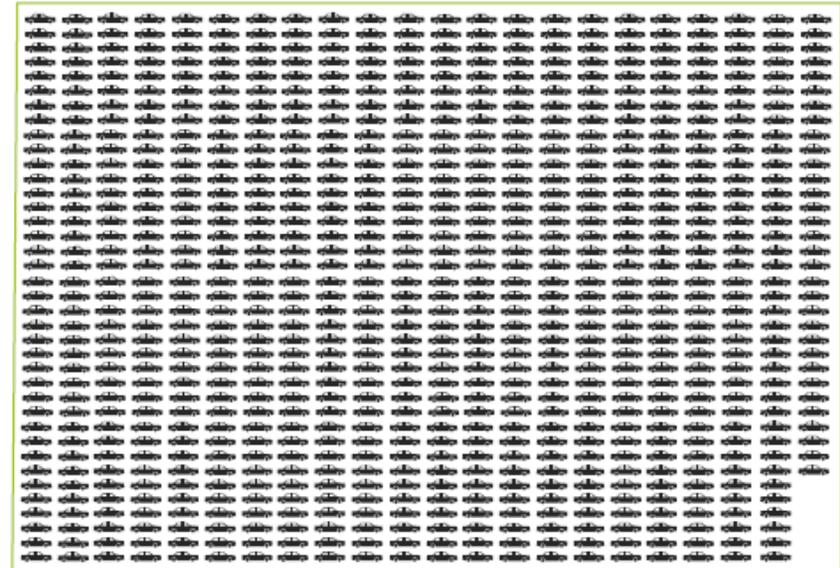
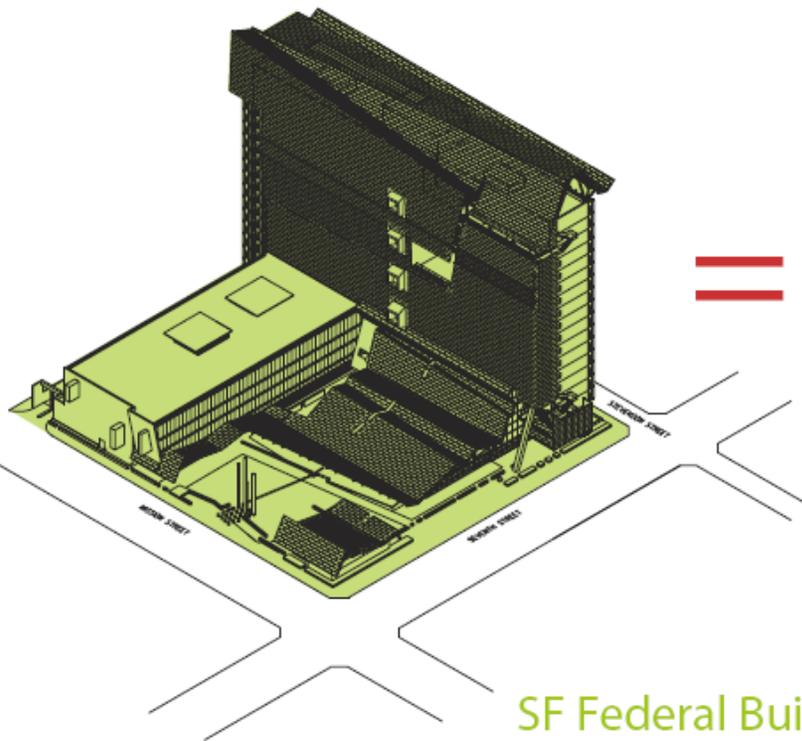
- 605,000 sq ft
- 2000 occupants
- 1st modern naturally ventilated high-rise
- 80% of workspaces access daylight
- \$240/ sq ft



Energy Use Comparison



SF Federal Building uses blast furnace slag to replace 50% of Portland Cement in concrete



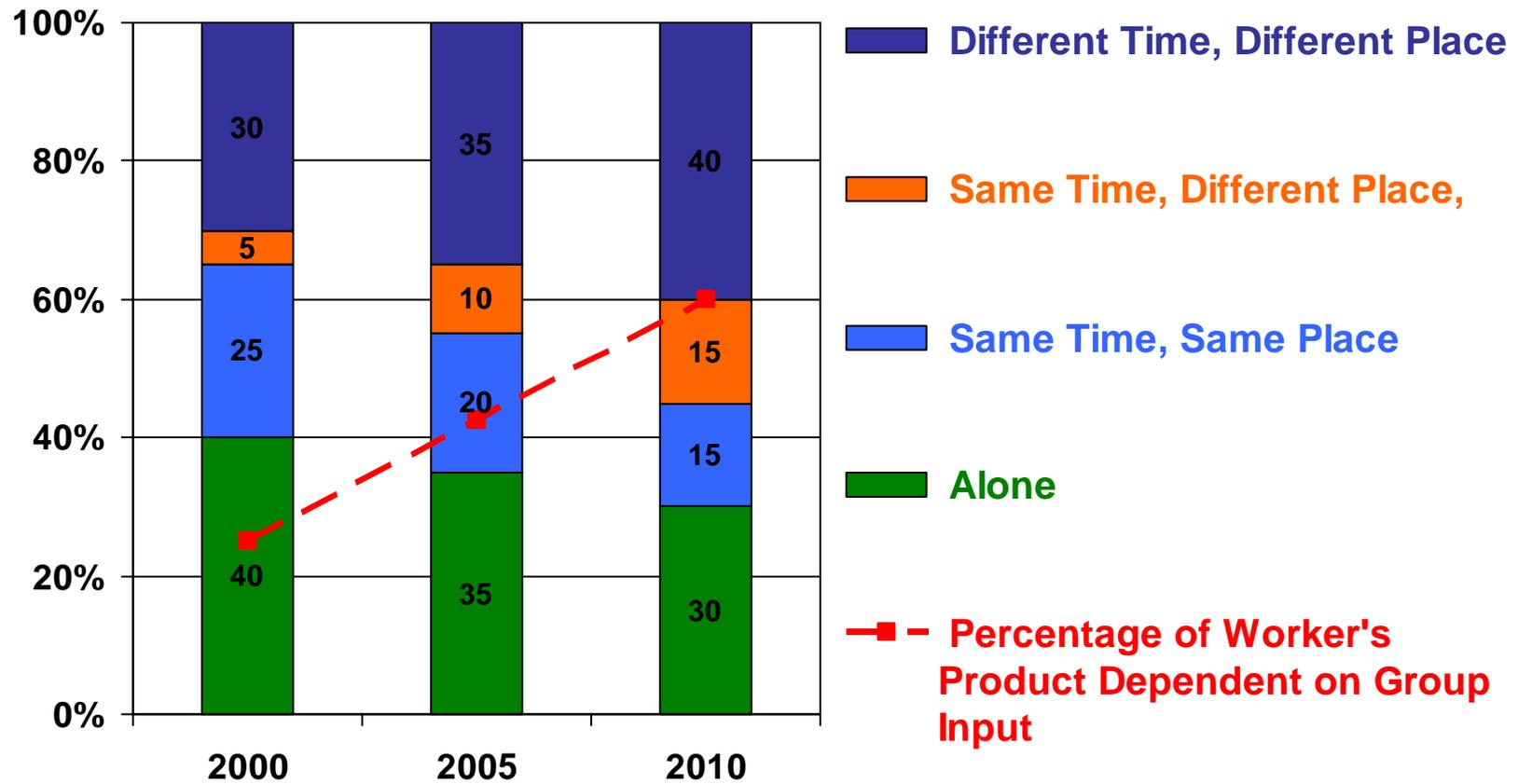
SF Federal Building saves CO2 amount equivalent to 830 cars emissions

total savings

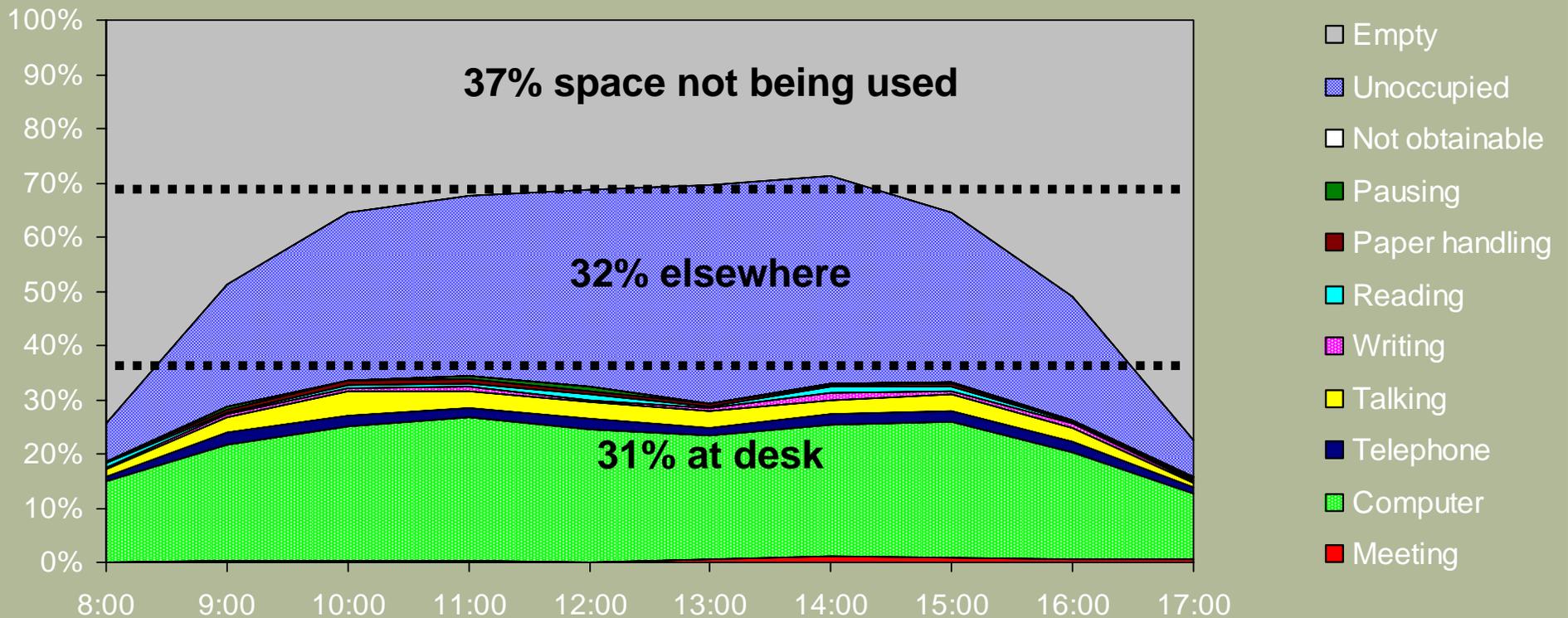


5,000 tons of CO2

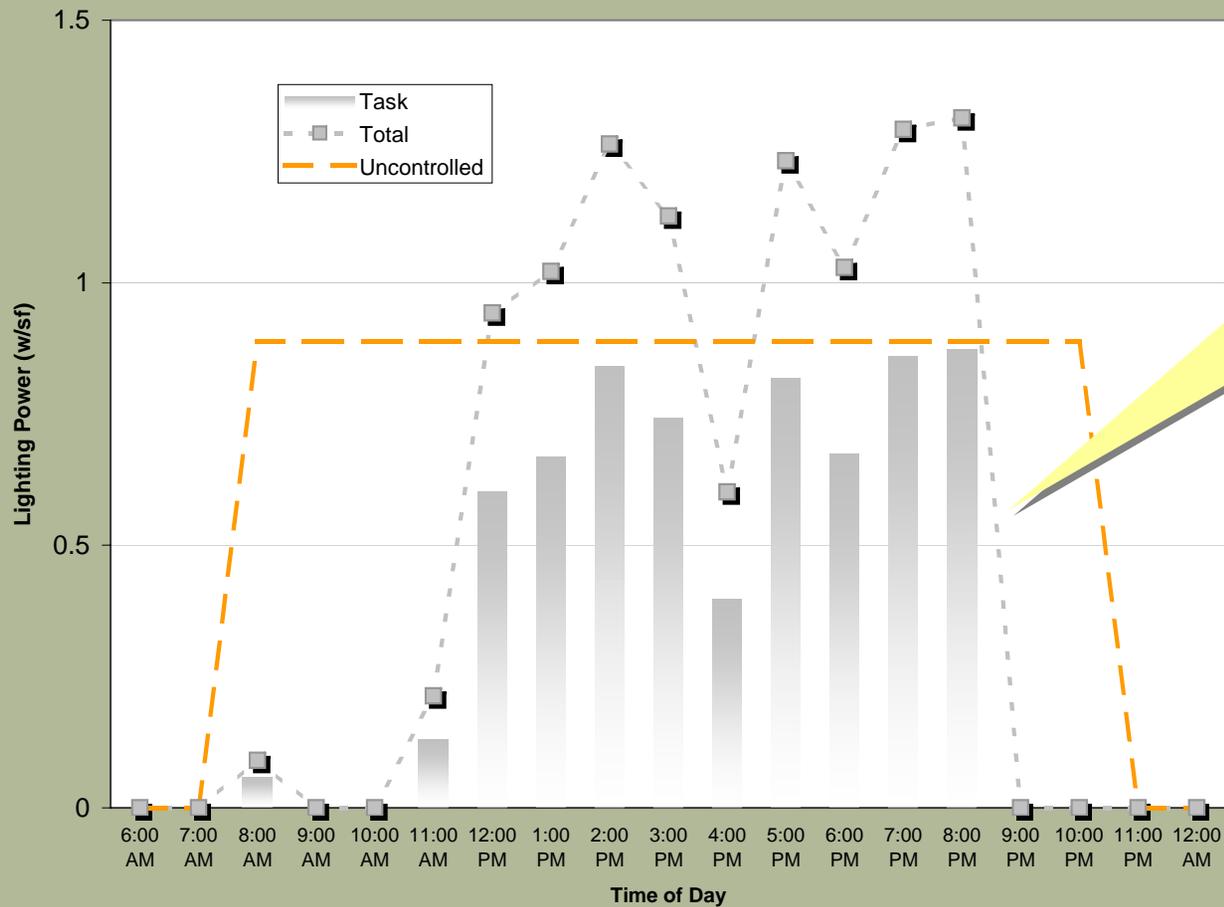
Changing Modes of Work



Average office space is dramatically under utilized



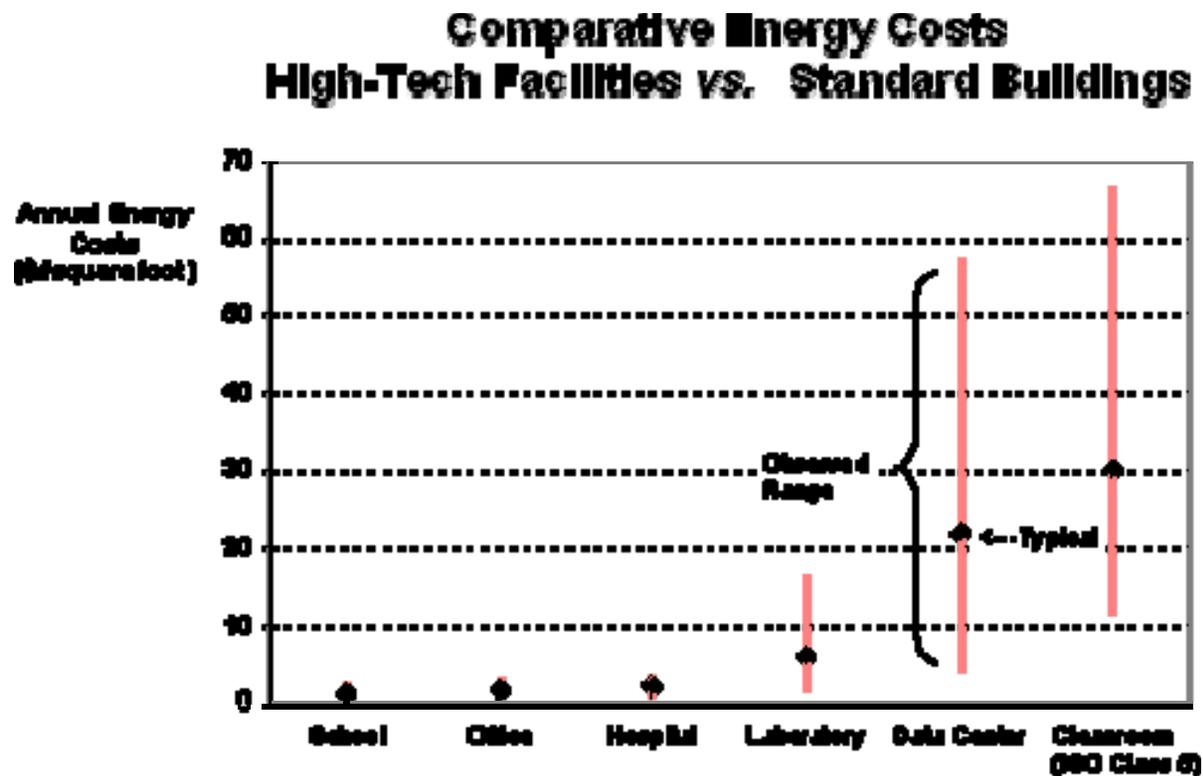
Burton Pilot: Occupancy and Daylight Sensor



*24% Energy Savings
.65 watt/sf*

High-tech buildings are energy hogs

Data Centers: 100x more energy than standard office space

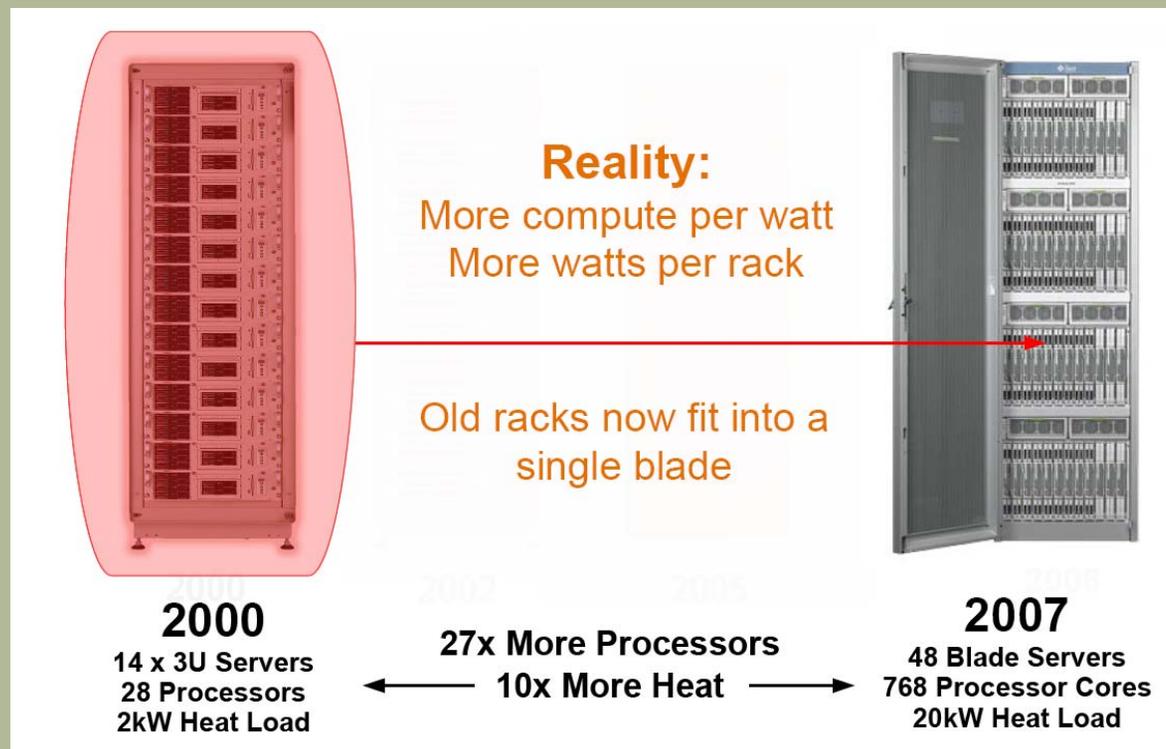


Rack densities are increasing

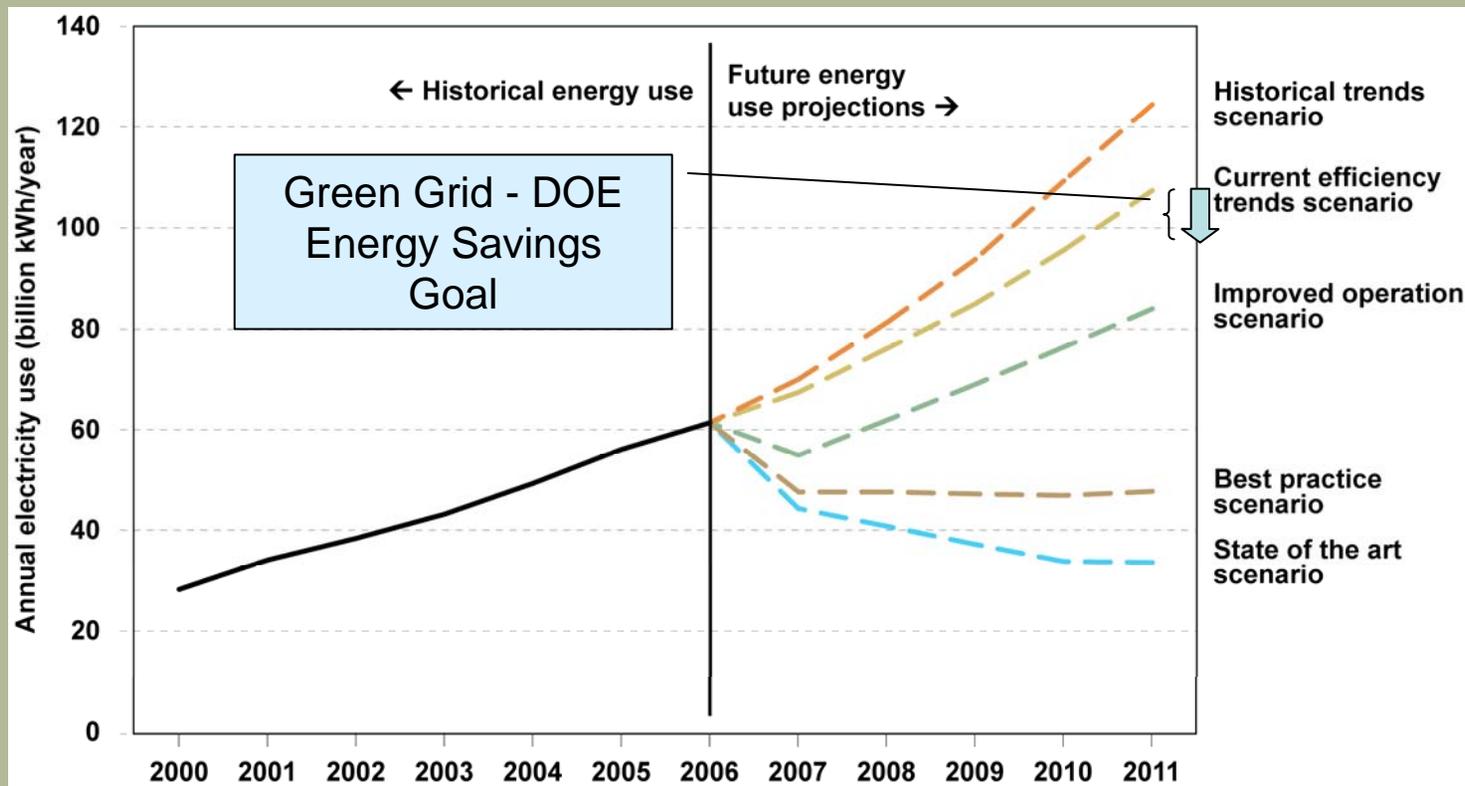
50% new data growth yearly; 390 GB created every second

Industry Average		Google	Next Generation
2003	2005	2002	
40 W/ft ² (430 W/m ²)	120 W/ft ² (1,300 W/m ²)	400 W/ft ² (4,300 W/m ²)	800 W/ft ² (8,600 W/m ²)
2 kW/rack	5 kW/rack	10 kW/rack	20 kW/rack

The annual energy used by a single rack of the emerging generation of servers (and associated air-conditioning) is equivalent to driving a car coast to coast 300 times



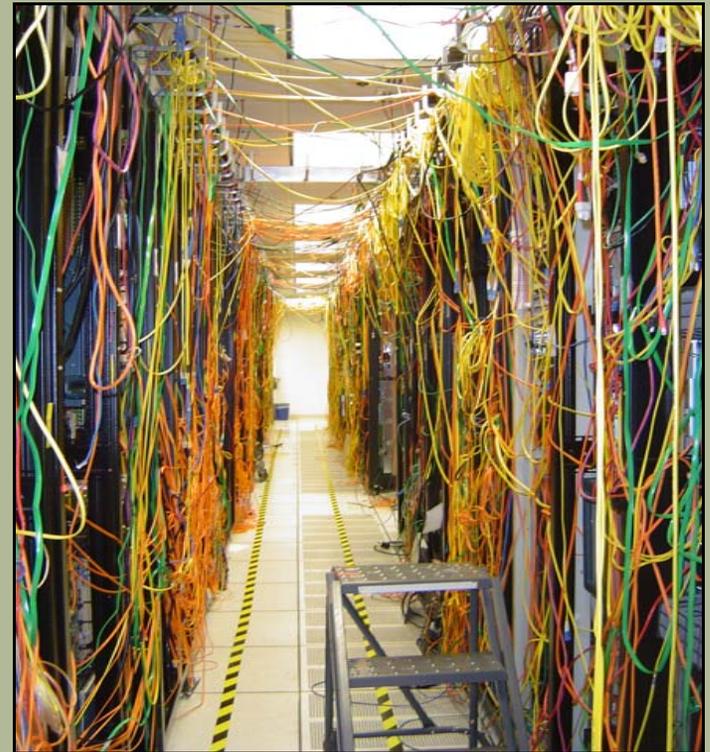
World's data centers projected to surpass the airline industry as a greenhouse gas polluter by 2020



Source: Report to Congress on Server and Data Center Energy Efficiency Public Law 109-431" US EPA, August 2, 2007

Benefits of Green Grid Data Center Energy Efficiency

- Save 11 billion kWh per year by 2011
- Potentially defer need to build new generating capacity and avoid millions of metric tons of carbon emissions
- Extend life and capacity of existing data center infrastructures
- But is my center good or bad?



Benchmarking for Energy Performance Improvement

Energy benchmarking can be effective in helping to identify better performing designs and strategies. As new strategies are implemented, energy benchmarking will enable comparison of performance.



What is efficiency benchmark for a green data center?

$$\frac{\text{Amount of Work Produced}}{\text{Amount of Energy Consumed}}$$

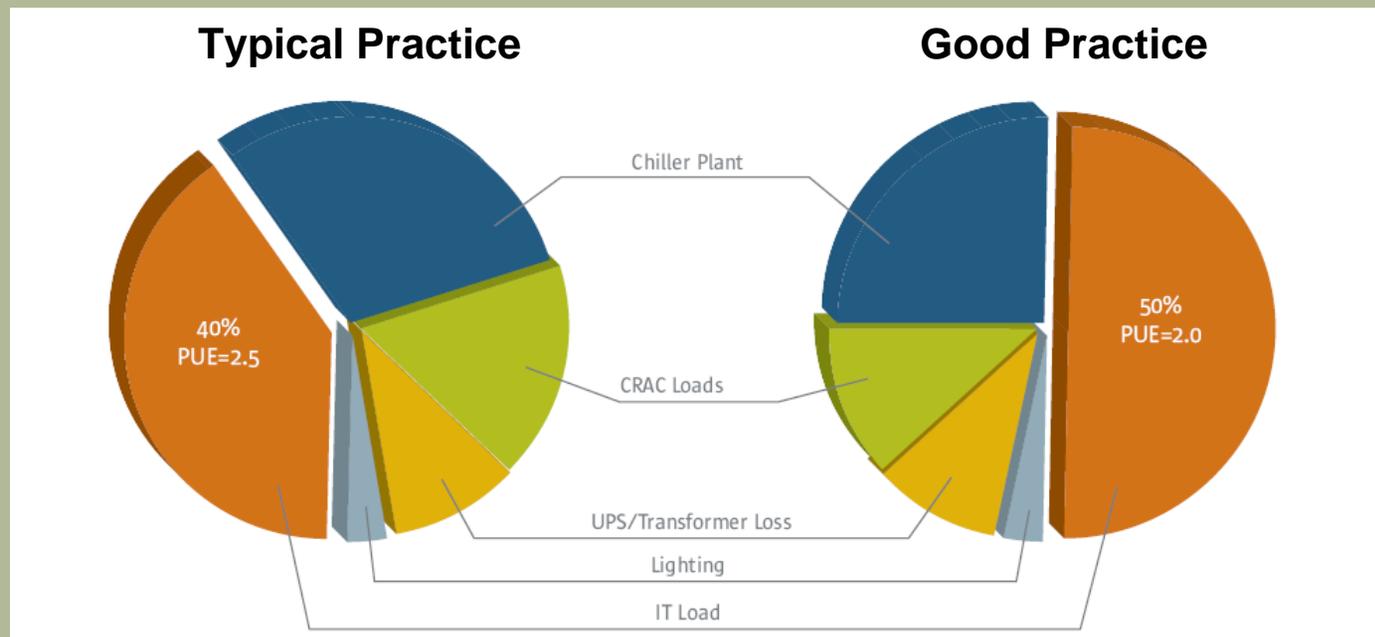
PUE (Power Usage Effectiveness)

DCiE (Data Center Infrastructure Efficiency)

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

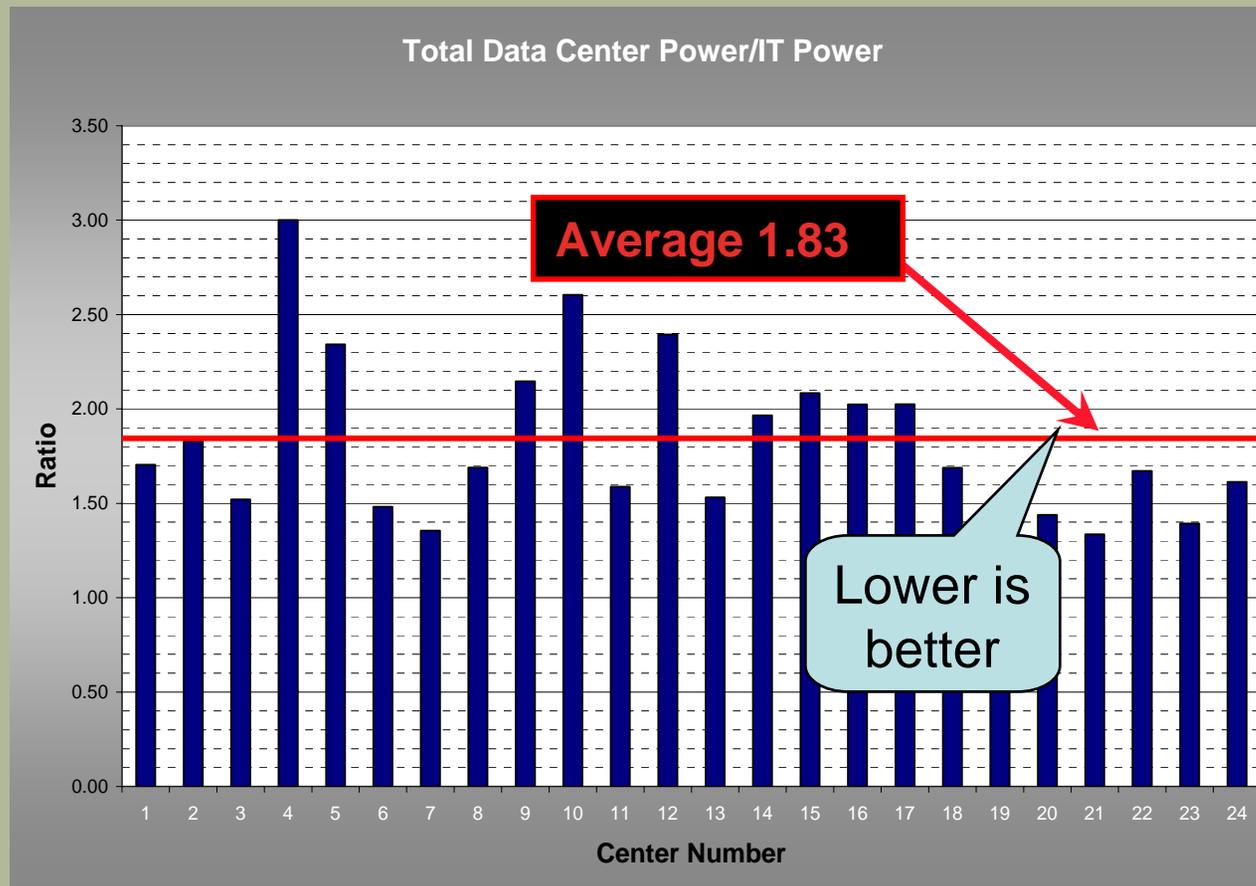
$$\text{DCiE} = \frac{1}{\text{PUE}}$$

The Challenge

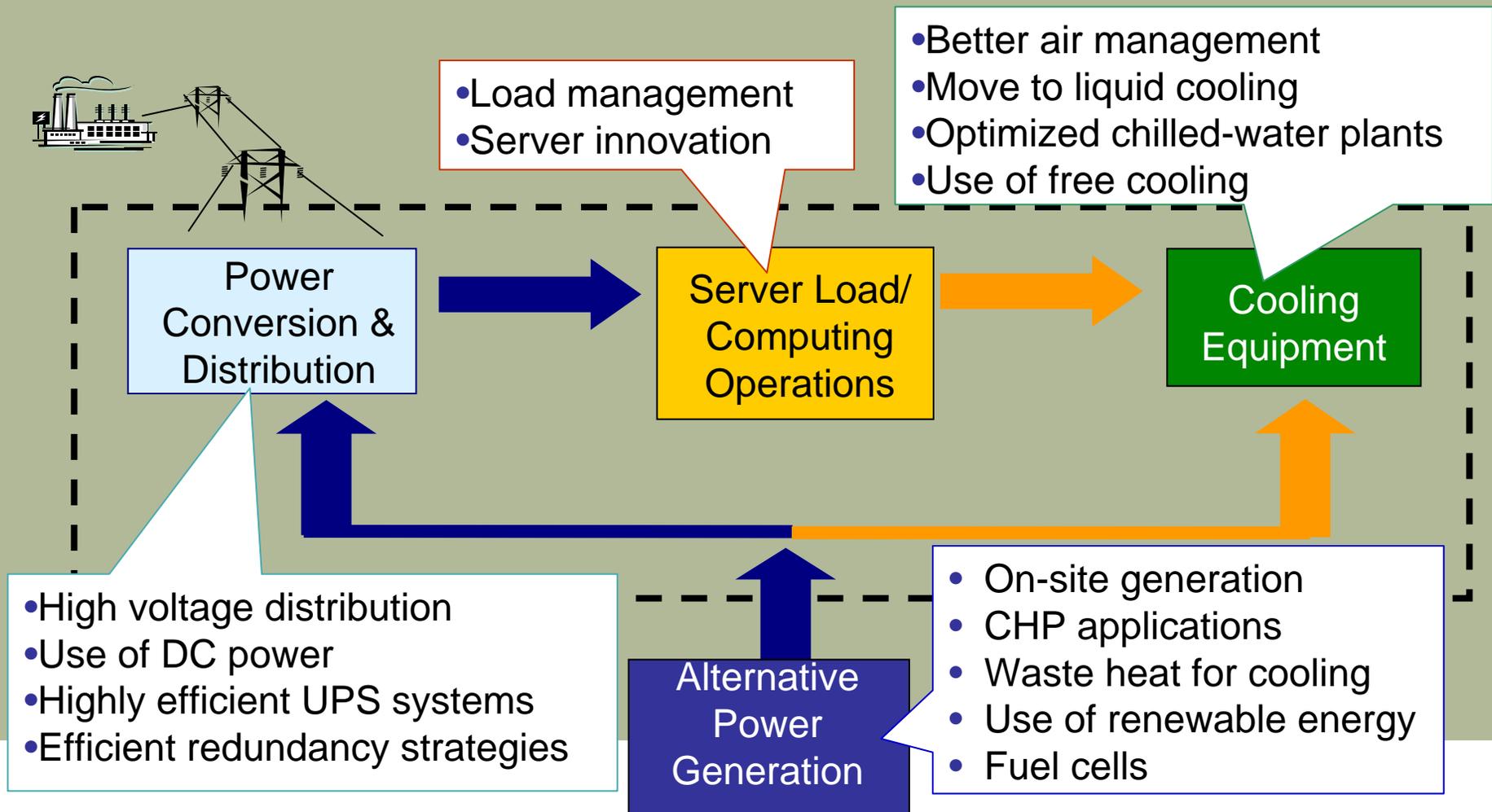


A typical datacenter consumes 1.5 watts of overhead for every watt delivered to its IT equipment. A datacenter using “good practices” will consume one watt of overhead. Contemporary better practice: PUE = 1.4. Best practice: PUE 1.2.

Green data centers: your mileage will vary



Data Center : Technologies, Tools and Metrics



What keeps us up at night?

In 2010, three people will leave the workforce for every one that joins.

In 2012, it will be four.

In 2016, it will be six.



Thank You

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