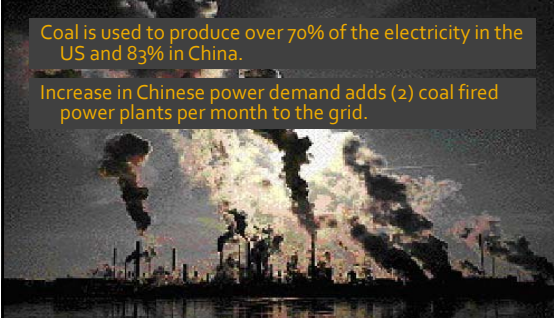


James R Benya, PE, FIES, FIALD, LC
Seriously Sustainable Lighting

Present Day

Coal is used to produce over 70% of the electricity in the US and 83% in China.

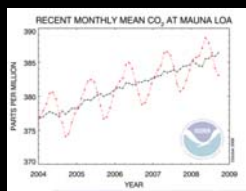
Increase in Chinese power demand adds (2) coal fired power plants per month to the grid.



Present Day

Global climate change is accelerating as greenhouse gas concentration rises faster than expected.

CO₂ concentration will soon damage ecosystems.



An international challenge



An international challenge



Sustainability is the Word



"Green is the new Black" - *NYTimes*, 2007

The Promise of Modern Lighting

- Beauty, discovery, wonder
- Necessary contributions to the functionality of the built environment
- Creative contributions to the enjoyment of life




The Reality of Modern Lighting

The Opportunity of Modern Lighting

Lighting is a prime opportunity to mitigate energy use and greenhouse gas production

- 70% of lighting energy use is by day
- 50% of lighting energy use is by older, inefficient technologies

The Opportunity of Modern Lighting

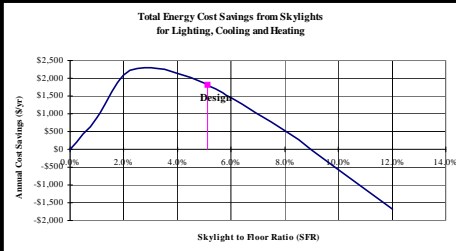
Lighting is 22-25% of electric energy use in the US

- 40% commercial
- 30% industrial
- 15% residential
- 10% outdoor and signs
- 5% other

Opportunities

Less is more


21st Century Daylighting



Skylight to Floor Ratio (SFR)	Annual Cost Savings (\$/yr)
0%	0
2.0%	~\$1,500
4.0%	~\$2,000 (Peak)
6.0%	~\$1,500 (Design point)
8.0%	~\$1,000
10.0%	~\$500
12.0%	~\$0
14.0%	~\$-1,500

Daylighting

The Next Great Frontier of Design



21st Century Daylighting



Conventional Lighting

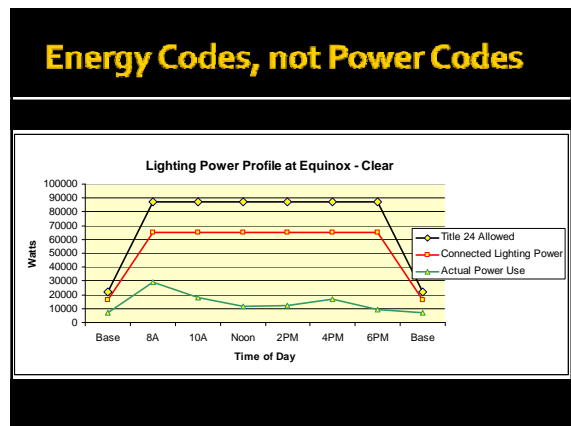
Less is more

Low Power Lighting

- Low watt sources
 - LED
 - Halogen
 - Fluorescent
- High Efficacy Sources
 - Linear fluorescent
 - High wattage HID
- High Efficiency Sources and Luminaires
 - LED
 - Plasma HID

Dynamic Standards

CURRENT	PROPOSED
<ul style="list-style-type: none"> ■ Illuminance <ul style="list-style-type: none"> ▪ Fixed ■ Energy <ul style="list-style-type: none"> ▪ Power, Fixed 	<ul style="list-style-type: none"> ■ Illuminance <ul style="list-style-type: none"> ▪ Ranges ▪ Adaptation based ■ Energy <ul style="list-style-type: none"> ▪ kWh ▪ Demand based



Real Time Energy Measurement

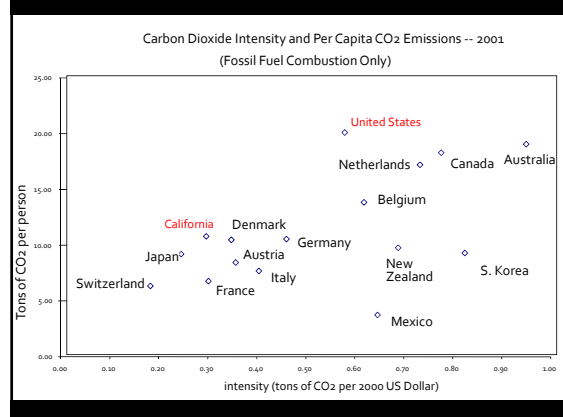
- Measure actual lighting power
- Disaggregate building energy use
 - Lighting
 - Computers
 - Transportation
 - Process
 - Food preparation
 - HVAC
 - Etc.
- Prominently Display data

Competitions Reward Sustainable Design

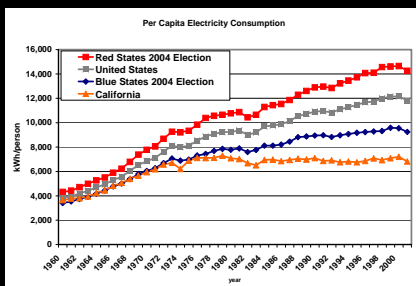


Require Modern Controls

- Digital infrastructure
- Smart, dimming ballasts and drivers
- Useful software
- Design principles and theory
- Proper strategy for each application



Retrofitting works



Reduce or Eliminate Excessive Exterior Lighting



Incentivize Better Buildings



For the Planet

- Reduce total use
- Free up peak power

For the Industry

- Good counter-cycle business
- Exciting integration of new light sources
- New opportunity to do quality lighting

Please read the paper!

Thank You