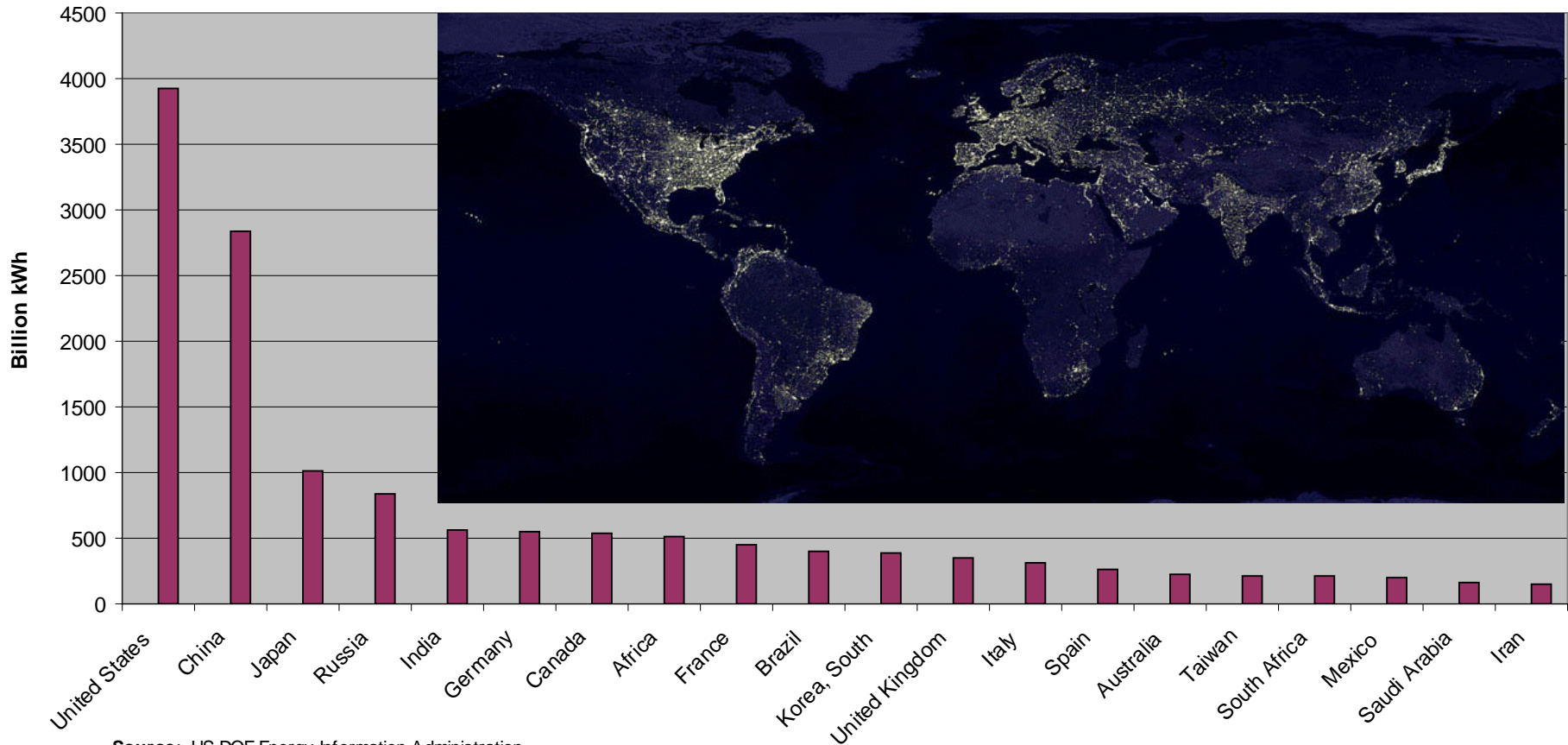


Total Light Management



Why is saving Energy Important

World Electricity Consumption (2007)
Top 20 Countries



Source: US DOE Energy Information Administration

Lighting Control Strategies



High-end trim/Tuning: Sets the target light level based on customer requirements in each space.



Occupancy or vacancy sensing: Automatically turn off lights when people vacate the space⁷.



Daylight harvesting: Automatically adjusts the electric lighting levels based on the amount of daylight in the space.



Personal light control: Allows users in the space to select the correct light level for the desired task. Often that is much less light than full-on.



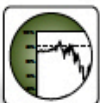
AC reduction due to lighting reduction: Research estimates that 1kWh lighting savings induces 0.48kWh cooling savings⁶.



Controllable window shades: Allows quiet control of daylight for improved comfort and productivity using Sivoia® QS shades.



Scheduling: Lights turn off or are dimmed and shades are adjusted automatically at certain times of the day or in relation to sunrise and sunset⁸.



Demand response: Allows the facility manager to reduce lighting load at times of peak electricity pricing to avoid extra charges, black-outs, brown-outs, and create revenue opportunities.

4 easy steps to 60% lighting energy savings



STEP 1:
Tuning



20%
Savings from Tuning



“We designed our building to use 1.28 Watts per square foot of lighting power... it's only using 0.33 — that's 75% less.”

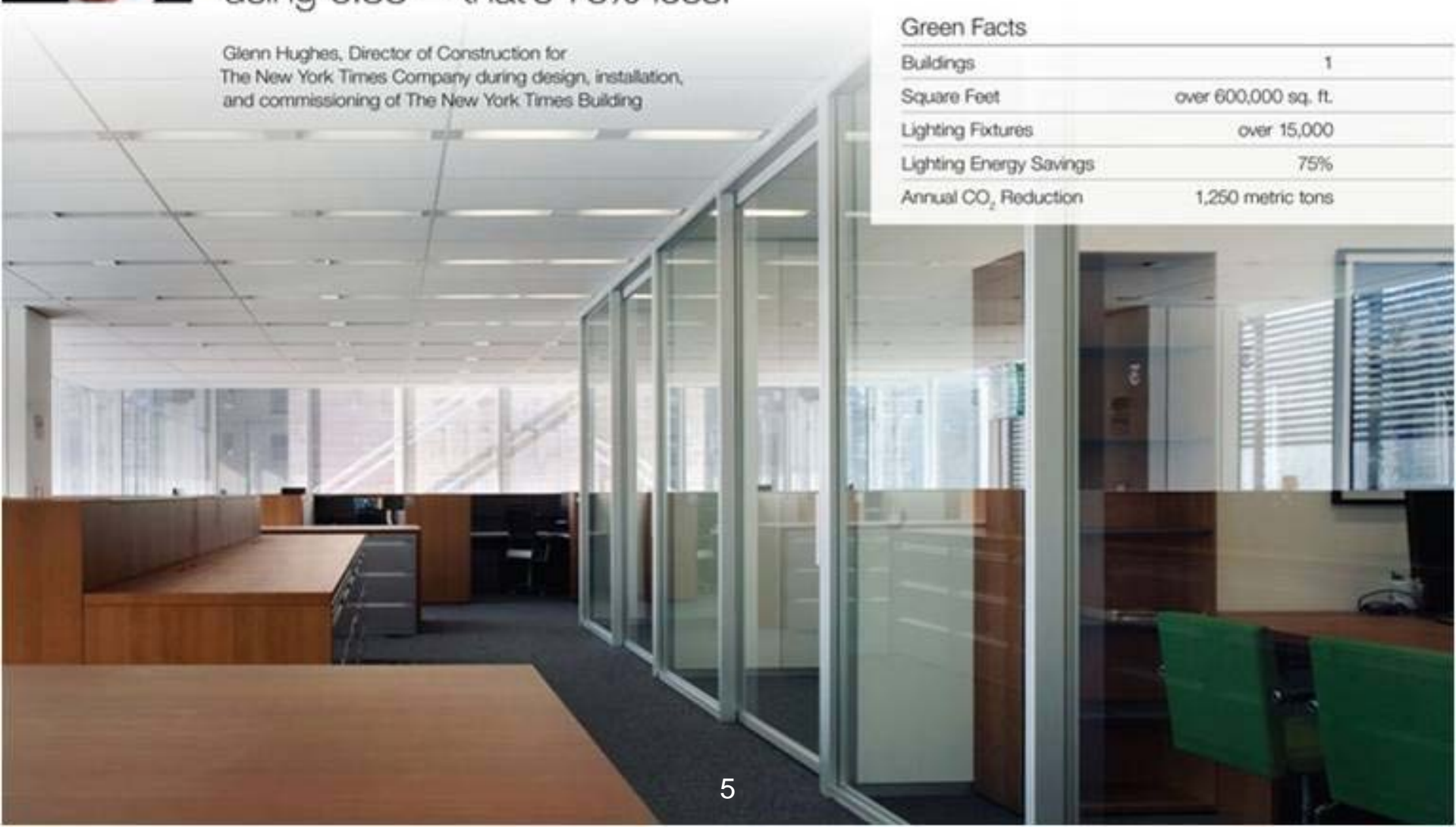
Glenn Hughes, Director of Construction for The New York Times Company during design, installation, and commissioning of The New York Times Building

This facility saves over \$315,000 each year by managing light with Lutron solutions.

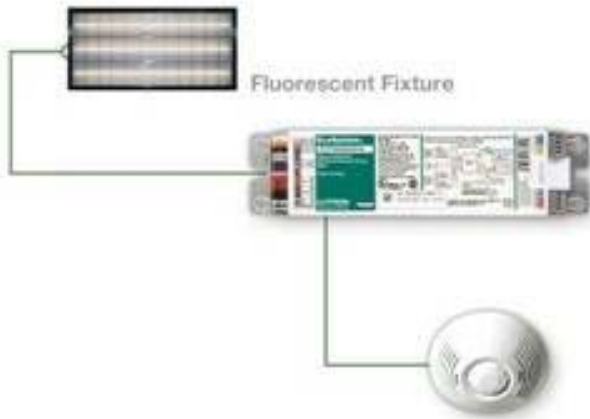
The New York Times, New York, New York, USA

Green Facts

Buildings	1
Square Feet	over 600,000 sq. ft.
Lighting Fixtures	over 15,000
Lighting Energy Savings	75%
Annual CO ₂ Reduction	1,250 metric tons



4 easy steps to 60% lighting energy savings



Fluorescent Fixture

STEP 1:
Tuning

STEP 2:
Occupancy/Vacancy Sensing

20%
Savings from Tuning

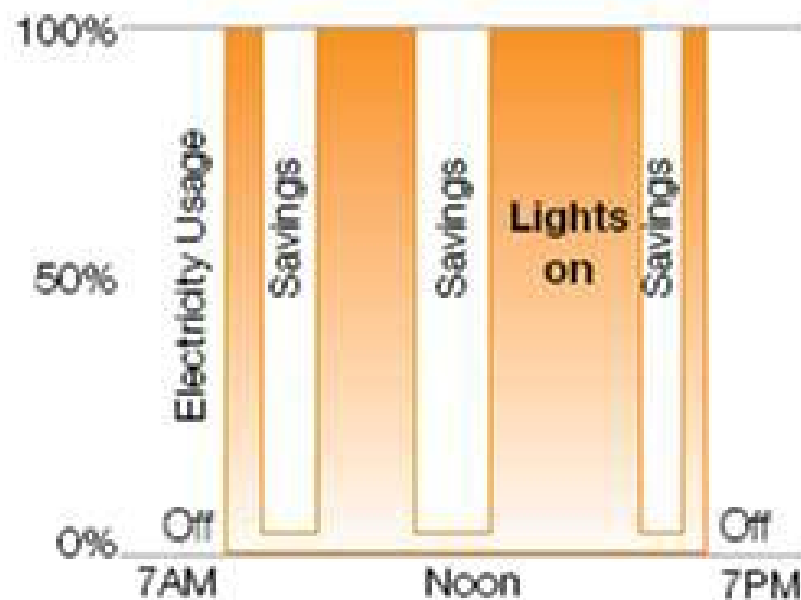
+ 15%
Savings from Occupancy/Vacancy Sensing

35%
Total Lighting Energy Savings

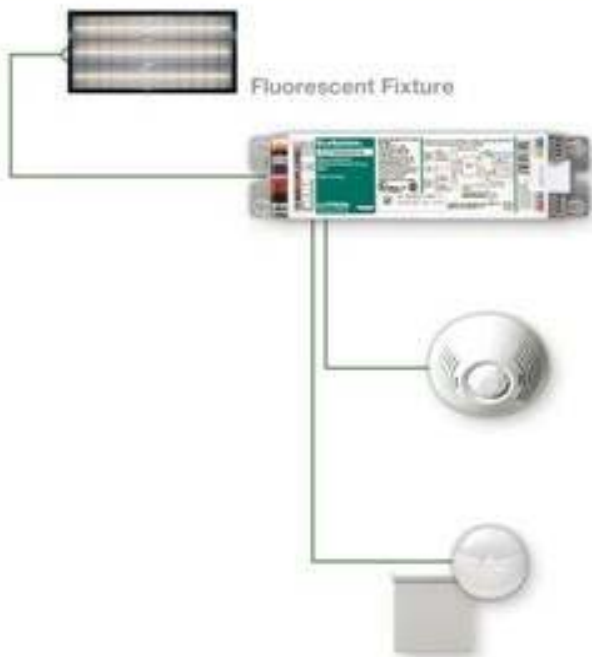


Occupancy/Vacancy Sensing

- The greatest energy savings achieved with any lighting fixture is when the lights are shut off
- Minimize wasted light by providing occupancy sensing or vacancy sensing



4 easy steps to 60% lighting energy savings



STEP 1:
Tuning

STEP 2:
Occupancy/Vacancy Sensing

STEP 3:
Daylight Harvesting and
Natural Light Control

Lighting Energy Savings from Steps 1, 2, and 3



20%
Savings from Tuning

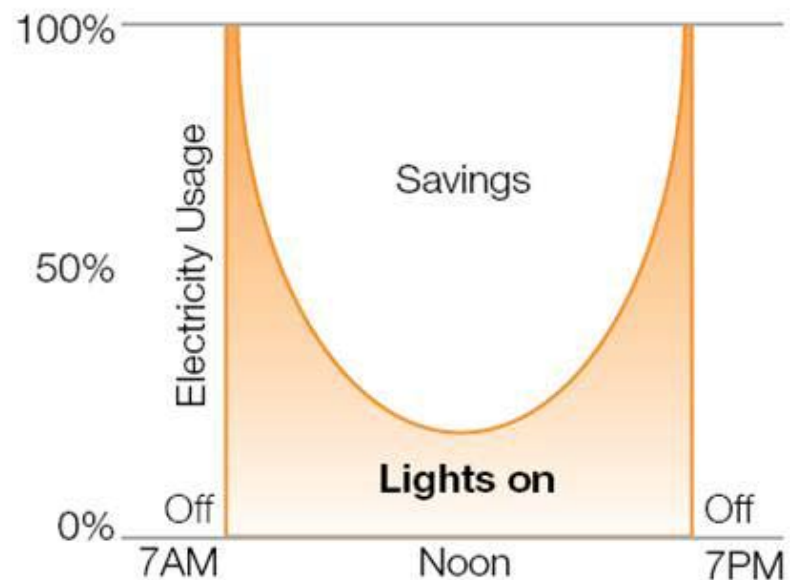
+ 15%
Savings from Occupancy/Vacancy Sensing

+ 15%
Savings from Daylight Harvesting
and Natural Light Control

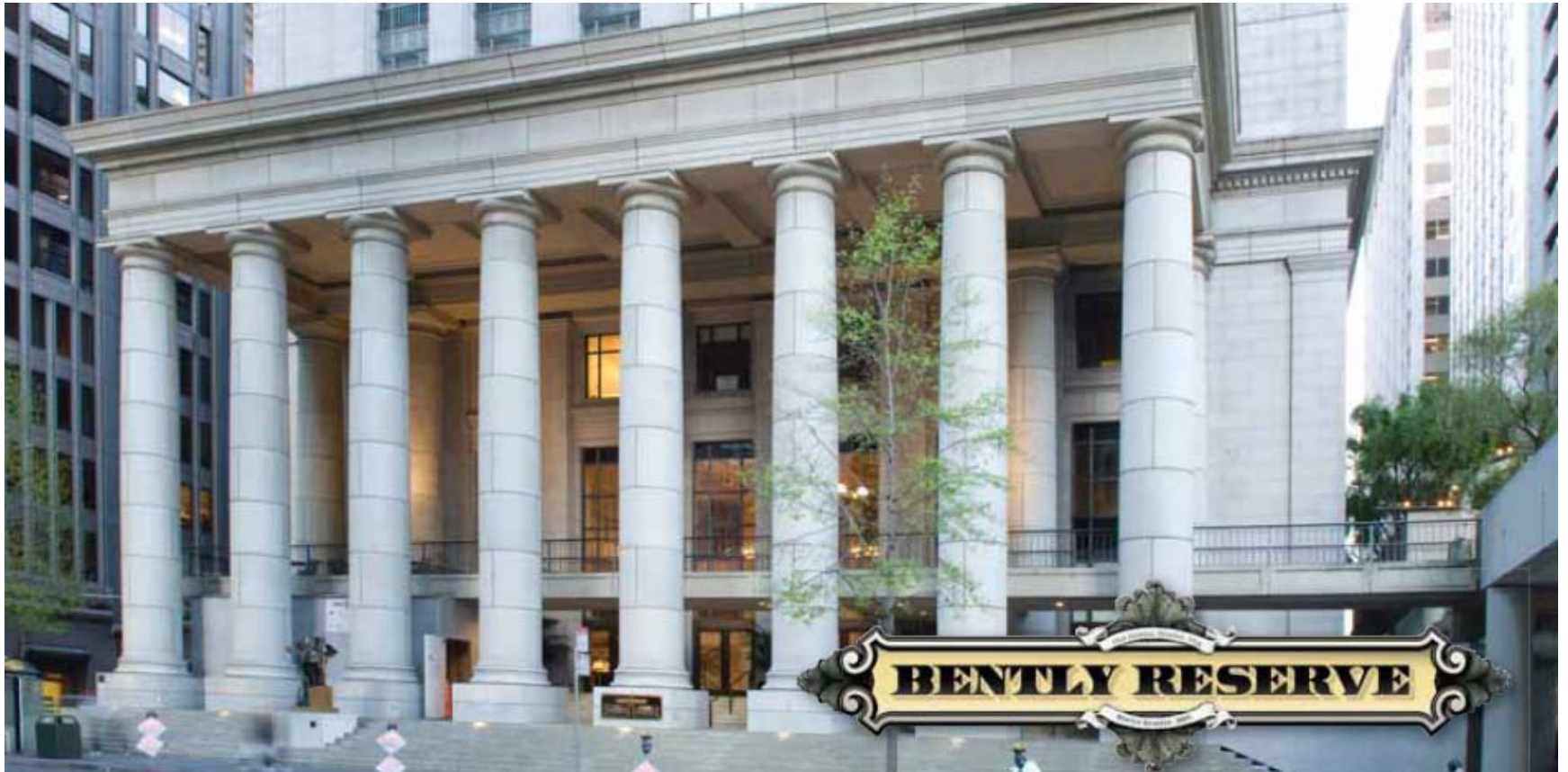
50%
Total Lighting Energy Savings

Daylight Harvesting

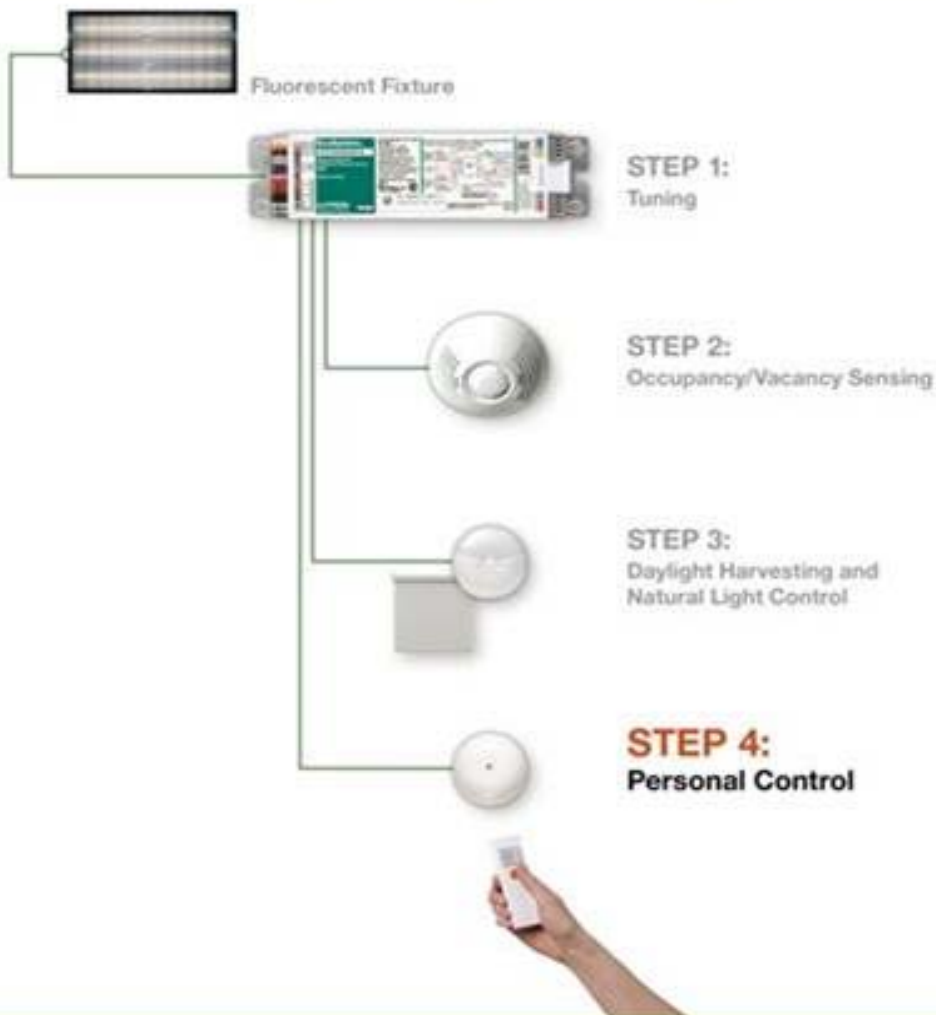
- Most commercial space has enough natural light flowing into it, and the amount of artificial light being generated can be unnecessary
- Cut back on the production of artificial lighting by implementing technologies that can measure and account for natural lighting



Bently Reserve Saves over 40% using Daylight control



4 easy steps to 60% lighting energy savings



Lighting Energy Savings from Steps 1, 2, 3, and 4



20%
Savings from Tuning

+ 15%
Savings from Occupancy/Vacancy Sensing

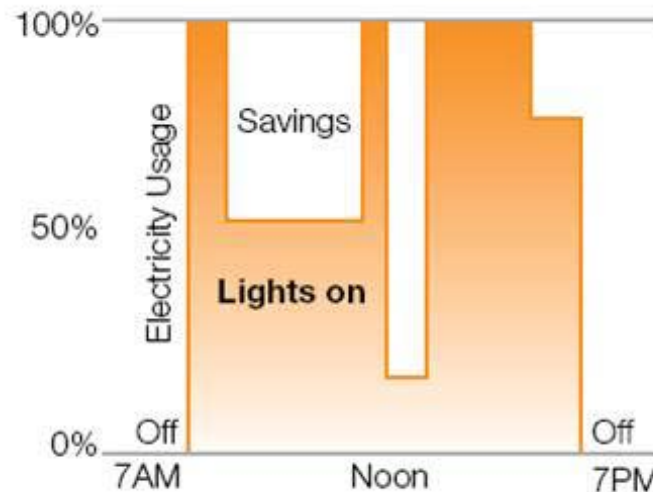
+ 15%
Savings from Daylight Harvesting and Natural Light Control

+ 10%
Savings from Personal Control

60%
Total Lighting Energy Savings

Personalized Control

- Many “green” technologies generate energy savings on the basis that some level of performance and convenience must be sacrificed
- One major benefit of dimming is its ability to save more energy as the lights are dimmed down (this is true of fluorescent as well)
- Providing personalized control of the light allows workers to optimize their performance and save energy in the process



Access Living utilize all strategies to save 65%



“At first, we weren’t even thinking about daylight sensing because we just assumed we couldn’t afford it. But we were pleasantly surprised by the cost savings and decided to integrate them into our plans to be both universal and green in our design.”

Karri Callahan, AIA, IIDA, LEED AP
Architect



Access Living, Chicago, Illinois

This facility saves over \$10,000 each year by managing light with Quantum.

Green Facts

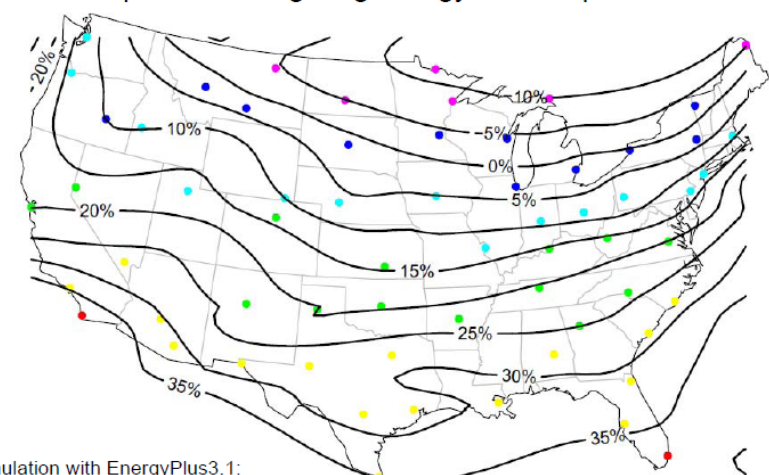
Buildings	1
Square Feet	50,000 sq. ft.
Lighting Fixtures	380
Lighting Energy Savings	65%
Annual CO ₂ Reduction	90 metric tons
Certification	LEED® Gold

Light Control and HVAC Reduction

- Rule of thumb: 3Watt reduced from Lights = 1Watt reduced from HVAC
- All Electric light sources give off heat
- Dimming reduces heat given off by each lamp



Additional incremental savings in total building energy consumption when lighting energy consumption is reduced

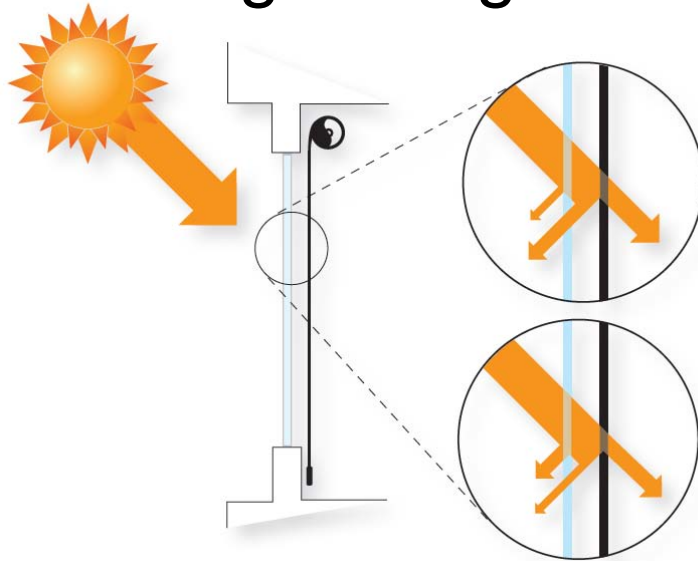


Simulation with EnergyPlus3.1:
Medium sized 3-story office building (6,144m²),
40% window-wall-ratio,
Packaged terminal air conditioner,
standard wall insulation (ASHRAE 90.1-2004)

© Lutron Electronics Co., Inc. 2010
Created by Pekka Hakkarainen, Ph.D.
Complaints to phakkarainen@lutron.com

Controllable Shade HVAC reduction

- Depending on the type of shades, glass properties and building design, shades can save 10% of HVAC energy: 9% in cooling savings and 1% in heating savings



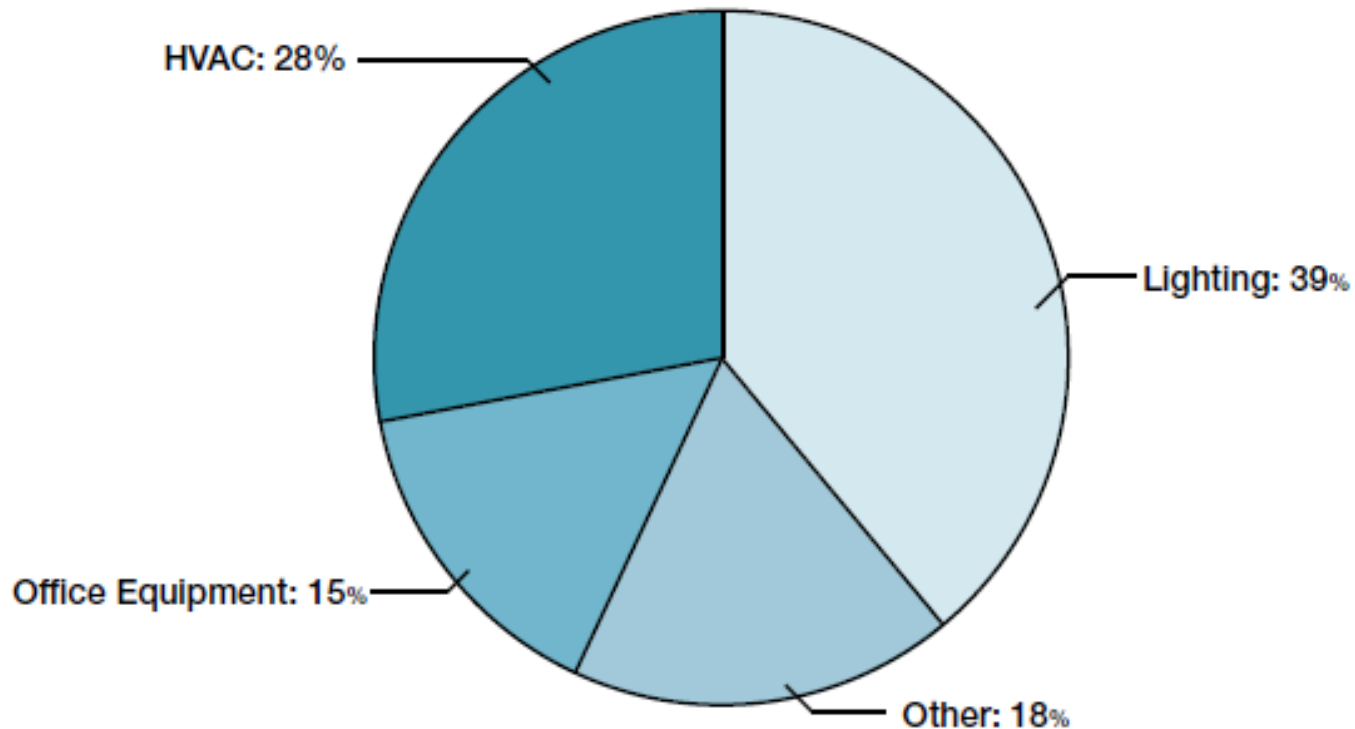
Lower Glass Solar Heat
Gain Coefficient requires
Higher shade reflectance

Higher Glass Solar Heat
Gain Coefficient requires
lower shade reflectance

The higher the SHGC and U-value, shades have more impact

Where is my Electrical Energy Used?

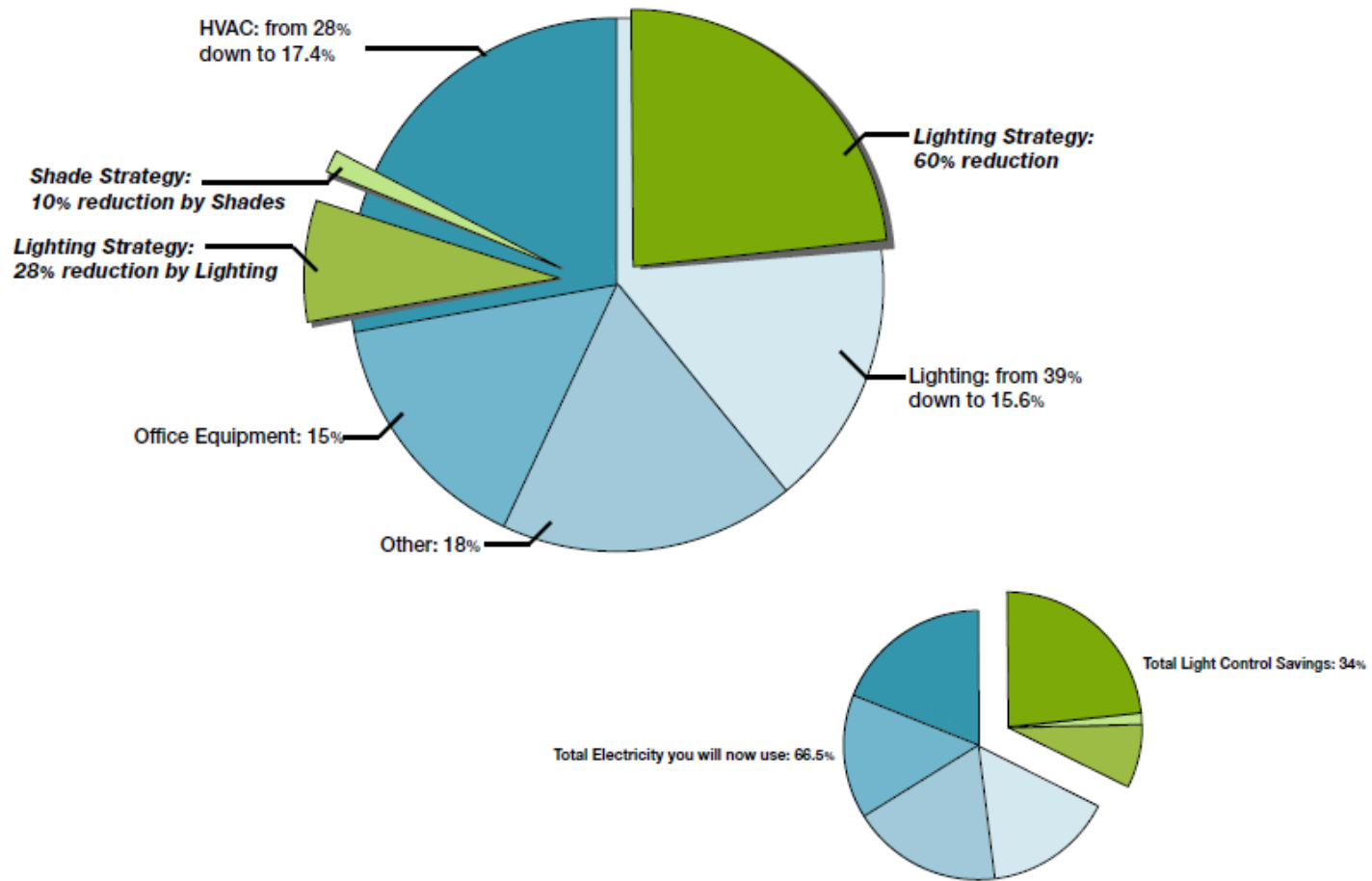
Annual Electricity Use in Office Buildings



Source: Energy Information Administration, 2003 Commercial Buildings Energy Consumption Survey, Released September 2008

Light Control Strategies- How they effect energy

Impact of Light Control on Annual Electricity Use in Office Buildings*



* Source: US Department of Energy Model Department of Energy-2, Energy 3W Reduction in Lighting - 1W Reduction in AC for Year Round Cooled Buildings
** Lutron Commissioned simulation by T.C. Chan Center University of Pennsylvania, September 2008

Demand Response with Lighting

Demand Response (DR)

- Manage customer electricity consumption in response to supply conditions, critical times or market prices.
- A different concept from energy efficiency, which means using less power to perform the same tasks.

Emergency DR vs. Economic DR

- Emergency demand response is primarily needed to avoid outages.
- Economic demand response is used to help utilities manage daily system peaks.

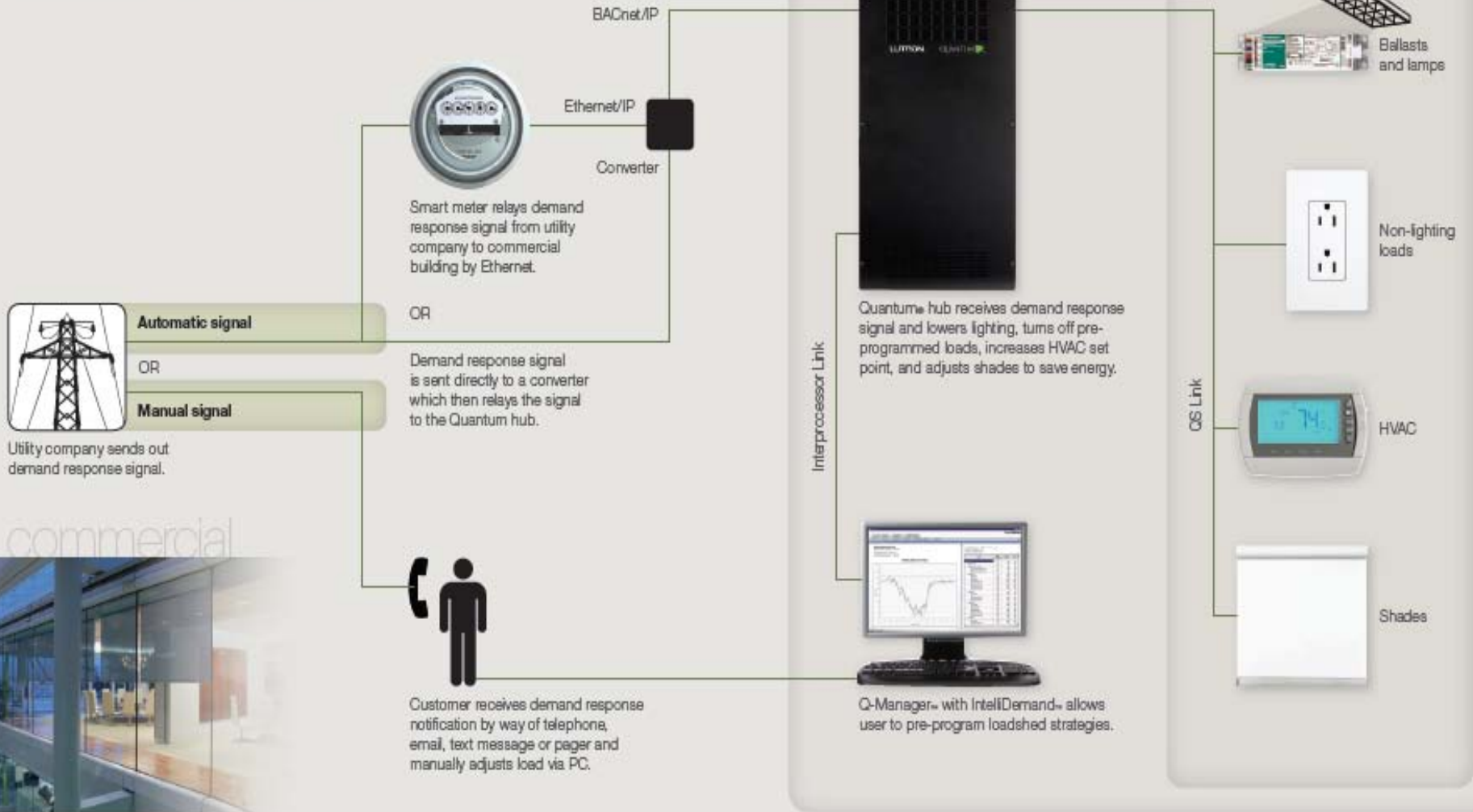
“The key to the potential of a demand-responsive lighting system is that it provides a simple, reliable, and painless way to decrease load.”

Energy-Efficient Load-Shedding Lighting Technology

California Energy Commission.

Demand Response can be used to temporarily reduce energy

Lutron commercial Smart Grid solutions allow a facility to respond to load shed requests automatically, or at the touch of a button. Just the right light ensures comfort and productivity.



Automatic signal

OR

Manual signal

Utility company sends out demand response signal.

commercial



Customer receives demand response notification by way of telephone, email, text message or pager and manually adjusts load via PC.



Quantum hub receives demand response signal and lowers lighting, turns off pre-programmed loads, increases HVAC set point, and adjusts shades to save energy.



Q-Manager with IntelliDemand allows user to pre-program loadshed strategies.



Ballasts and lamps



Non-lighting loads



HVAC



Shades

Whole-Building Solutions

How it all ties together



Quantum

- Ultimate level of interoperability and scalability for lighting control
- Manages both electric and natural daylight through automatic and manual control

Quantum Layer



Quantum



Sub-System Layer

Sensors
Wired or Wireless



Digital
Ballasts



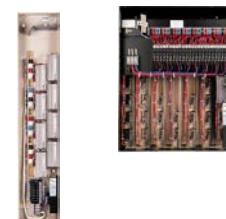
Grafik Eye QS



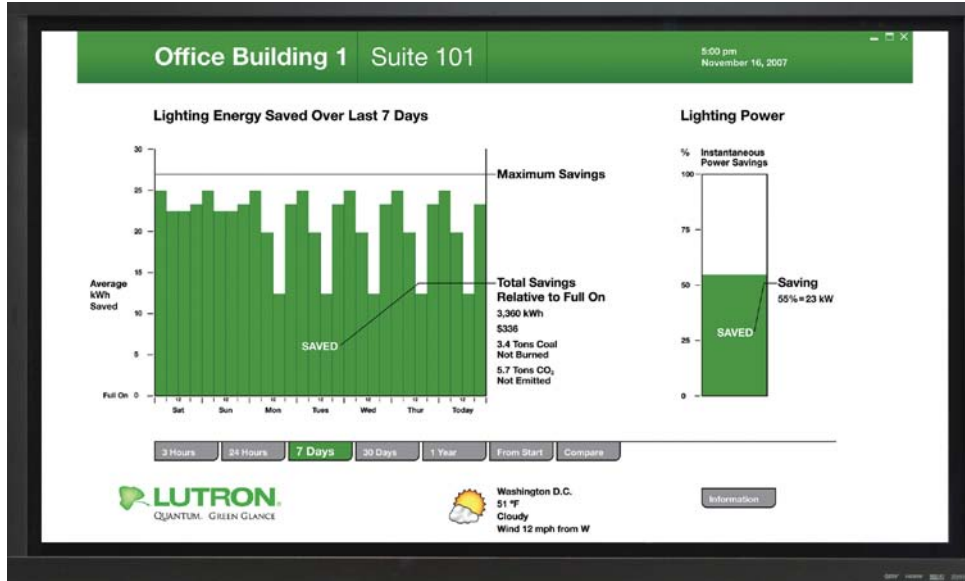
Sivoia QS
Shades



Panels



Green Glance Display



Green Glance



Integration to other building Management Systems

BACnet Integration:

- Connection on any processor in the Quantum network over a standard IP based network
- The connected processor is programmed at start-up to manage all BACnet/IP communications
- Control and monitor areas or groups
- No gateway required, BACnet/IP is resident in each Quantum processor



BACnet Integration

- With no gateway integrators can work with proper names automatically generated by the Quantum processor

The screenshot displays the 'BACnet Quick Test for WinXP v4.63' application. The interface is divided into three main sections:

- Left Panel (Tree View):** Shows a hierarchical structure of BACnet objects. The root is 'BACnet', followed by 'BACnetRP (19 peers)'. Underneath, there are several systems and rooms, including 'Floor 2 System (1000)', 'Training Room 101 (1014)', and 'Conference Room 115 (1002)'. The 'Conference Room 115 (1002)' is currently selected, and its sub-objects are listed below it, such as 'Accent Lighting Level (Analog Value-1002)', 'Additional Occupancy Times of (Analog Value-11)', and 'Lighting Level (Analog Value-2)'. Other rooms listed include 'Electrical Chast 105 (1003)', 'Conference Room 118 (1004)', 'Conference Room 121 (1005)', 'Conference Room 112 (1006)', 'Conference Room 212 (1007)', 'Conference Room 122 (1008)', 'Conference Room 222 (1009)', 'Publishers Room 120 (1010)', 'Publishers Room 130 (1011)', 'Eagle Room 131 (1012)', and 'Training Room 104 (1013)'.
- Right Panel (Table):** A table with columns 'ObjID', 'Name', and 'Value'. It lists various BACnet objects and their current values. For example, 'Analog Value 1002' has a value of '0.00000', 'Multistate Value 14' has a value of '3', and 'Device 1002' has a value of 'OPERATIONAL (0)'. The table lists 19 objects in total.
- Bottom Panel (Status Bar):** Contains copyright information '©2001-2000 Lutron R Inc.', a unique identifier 'TX=191,RI=294,TC=0xR10=0,TCVer=FDU=0,Rebits=0', and connection details '19 peers, 19 BACnet/IP'. There is also a 'Process' button on the right.

Thank You – Questions?

