



Personal Controls for Office Lighting

Roy Hughes, PEng, LC
Project Manager
Technologies Solutions
BC Hydro

The Need for Control - the Economics

- For most office facilities, lighting accounts for over **40%** of the electrical bill
- Potential energy savings involved with lighting control can be above **30%** of the total building energy usage



Power Smart Workspace System

BC Hydro's Power Smart division realizes 80% energy savings in new offices

- Electric business March 2003

Personal Lighting Controls

- personal dimming
- on-board occupancy sensor
- photo control sensor



The Ideal Automated Lighting System

- supports the task at hand
- accommodates the individual
- integrates lighting controls and natural light
- energy efficient
- environmentally sensitive, maintainable and sustainable,
- well integrated with the architecture
- reinforces an organization's image and culture

Lighting Design Approaches

Traditional approach:

- ◆ lowest cost to achieve basic light level throughout facility
- ◆ few lighting control points

Lighting Design Approaches

Better approach:

- ◆ best financial value based on energy savings and productivity benefit
- ◆ flexible lighting control

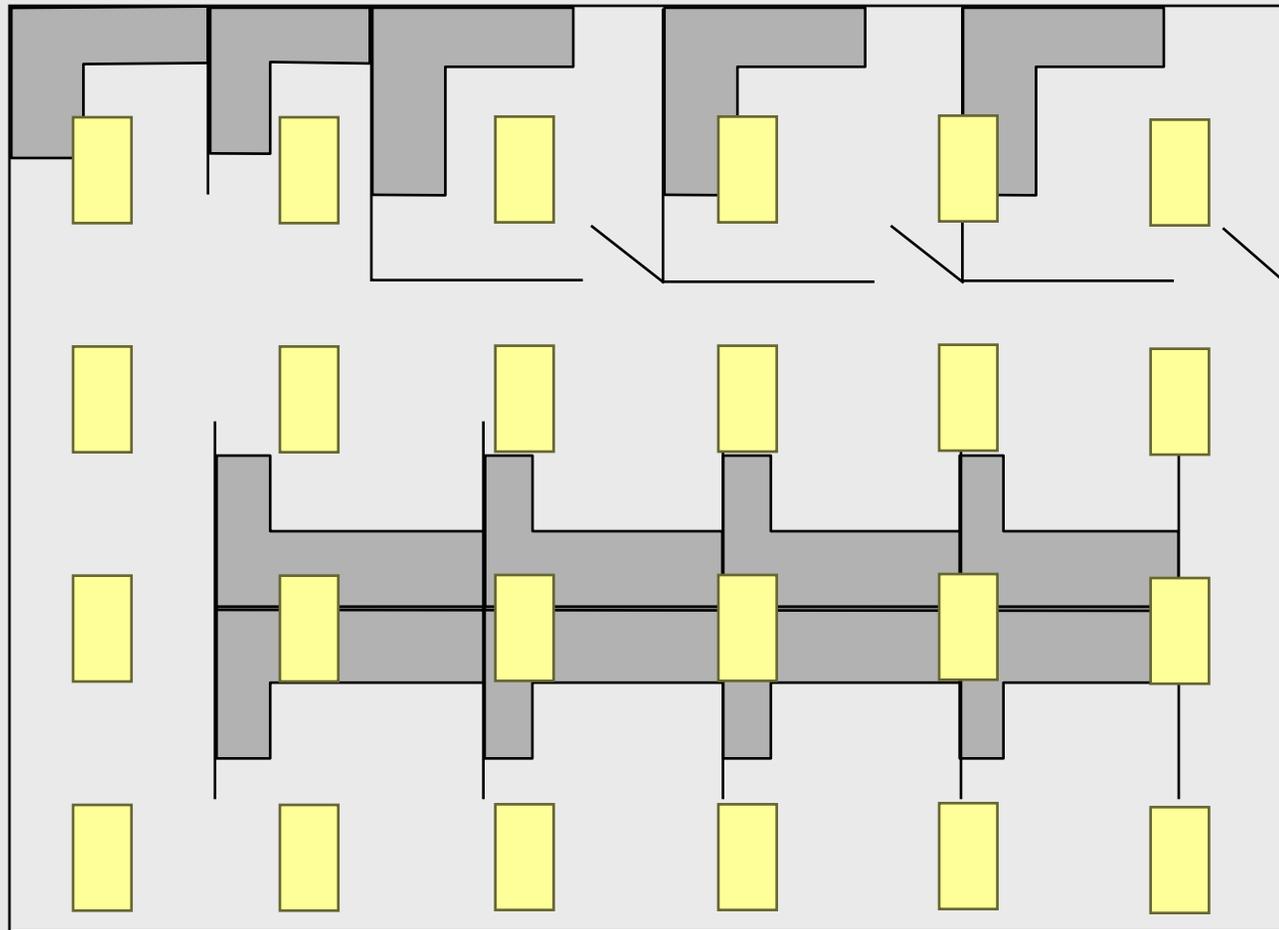
Maximum Expected Energy Savings

Space Type	Controls Type	Max. Expected ES
Private office	Occ. sensor	45%
	Photo dimming	30%
	Manual dimming/ Multi-level switching	25%
Open office	Photo Dimming	35%
	Occ. sensor	25%

Study by Lighting Research Center at several federal office buildings - 2000

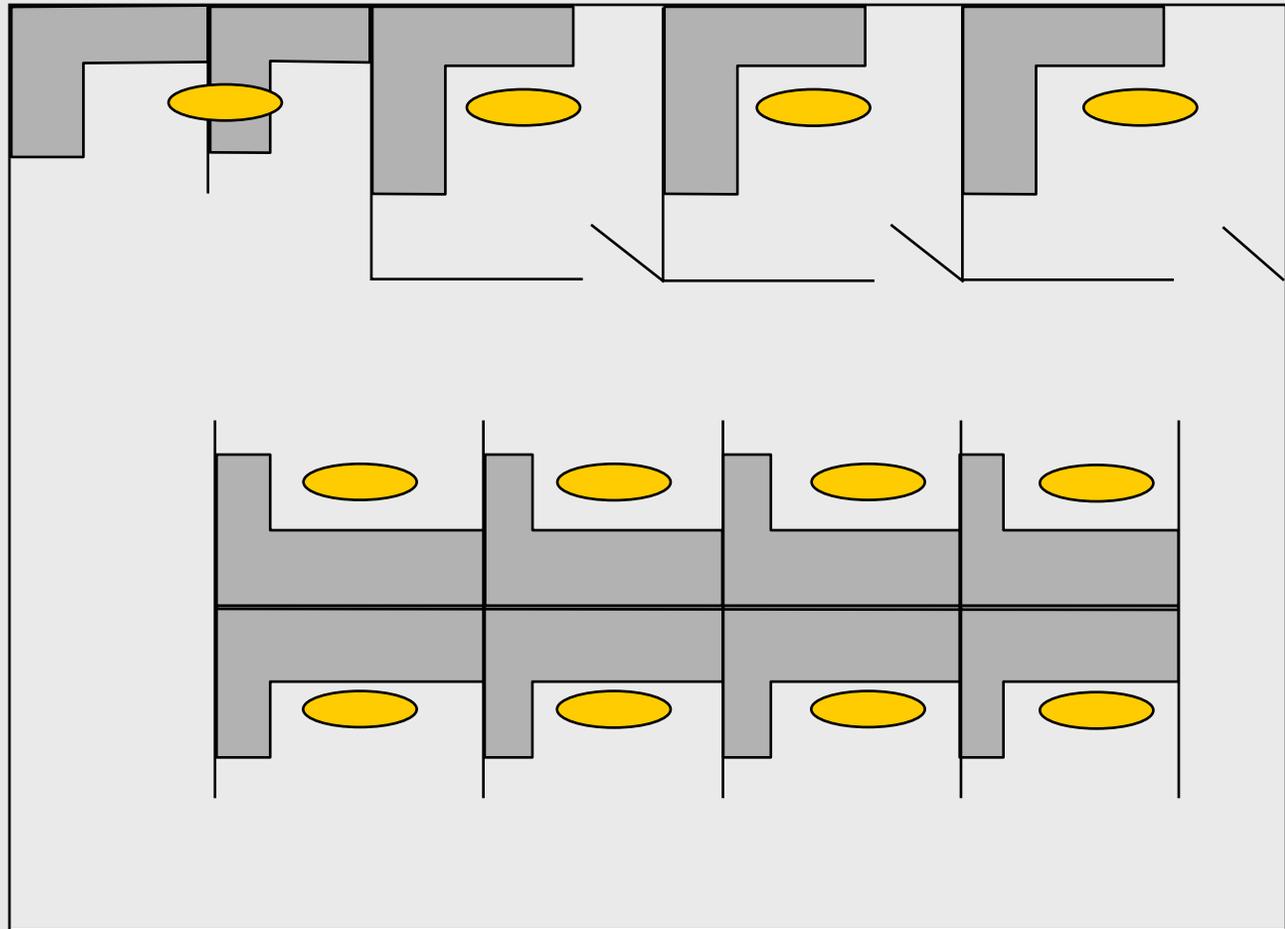
Standard Troffer Layout

24
2'x4'luminaires
72 lamps



Workspace Specific Layout

12
Power Smart
luminaires
36 lamps
50% fewer
lamps!



Power Smart Office System

Data	Base Design	Power Smart
■ Luminaire	2x4-2T8 (59W)	3T8 (95W)
■ Luminaire Q-ty	500	195
■ Ltg. Load Density	1 W/sqft	0.5 W/sqft
■ Energy savings	N/A	80%
■ New Building Payback	N/A	2 yr.
■ Retrofit Payback	N/A	5 yr.

Ceiling Light Constant in Open Offices

- Full Output



Ceiling Light Constant in Open Offices

- Daylighting sensing
- Task Dimmed

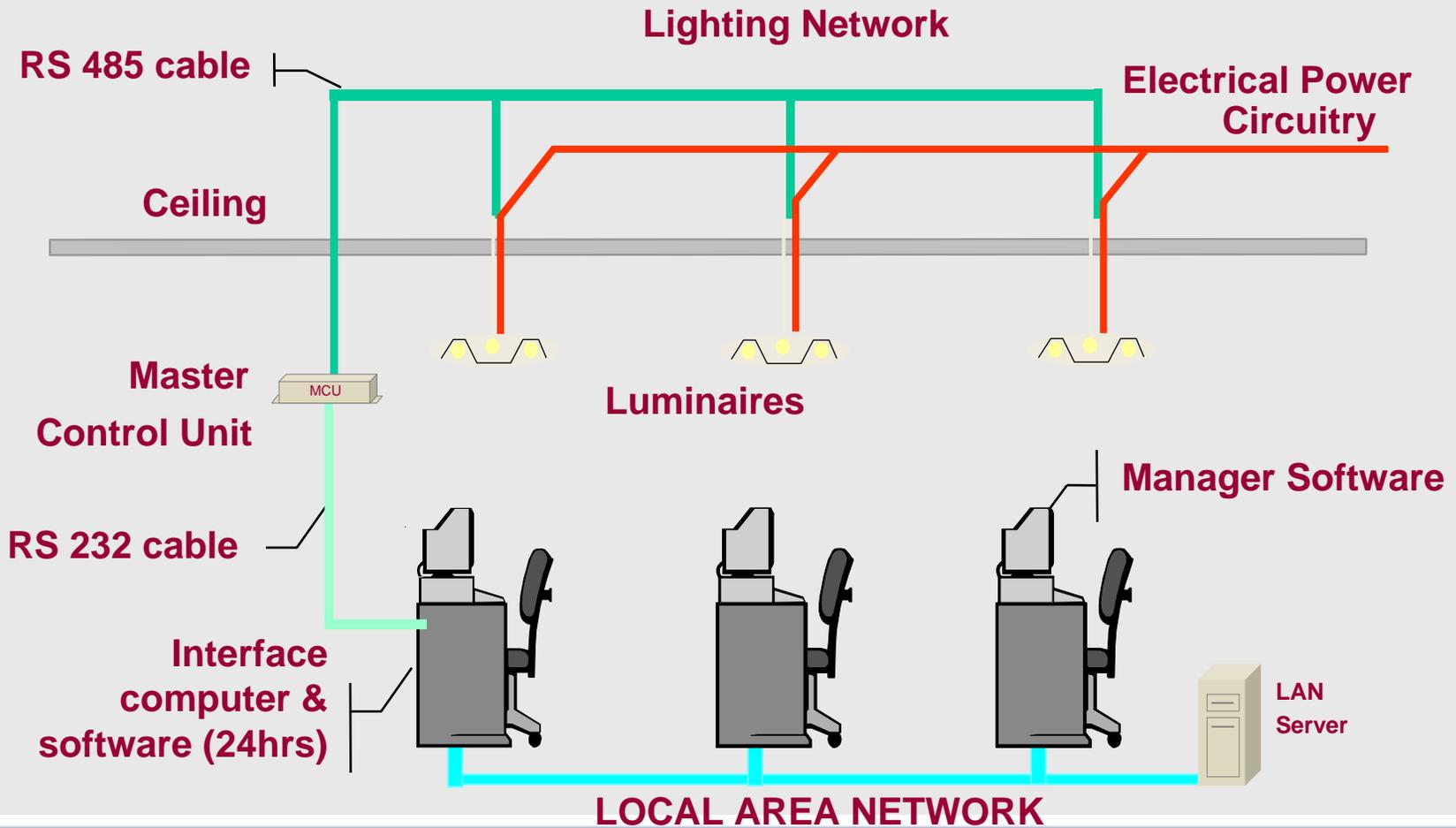


Ceiling Light Constant in Open Offices

- Occupancy sensing
- Task Off - Ambient On



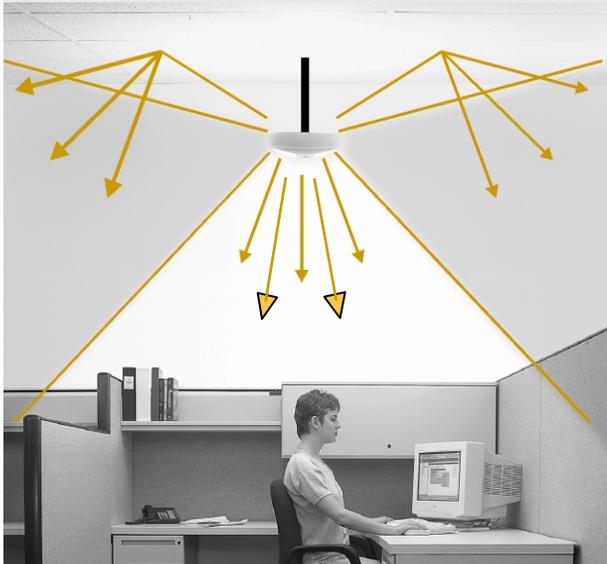
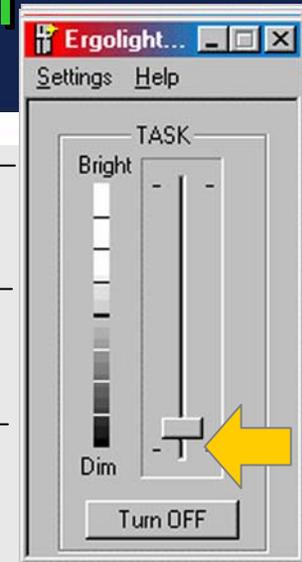
Network Connected



Control software on all computers
www.bchydro.com/business

Personal Dimming Control

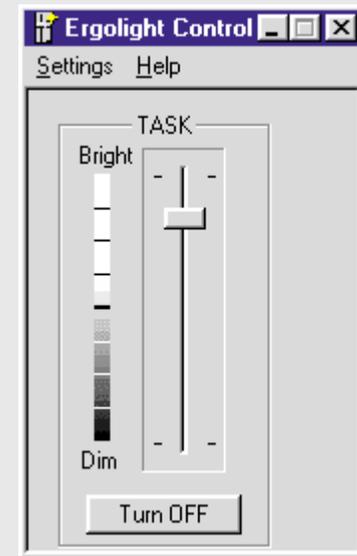
- On-screen control panel
- Users select preferred light level
- Ceiling light stays constant



Graphic User Interfaces



Energy Manager Controls



Individual User Controls

Energy Management Reports

Monthly Energy Report [X]

March [v] 2002 [v] Calculate Exit

Energy Summary

Energy Consumption:	0.166	kWh
Peak Demand	0.00	kW
Energy Charge	\$.60	per kWh
Monthly Peak Demand Charge	\$ 0.00	per kW
Total Electricity Cost	\$ 000.22	[for the month]
Daily Average Electricity Cost	\$ 000.01	

Company Information

Create text report

Energy reports provide accurate tracking of energy saving

Maximum Expected Energy Savings

Space Type	Controls Type	Max. Expected Energy Savings
Private areas	Manual dimming /switching	25%
	Photo Dimming	35%
	Occ. sensor	25%
Power Smart Goal		<hr/> 85%

Synopsis of Daytime Energy Savings

Average Energy Use

8am

12 noon

5pm

Reduction in
fixture quantity

Sensor savings

Dimming savings

Actual
Energy Usage

Power Smart Office System



Power Smart Office System

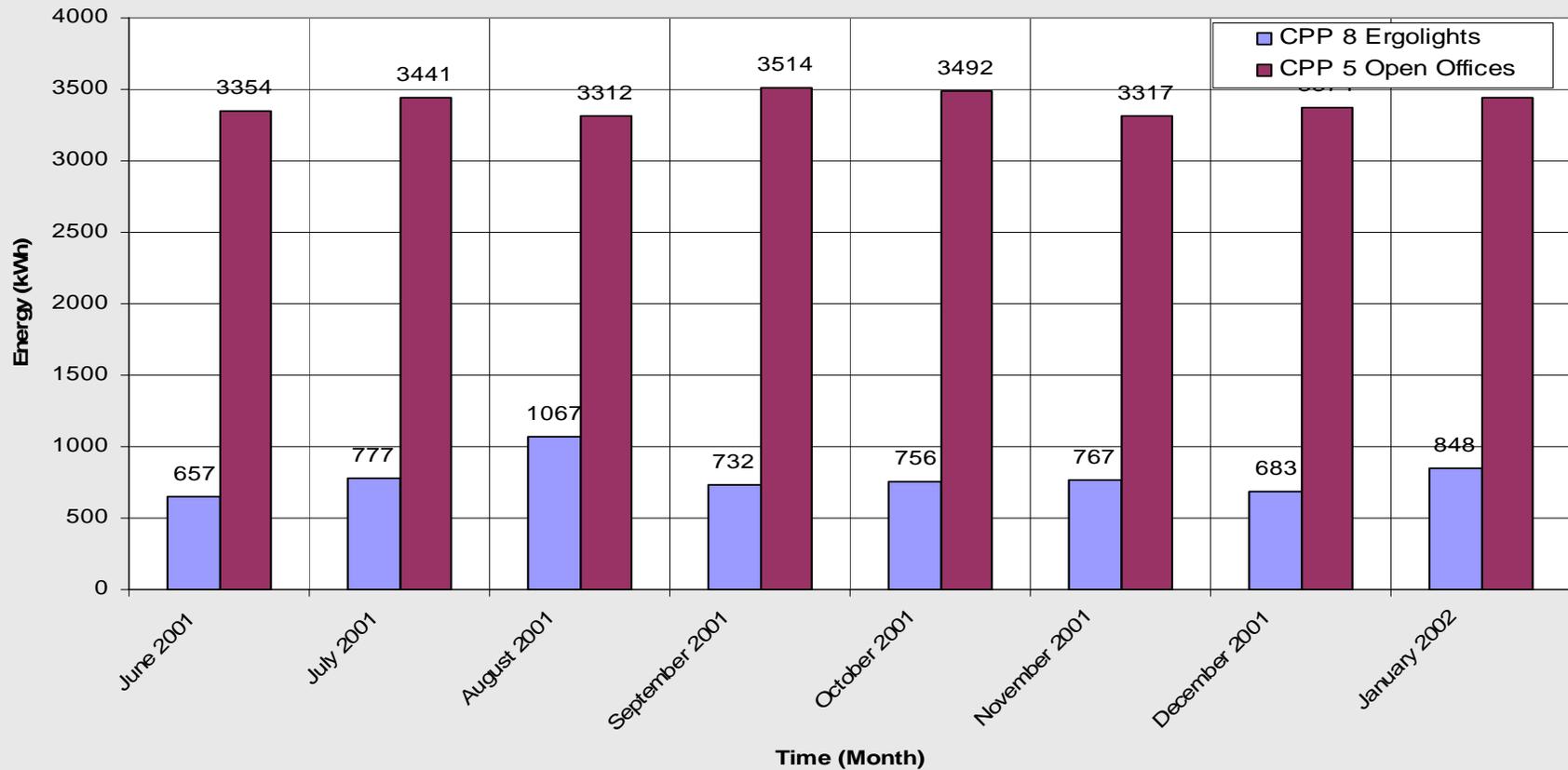


Power Smart Office System



Power Smart Office System

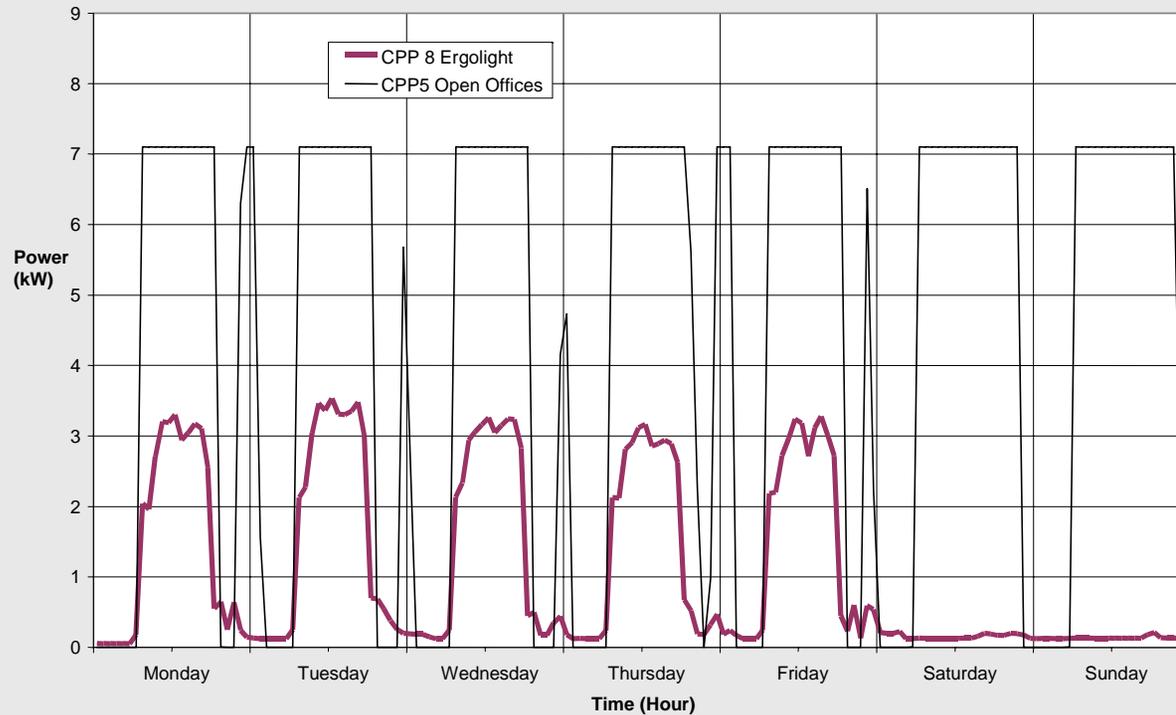
Monthly Energy Consumption for an Power Smart floor



Power Smart Office System

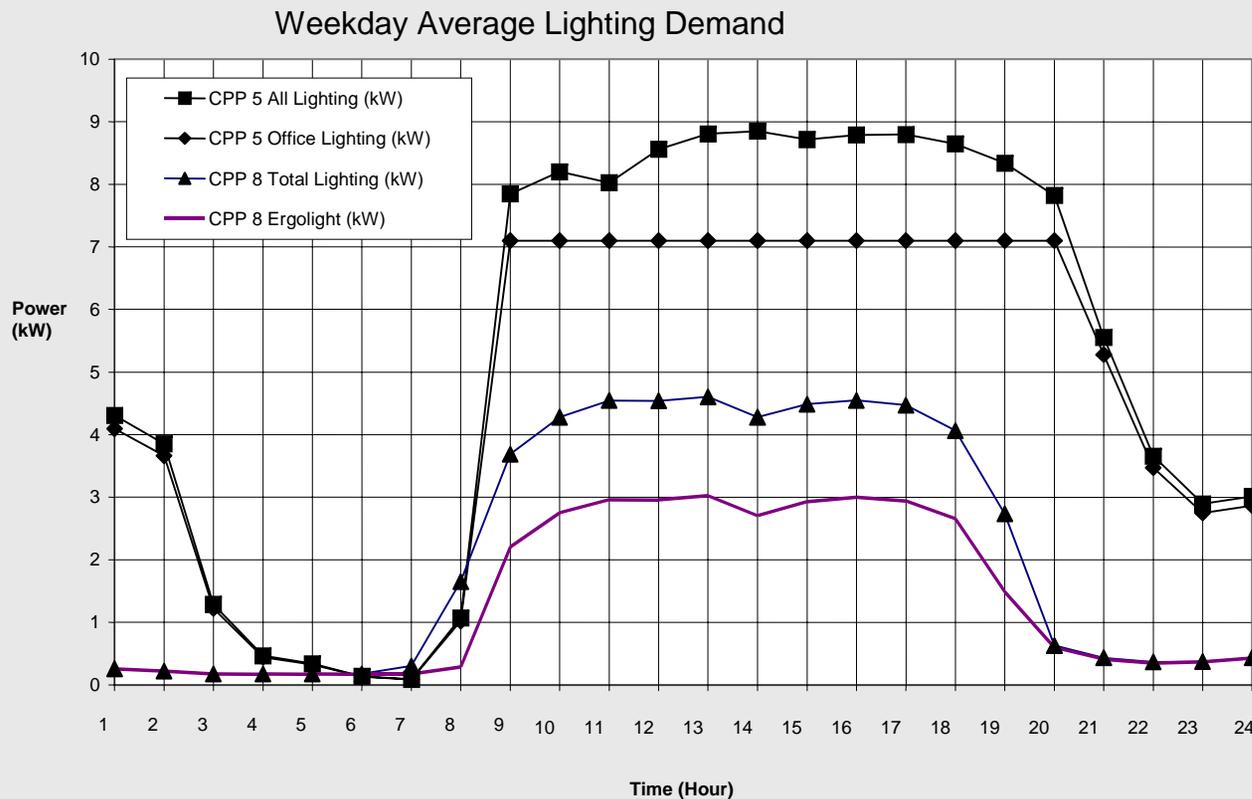
Weekly Profile of Energy Savings for a Power Smart floor

Weekly Power Profile Comparison –
8th floor (Ergolight) vs. 5th floor (Reference)



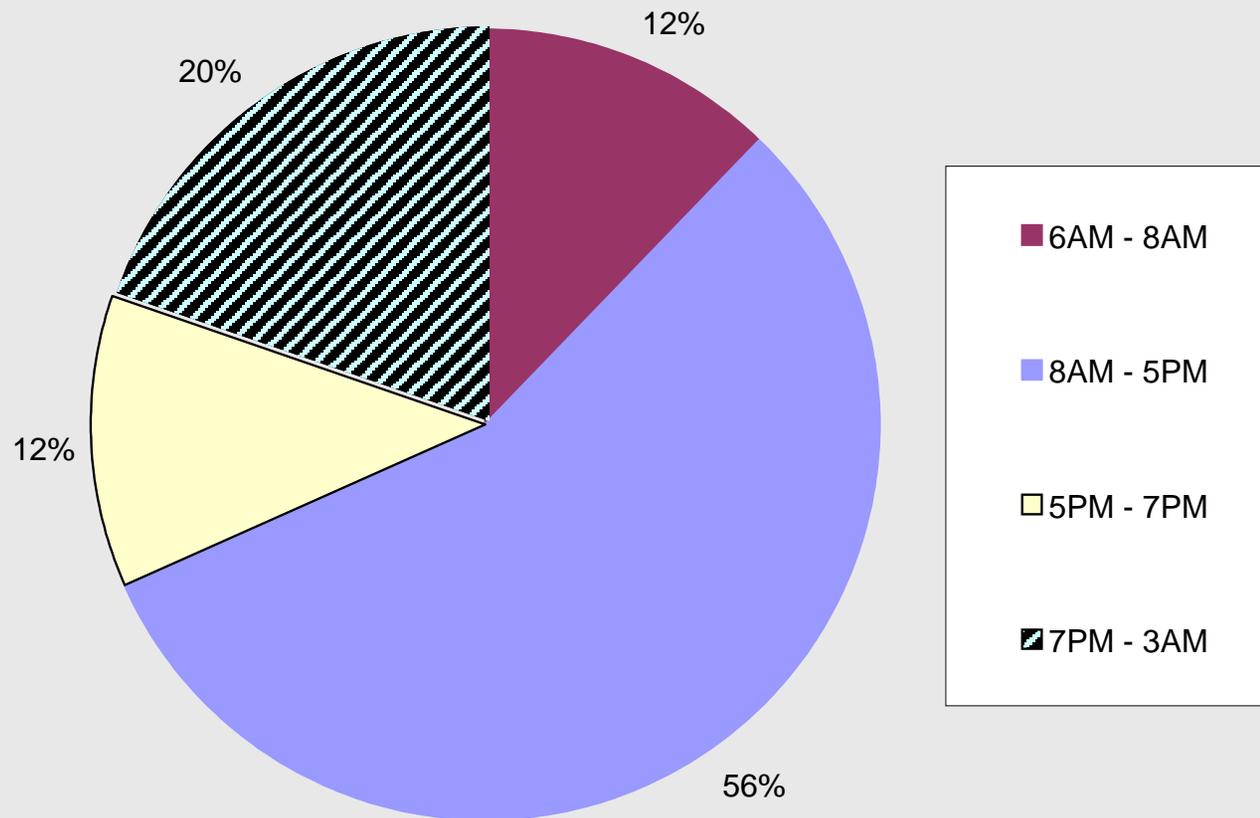
Power Smart Office System

Average Weekday Energy Savings for a Power Smart floor



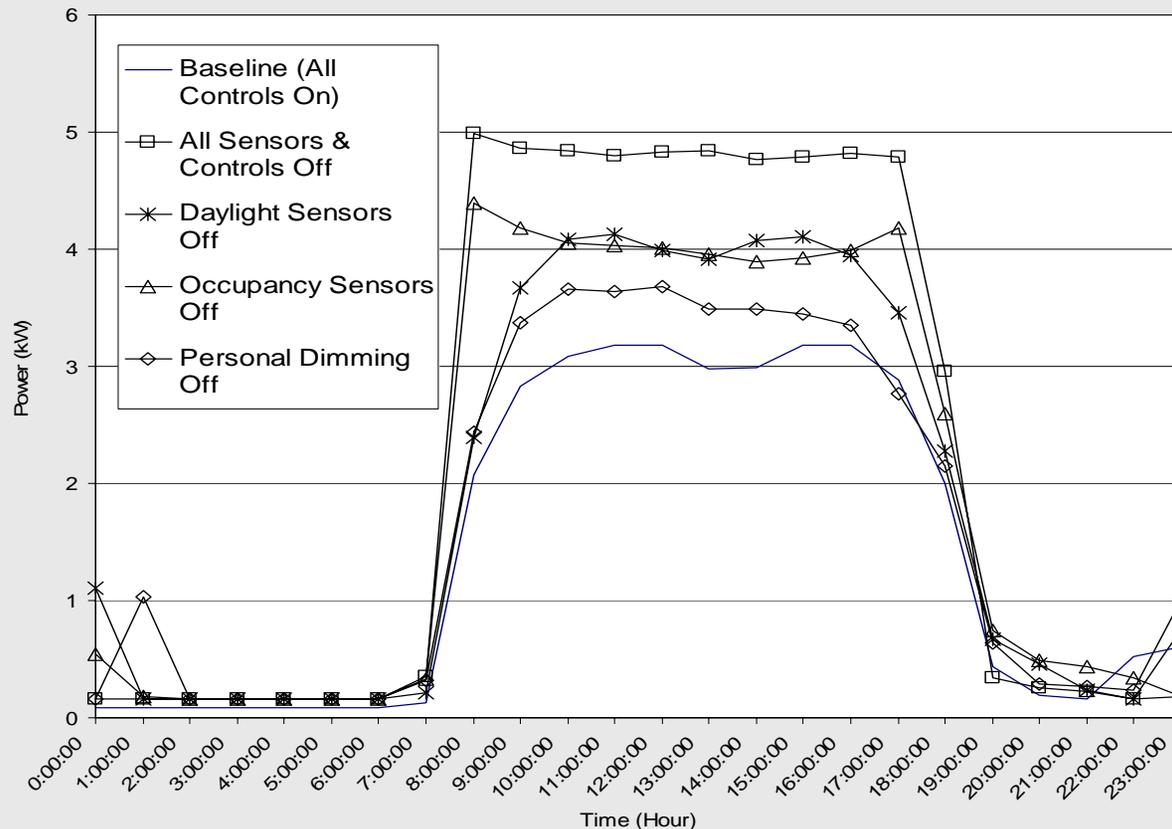
Power Smart Office System

Average Weekday Energy Savings for a Power Smart floor



Power Smart Office System

Contributions of various sensors/ control features

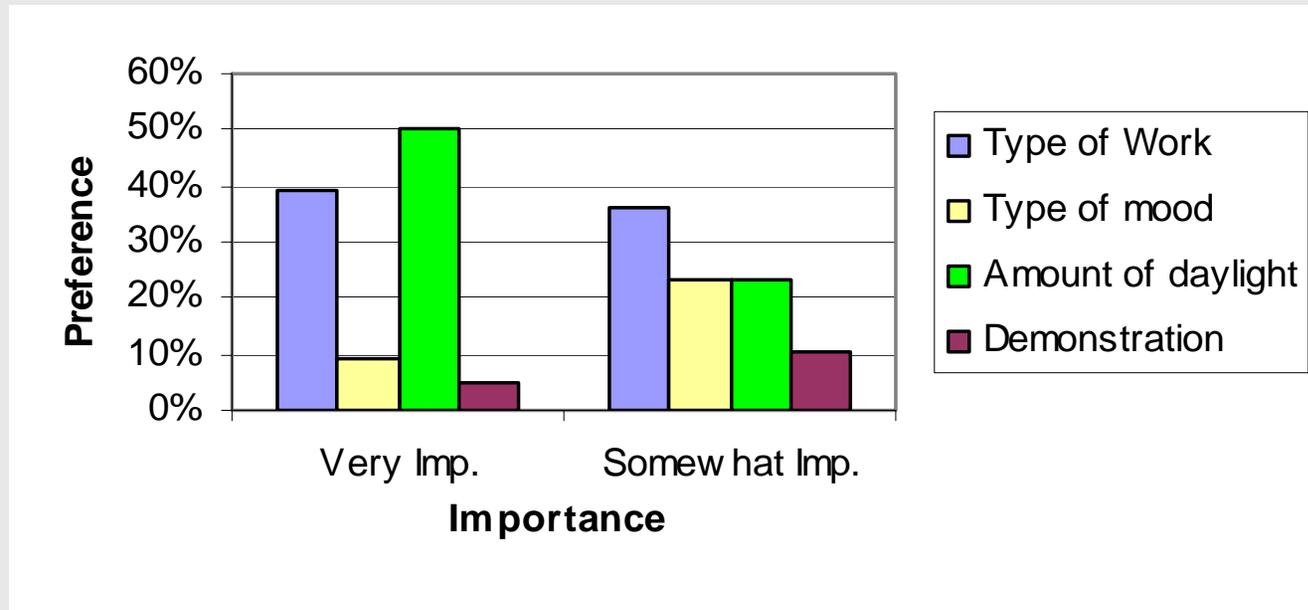


Overall contribution:

Daylight	35%
Occupancy	48%
Dimming	17%

Power Smart Office System

Survey - decision factors for adjusting the light settings



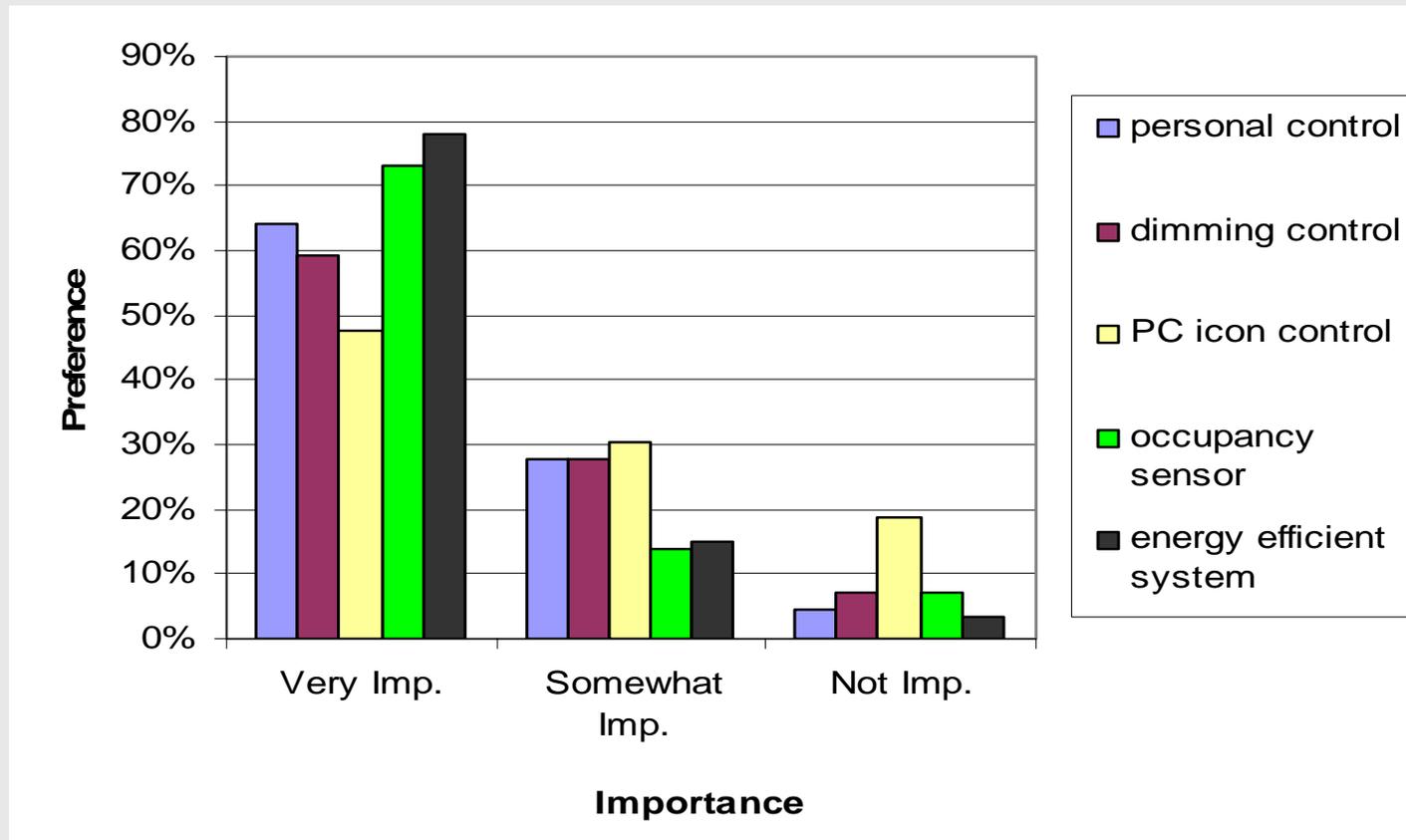
Power Smart Office System

At what brightness, do you usually operate your Personal Lighting Control?

	Total	Window	Interior
■ At 100%	21%	50%	50%
■ About 80%	27%	58%	42%
■ About 50%	29%	65%	35%
■ Less than 50%	9%	87%	13%
■ N/A	14%	50%	50%

Power Smart Office System

Survey - importance of various personal control features



Power Smart Office System

Has the Personnel Lighting Control System contributed to your work productivity?

- | | |
|------------------------------------|-----|
| ■ Increased productivity | 30% |
| ■ Decreased productivity | 1% |
| ■ No change in productivity | 65% |
| ■ N/A | 4% |

Power Smart Office - Conclusion

- Using a workstation-specific lighting system, significant operational savings result from reducing the quantity of luminaires by 40% to 50% in open office spaces.
- Additional savings of up to 40% can be achieved by adding occupancy sensors, photocell sensors and personal dimming PC controls.
- Potential weekly overall energy savings:
 - ◆ 56% weekday daytime 8AM to 5PM
 - ◆ 44% weekday after-hours 5PM to 8AM
 - ◆ 95% weekends

Power Smart Office - Conclusion

- While a small number of office occupants still prefer their lights full on, at least half will dim their lights to as low as 50% if provided with a convenient personal control.
- While resulting ergonomic benefits may be difficult to determine accurately, at least 30% of the occupants felt that their productivity has improved as a result of using the personal controls.
- Thank You!