



U.S. Department of Energy
Energy Efficiency and Renewable Energy

LIGHTING

Kenton Baker

Philips Lighting



Lighting

Good Lighting (not *BAD* Lighting):



- Is Efficient and Lowers Energy Costs
- Raises Productivity
- Improves the Work Area
- Is Easy to Maintain

1931



A room 25x30x12 feet in Central School, Glencoe, Ill., has an average intensity of twelve foot-candles provided by six 300-watt indirect units.

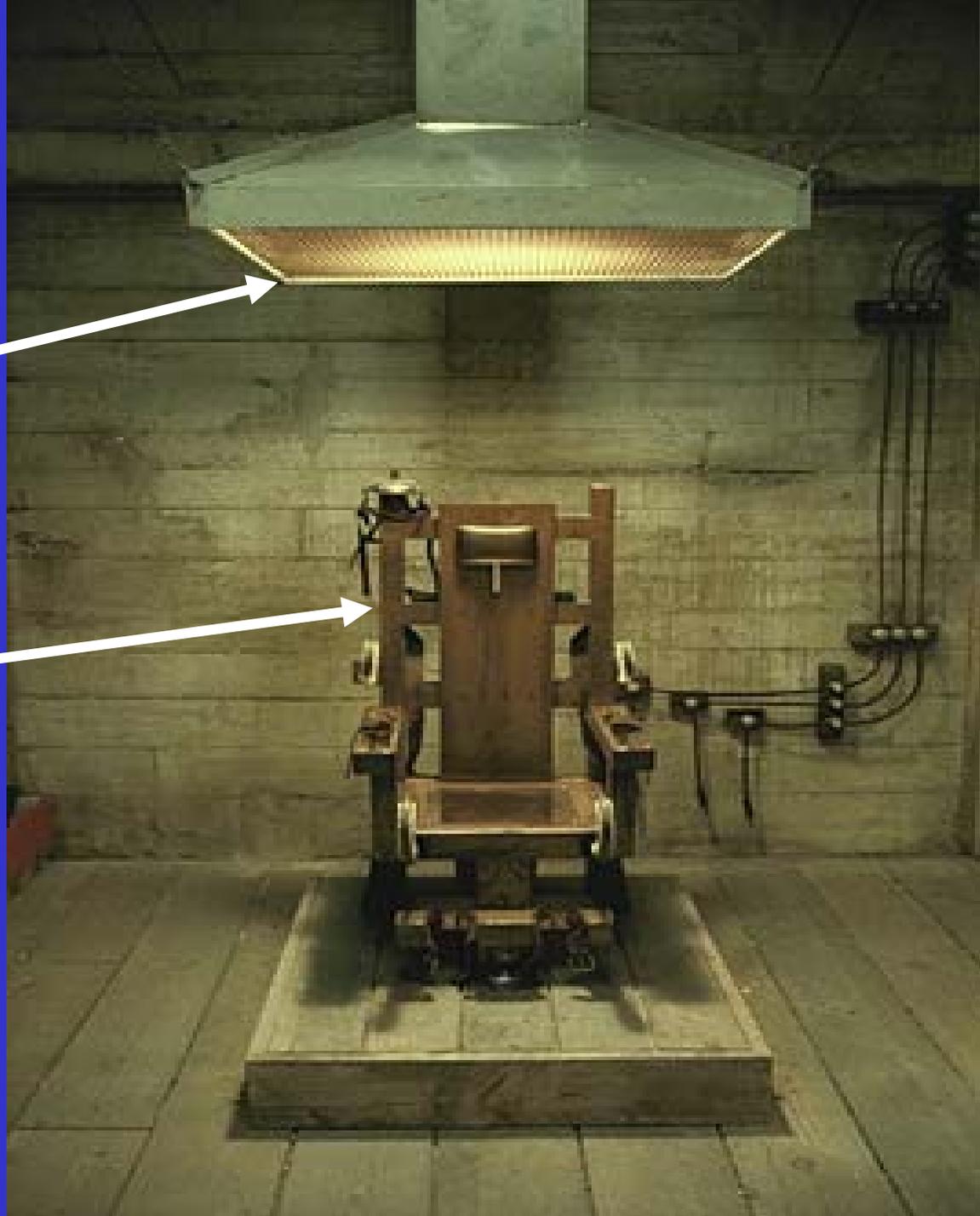




Direct Glare



Discomfort

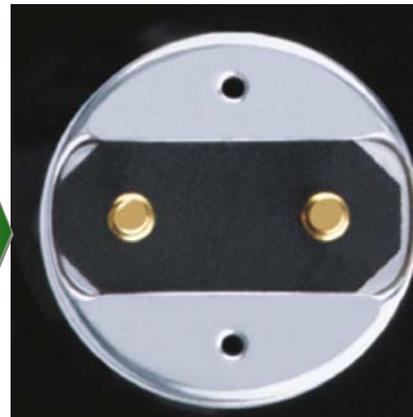
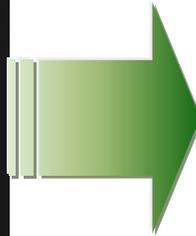




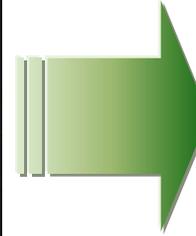
Technology Moved Forward



1.5" T12



1.0" T8



0.625" T5



T8 Vs T12

	T12	T8
Watts	40	32
Initial Lumens	3350	2950
Mean Lumens	3050	2800
Mean LPW	76.3	87.5
Lumen Maintenance	78%	90%
CRI	80	86

The T8 gave us a 15% improvement in efficacy while improving on lumen maintenance and color rendering.



T5 Vs T8

	T8	T5	T5HO
Watts	32	28	54
Initial Lumens	2950	2900	5000
LPW	92.2	103.6	92.6
Lumen Maintenance	90%	97%	95%
CRI	86	>80	>80

The T5 gave us continued improvement in efficacy and lumen maintenance.



T5 vs. T8

T8 Applications

- Retrofitting T12 fixtures
- New direct fixtures

T5 / T5HO Applications

- New indirect fixtures
- Multi-lamp high bay fixtures
- Not really a retrofit



T5HO – Indirect





T5HO – High Bay

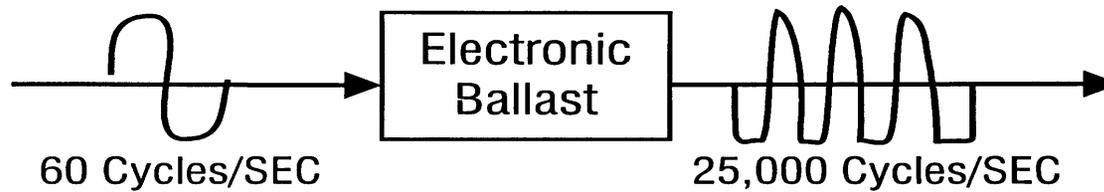
Lamp	Maintained Lumens at 8000 hrs	System Wattage*
4 - T5/HO lamps	18,600 lm	234 W
1 - M250/U	13,500 lm	295 W
1 - M250/PS	17,000 lm	288 W
6 - T5/HO lamps	27,900 lm	351 W
1 - M400/U	23,500 lm	460 W
1 - M400/PS	31,000 lm	452

**Advantages: No color shift, compatible with
occupancy sensors, and instant on**





FLUORESCENT ELECTRONIC BALLAST



- **Up to 40% efficiency improvement over electromagnetic ballasts**
- **No ballast “hum”**
- **Cooler operation for reduced air conditioning load**
- **Can drive up to 4 lamps/ballasts**
- **Low temperature operation**
- **High Power Factor**
- **Low THD**
- **Light weight**
- **Instant on**
- **No flicker**
- **Universal Input Voltage**



Ballasts: Some Things to Remember...

Ballast Factor : Fraction of Rated lamp lumens emitted when using lamps on this ballast. (approx. .7 - 1.3 available)

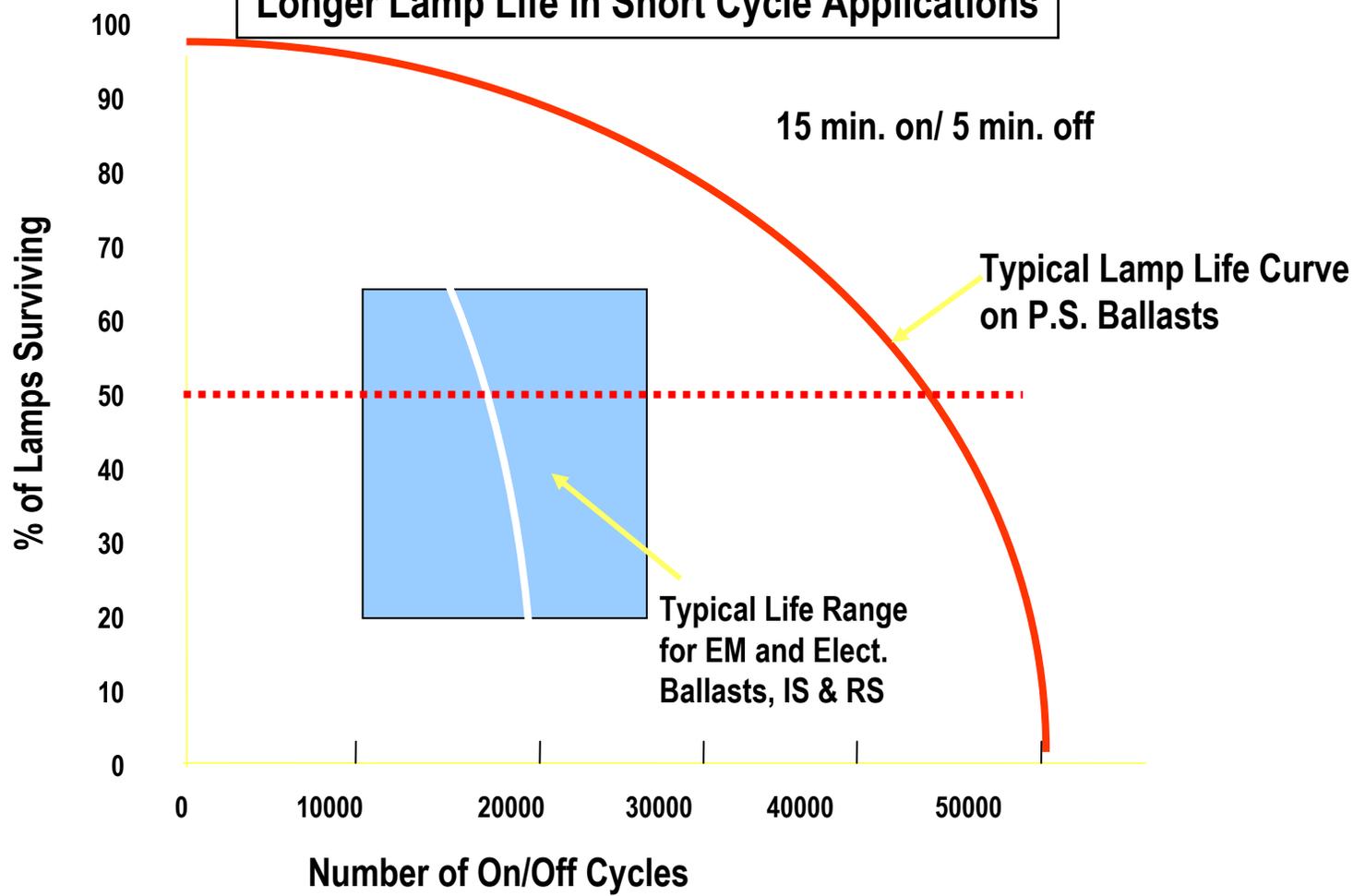
- Minimum Start Temperature: Minimum temperature Lamp will start when using this ballast. (NOT a guarantee of light output)

New Generation of Electronic Ballasts: Approx. 5% higher system efficiency

- End of Life Protection (EOL) : Built into Electronic ballasts for lamps \leq T5
- Universal Input Voltage: Typically operates from 105 AC - 305 AC
- Programmed Start Ballasts: Long Lamp life at short cycles



Programmed Start Ballasts Longer Lamp Life in Short Cycle Applications





Fluorescent Ballast Regulations

Enacted efficiency requirements eliminating electromagnetic ballasts for 40T12 (4'), F96T12 (8'), and F96T12HO (8') fluorescent lamps.

- April 1, 2005
 - Eliminates production for use in new fixtures
 - Ballasts for replacement can still be produced/sold
- July 1, 2010
 - Eliminates all production, including replacement ballasts for existing installations.

Ballast

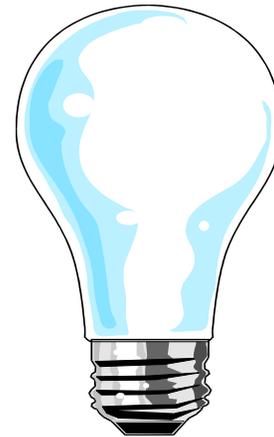


Compact fluorescent lamps, They are all the same...

Osram calls them CF lamps
Philips calls them PL lamps
GE calls them Biax™ lamps



Compact Fluorescent Light Output Equivalency



15 - watts

20 - watts

23 - watts

60 - watts

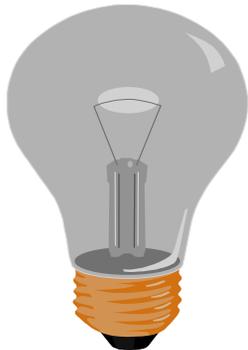
75 - watts

90 - watts



CFL Lamps

- High efficacy
 - **75% energy savings over standard incandescents**
- Long 10,000 hour life
 - **Reduced maintenance costs**



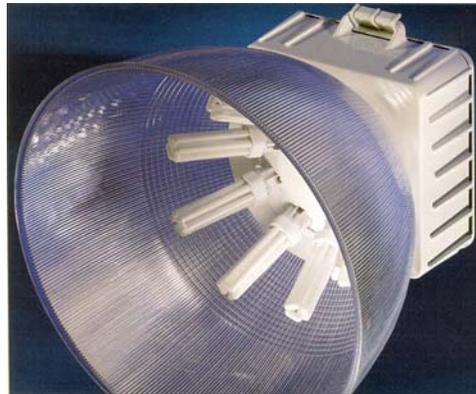
VS.





CFL Systems

- Applications: downlights, wall washers, wall sconces, table lamps, floor lamps, pendants, low and high-bay industrial/sports lighting





Controlling Light Output



Controlling Light Output

What ballast types are used
to control light output?

- Fixed ballasts
- Step-dimming ballasts
- Continuous dimming ballasts



Definition

What is a fixed ballast?

- On/Off control
- Not dimmable



Definition

What is a step-dim ballast?

- Steps light levels
 - Two or three
- Not a dimming ballast



Definition

What is a dimming ballast?

- Continuously adjusts light level
- Increases/decreases voltage to lamp



Definition

Available dimming methods?

- Line voltage
- Low voltage
- DALI



What are the Benefits of Fluorescent Dimming?

Energy Savings

Versatile

Flexibility

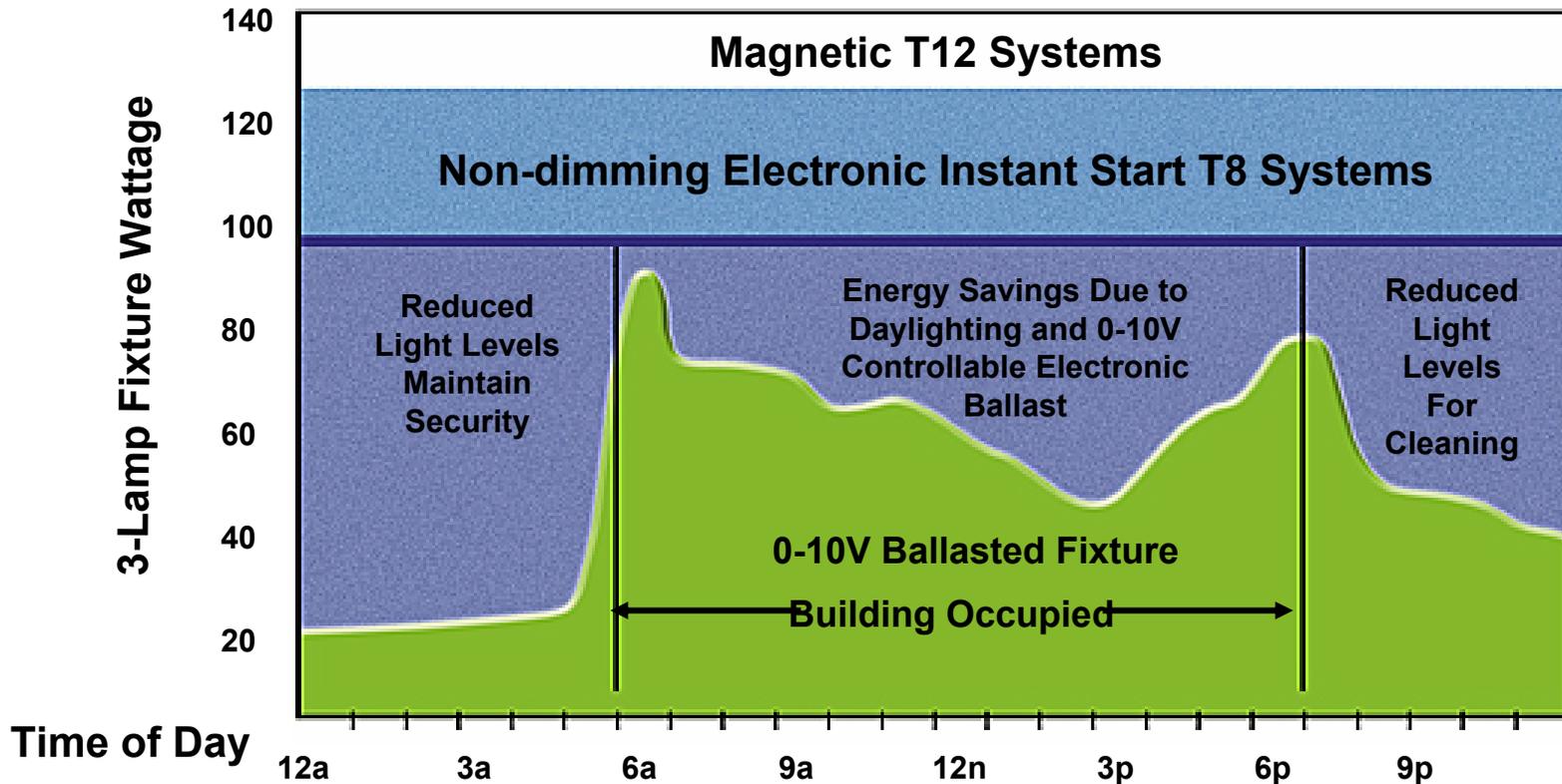
Affordable

Productivity

Easy to Install

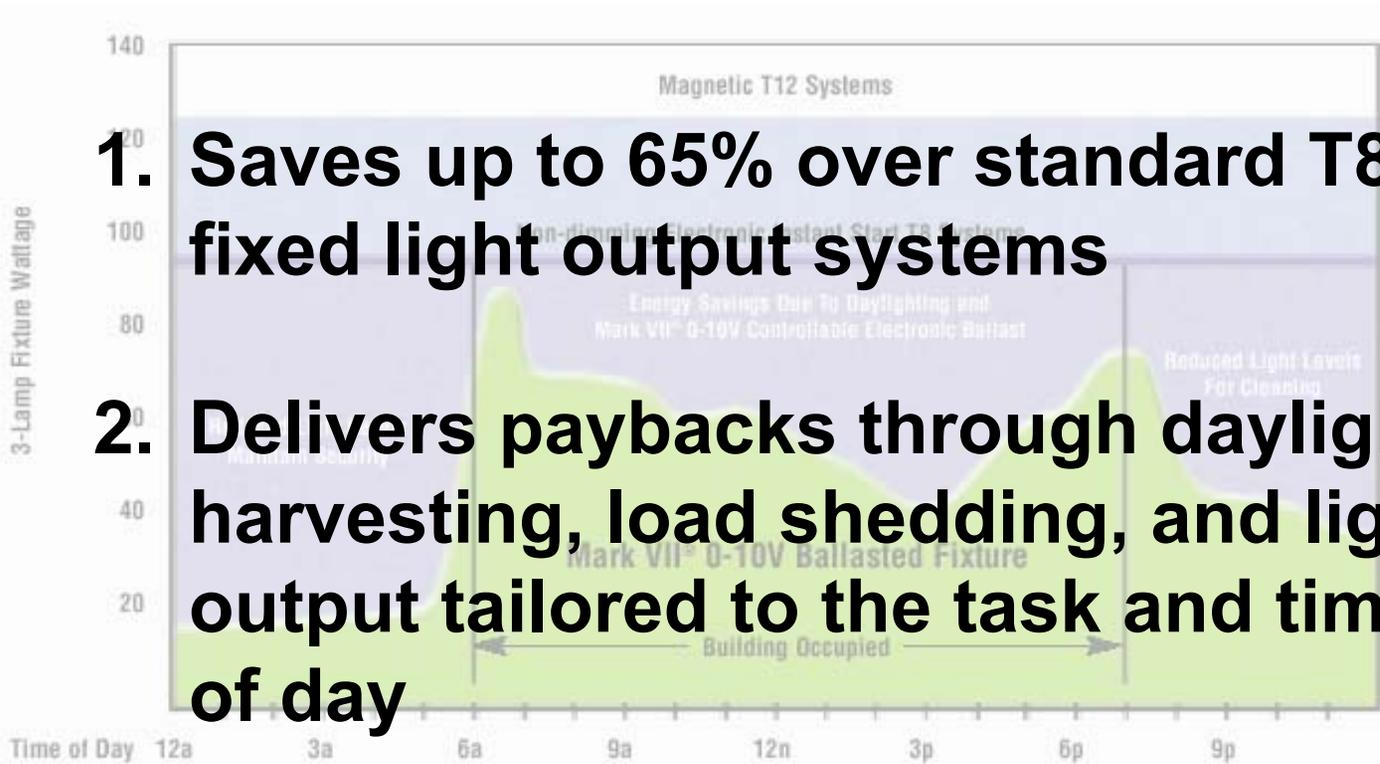


How can dimming save you energy?





How can dimming save you energy?



- 1. Saves up to 65% over standard T8 fixed light output systems**
- 2. Delivers paybacks through daylight harvesting, load shedding, and light output tailored to the task and time of day**



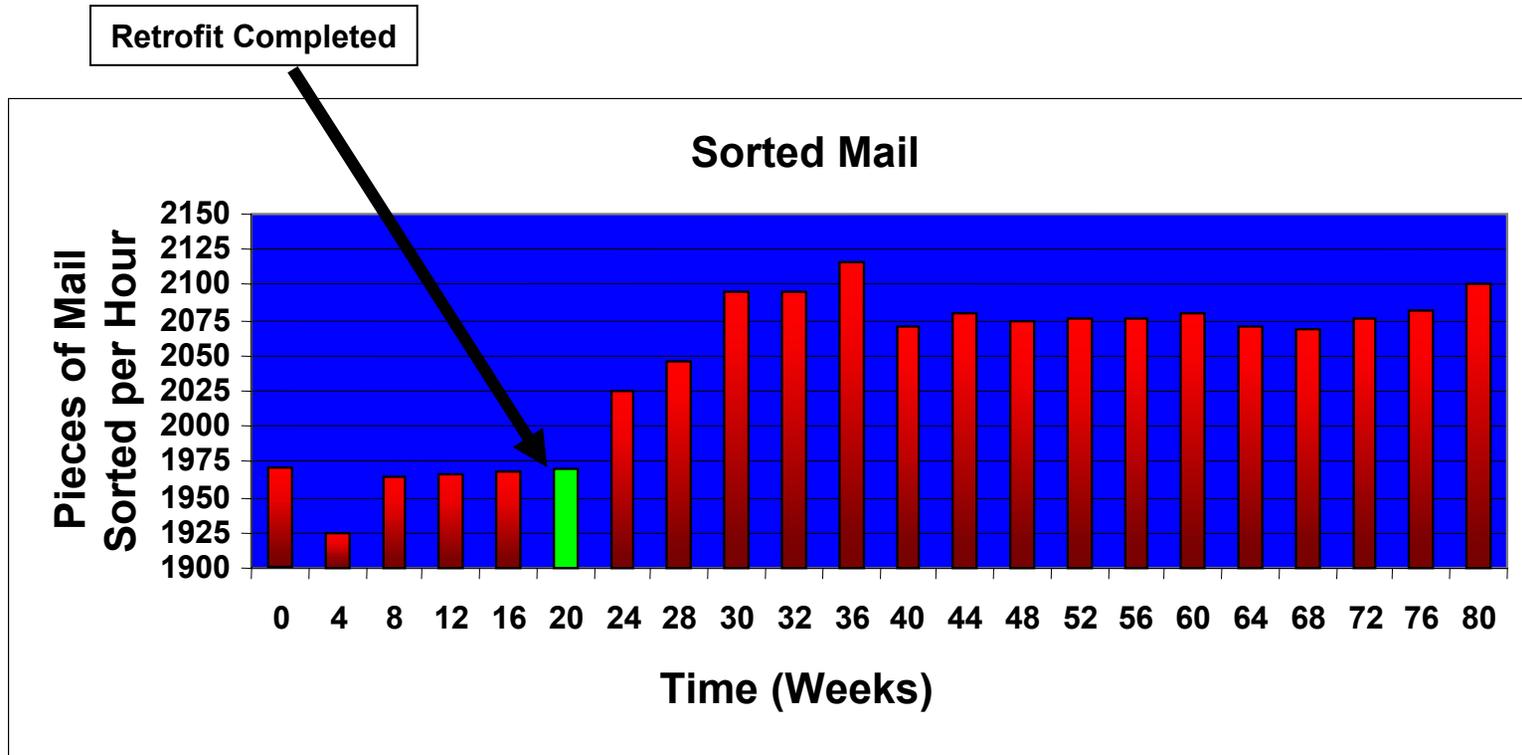
How can dimming improve productivity?

Example: Post Office

1. Post Office wanted to improve lighting for workers
2. Ceiling was lowered and downlighting was replaced with dimming
3. In test area after retrofit completed, productivity increased 8% while old work area had no productivity increase.
4. One year later, productivity improvements remained at 6%



How can dimming improve productivity?





In the near future, the issue will no longer be *magnetic* versus *electronic*, but *digital* versus *analog*...



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QUESTIONS?