



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

# Lighting Technology Update

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# Technologies

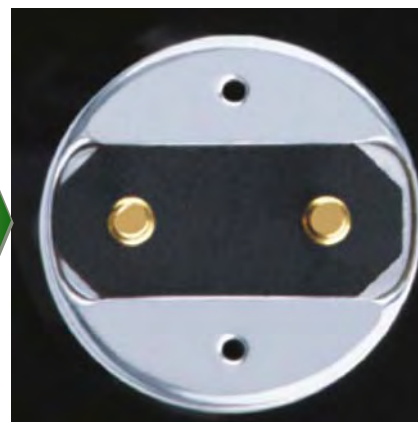
- T-8 vs T-5 Fluorescent Systems
- T-5 vs HID Systems
- Lighting Controls



## Lamp technology has moved forward



**1.5" T12**



**1.0" T8**



**0.625" T5**



## T-5 vs T-8



### T-8 Applications

- Retrofitting T-12 fixtures
- New direct fixtures

### T-5 / T-5HO Applications

- New indirect fixtures
- Not really a retrofit



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# T-5 Fluorescent Applications

## T-5 – Direct/Indirect





## T-5 vs HID

### T-5HO/HID Applications

- Gymnasiums
- Natatoriums
- Large libraries





## T-5 vs HID

SYSTEM DESCRIPTION	LAMP TYPE	LAMPS	WATTAGE	LAMP LIFE	LAMP COST
High bay metal halide	400W-MH	1	465	20,000	\$25.00
High bay T-5 fluorescent	54W T-5 HO	4	234	20,000	\$28.00

### T-5HO/HID Comparison

- 40 fixtures operating 2288 hours per year
- HID is 18.6 Kw compared to 9.4 Kw for the T-5
- Energy Savings at \$0.08 per KwH is \$1,690/yr





## Benefits of Lighting Controls

- Energy savings
- Maintenance savings
- System life extension
- Reduction in air conditioning load
- Behavioral change





## Lighting Control Strategies

- Time based
- Occupancy based
- Light level based

Can be mixed and matched for effectiveness





## Time Based or Scheduled Controls

- Provides light to an area when scheduled for use
- Does not control amount of light
- Simple mechanical timer to central building systems
- Some lights must always remain on
- Not suitable for areas with highly variable occupancy



## Occupancy Based Controls

### Occupancy Sensors

- Regulate lighting system operation based on actual use
- Do not require scheduling
- Off delay time must be set with consideration to source used and application.

### Occupancy Sensor Types

- Infrared - Direct Line of Sight
- Ultrasonic - Indirect, Spatial limits
- Microwave - Indirect, Similar to Ultrasonic
- Dual Technology - False Tripping
- Ceiling and Wall Mounted
- Line and Low Voltage



## Lighting Level Based Controls

- Vary light output of system to match desired target illuminance
- Provide only the quantity of light required
- Can compensate for lamp/fixture depreciation
- Two methods of control
  - Selective switching (banks of lights or stepped dimming)
  - Continuous dimming



## Energy Savings from Lighting Controls

- Typically 35%-45% in Commercial and School Buildings
  - California Energy Commission
- 58 Office Study – 43% Energy Savings from Occupancy Sensors increases to 61% when combined with manual dimming capability
  - Lighting Research Center