CALIFORNIA LIGHTING TECHNOLOGY CENTER

Outdoor Lighting Energy Savings Potential

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PUBLIC INTEREST ENERGY RESEARCH
"Research Powers the Future"

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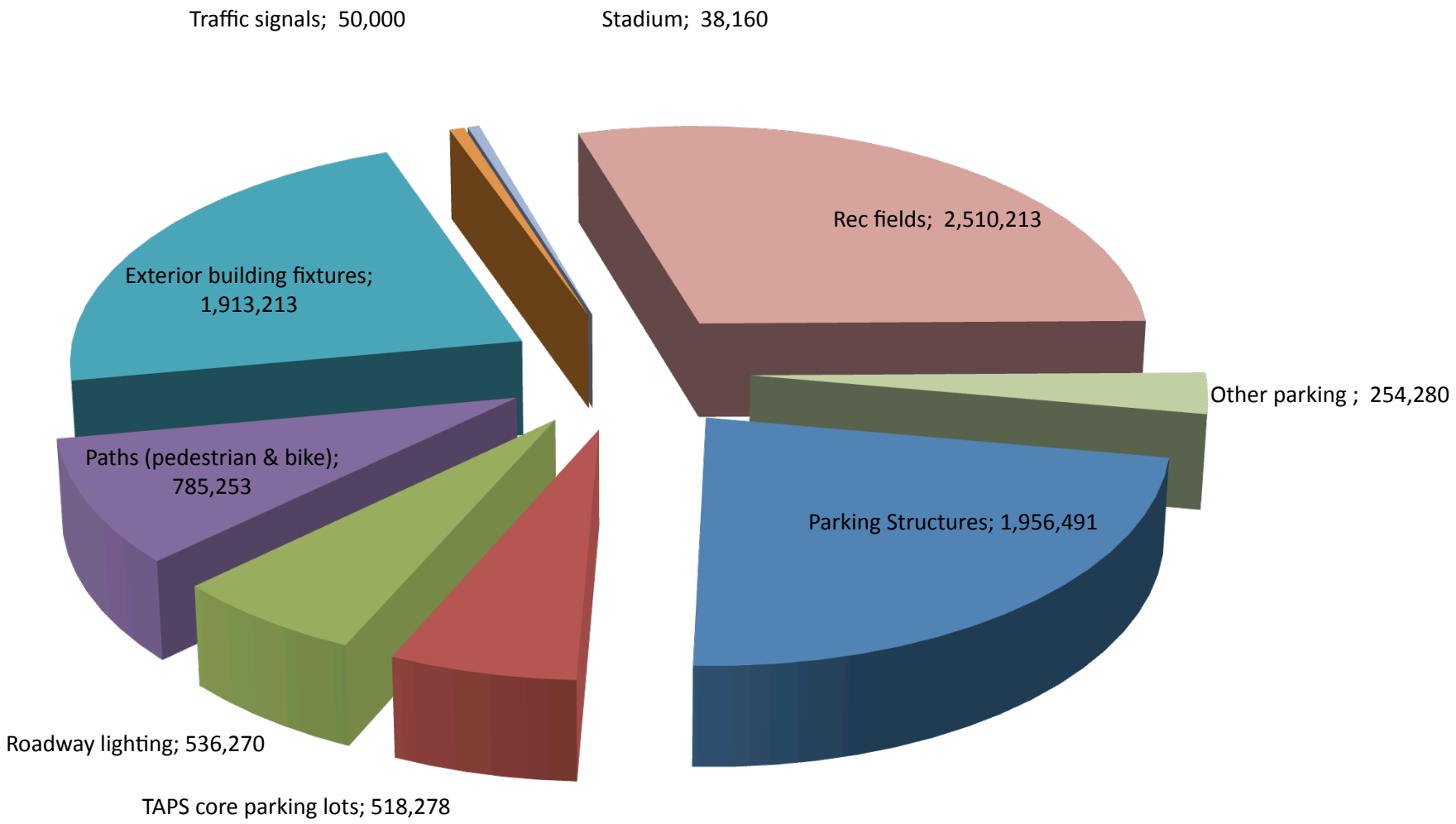
UC Davis Outdoor Lighting Energy Use
8.5 million kWh (from 50 million kWh total)



Main Energy Saving Strategy

- **Bring Right Light**
  - Light Sources
    - Luminous Efficacy
    - Correlated Color Temperature (CCT)
    - Color Rendering (CRI)
- **Where Needed**
  - Luminaire Optics
    - Luminaire Efficacy
    - Application Efficacy
- **And When Needed**
  - Adaptive Controls
    - Astronomical Timing
    - Photo Sensing
    - Occupancy Sensing

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San Jose, CA – PG&E Study

Before

55W LPS

After

34.9W (75W @ 50%) LED

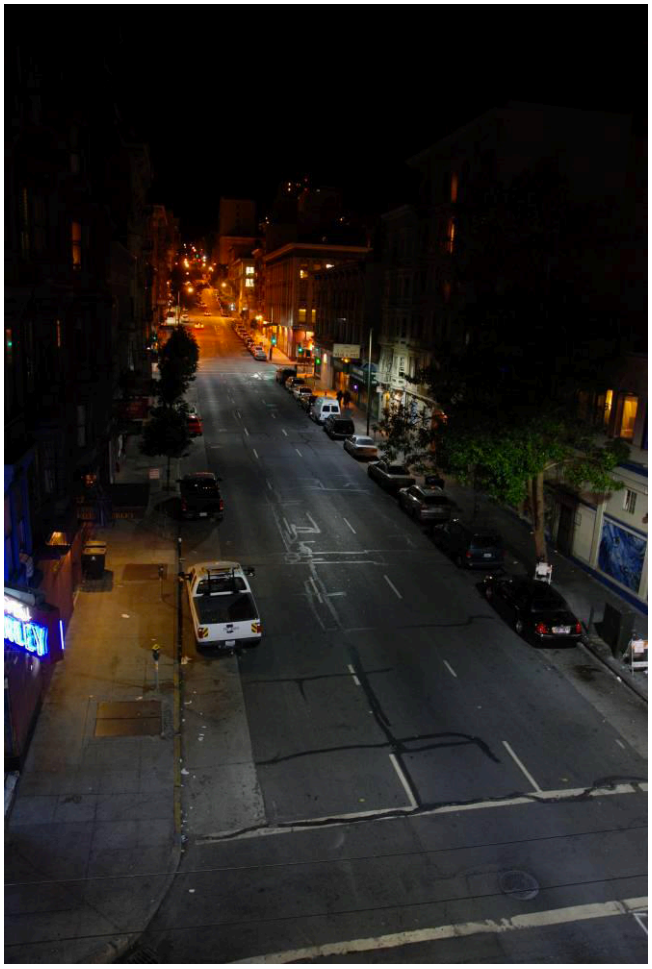
http://www.etcc-ca.com/component/content/article/48-commercial/2894-led-street-lighting-and-network-controls-san-jose

San Francisco, CA – PG&E Study

Before

400W HPS

After



222W LED

http://www.etcc-ca.com/component/content/article/48/2921-led-street-lighting-and-network-controls-san-francisco-ca

San Francisco, CA – PG&E Study

Before

400W HPS

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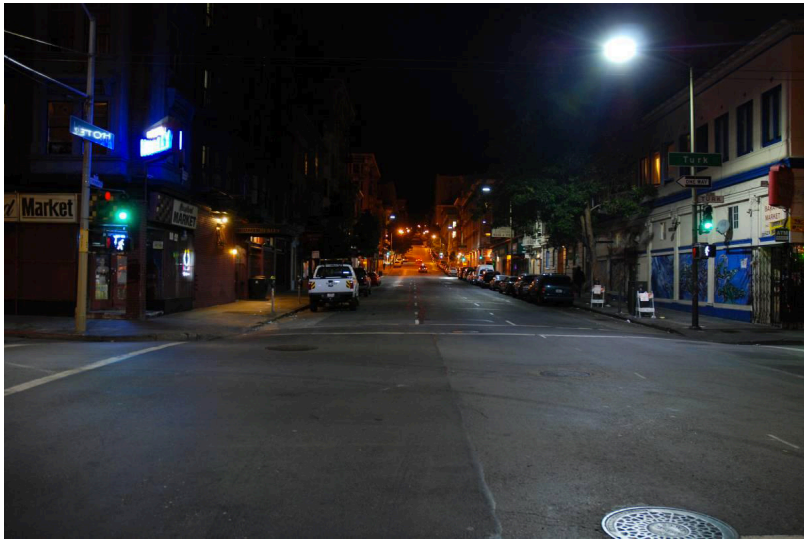

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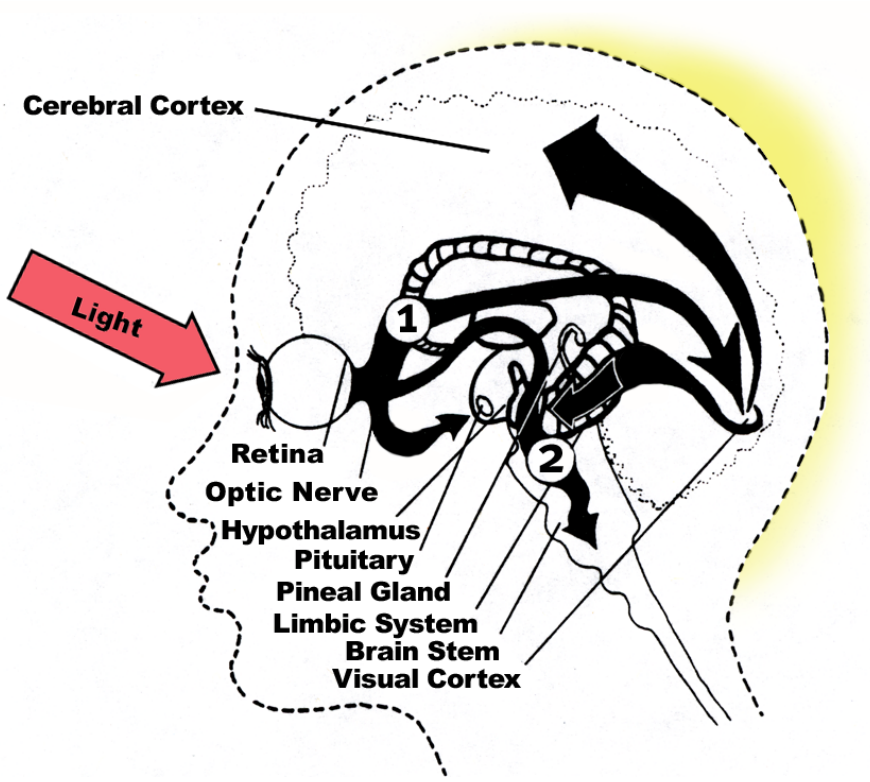
Visual & Biological Pathways

1. Visual Pathway

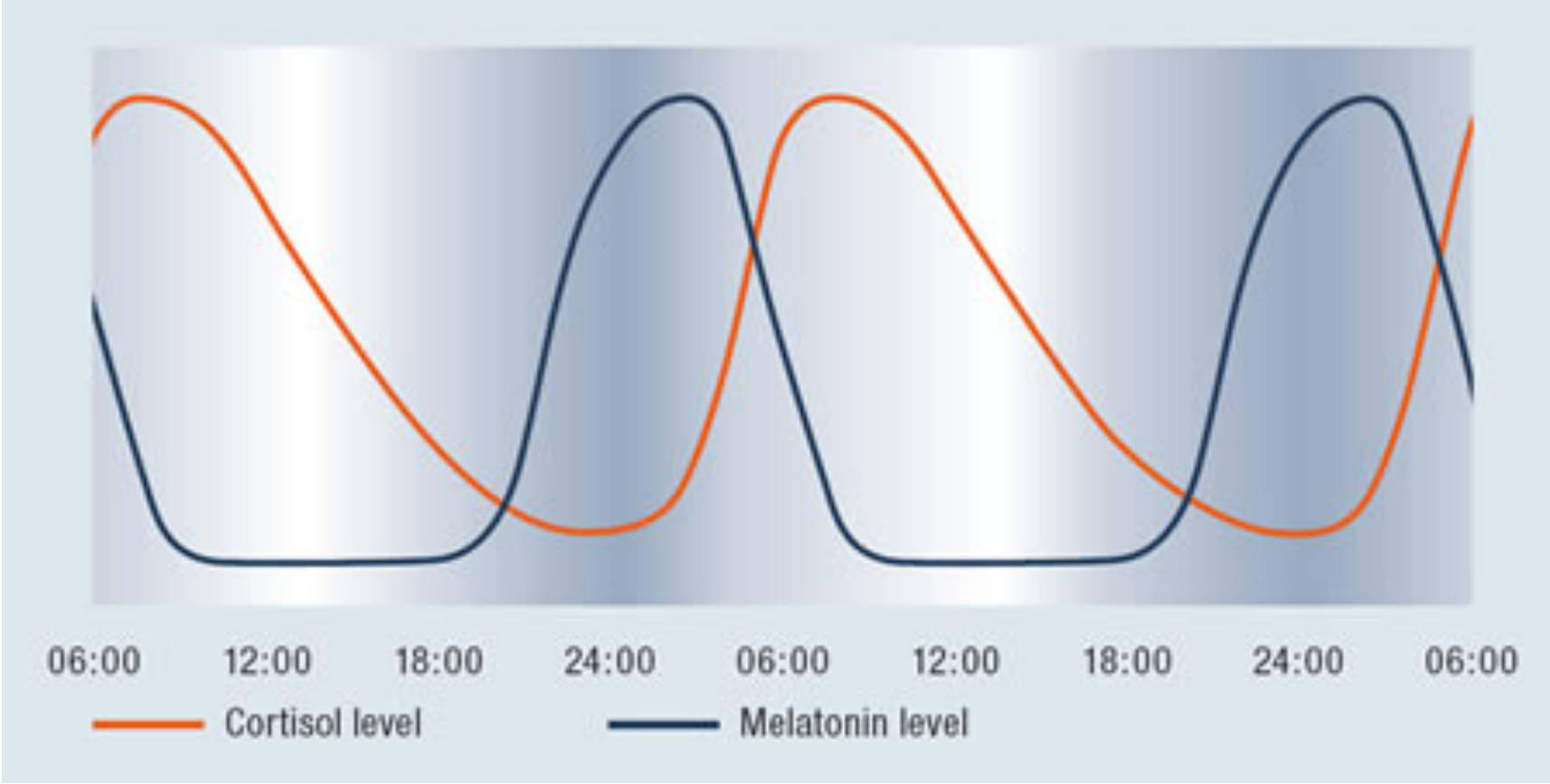
Light stimulates the cerebral cortex for vision & perception

2. Biological Pathway

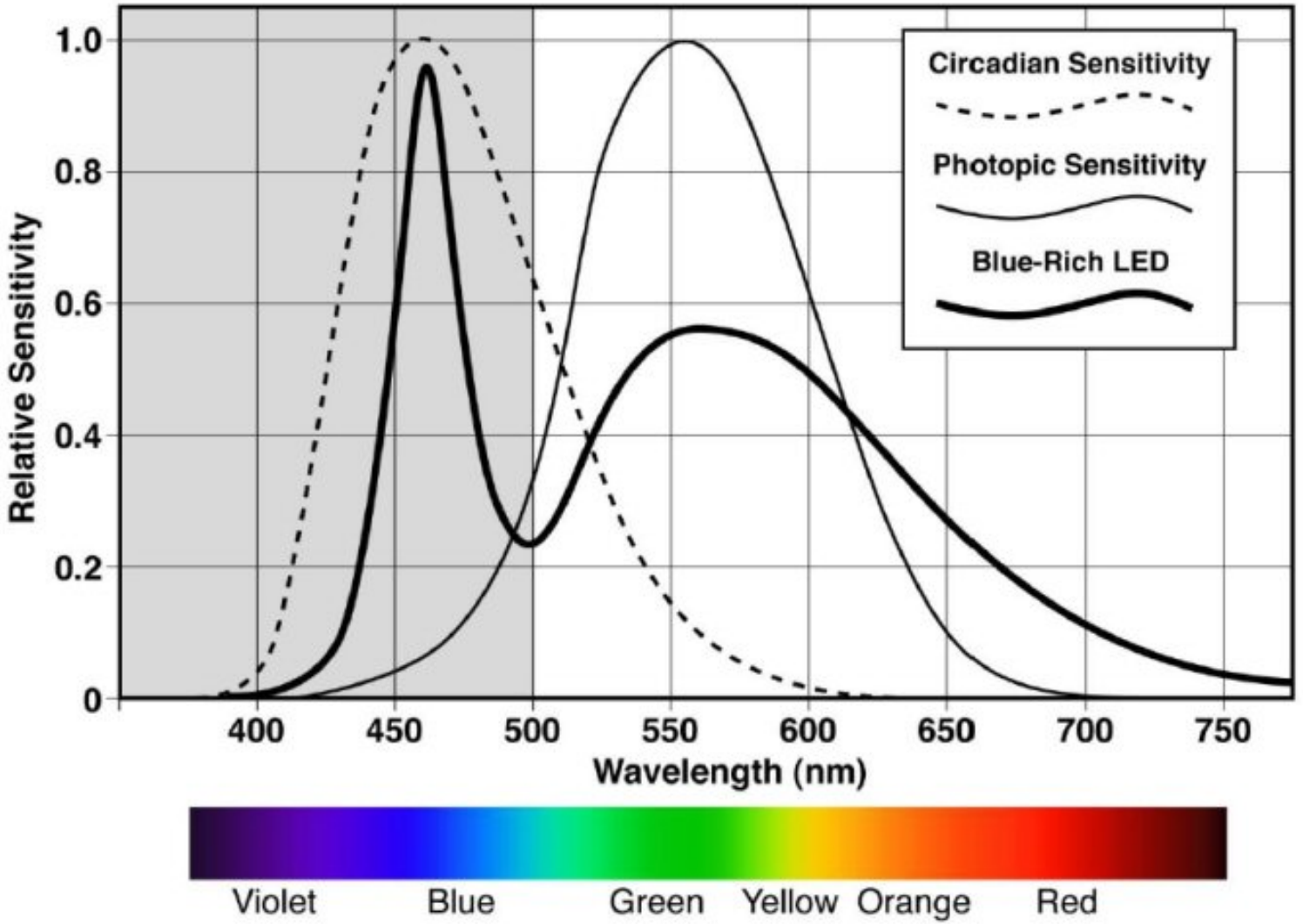
Light causes the hypothalamus to send messages along a biological pathway regulating the body's autonomic nervous and endocrine systems



Circadian Rhythms



Circadian Sensitivity & White LED SPD



http://docs.darksky.org/Reports/IDA_Blue-Rich_Light_White_Paper051710.pdf

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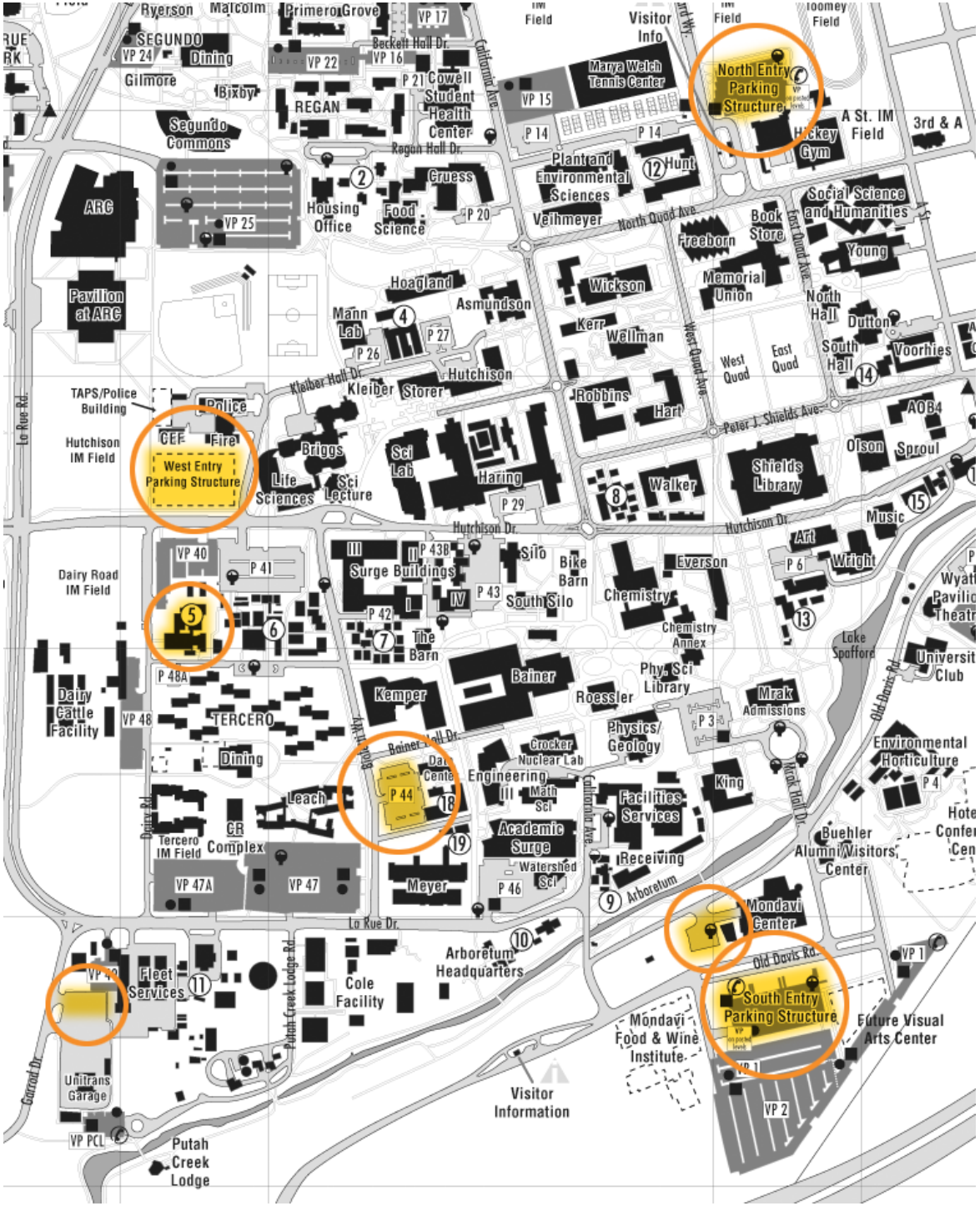
GOODYEAR


PAY HERE
GOODYEAR

Bi-level Smart Lighting Initiative

- **Automatically reduce power to 50% or less upon vacancy and increase to 100% upon occupancy**
- **Potential for 30-50% energy savings**
  - Parking Lots
  - Parking Garages
  - Pathways
  - Building Exterior
  - Signage

UC Davis Campus-Wide Retrofit Program



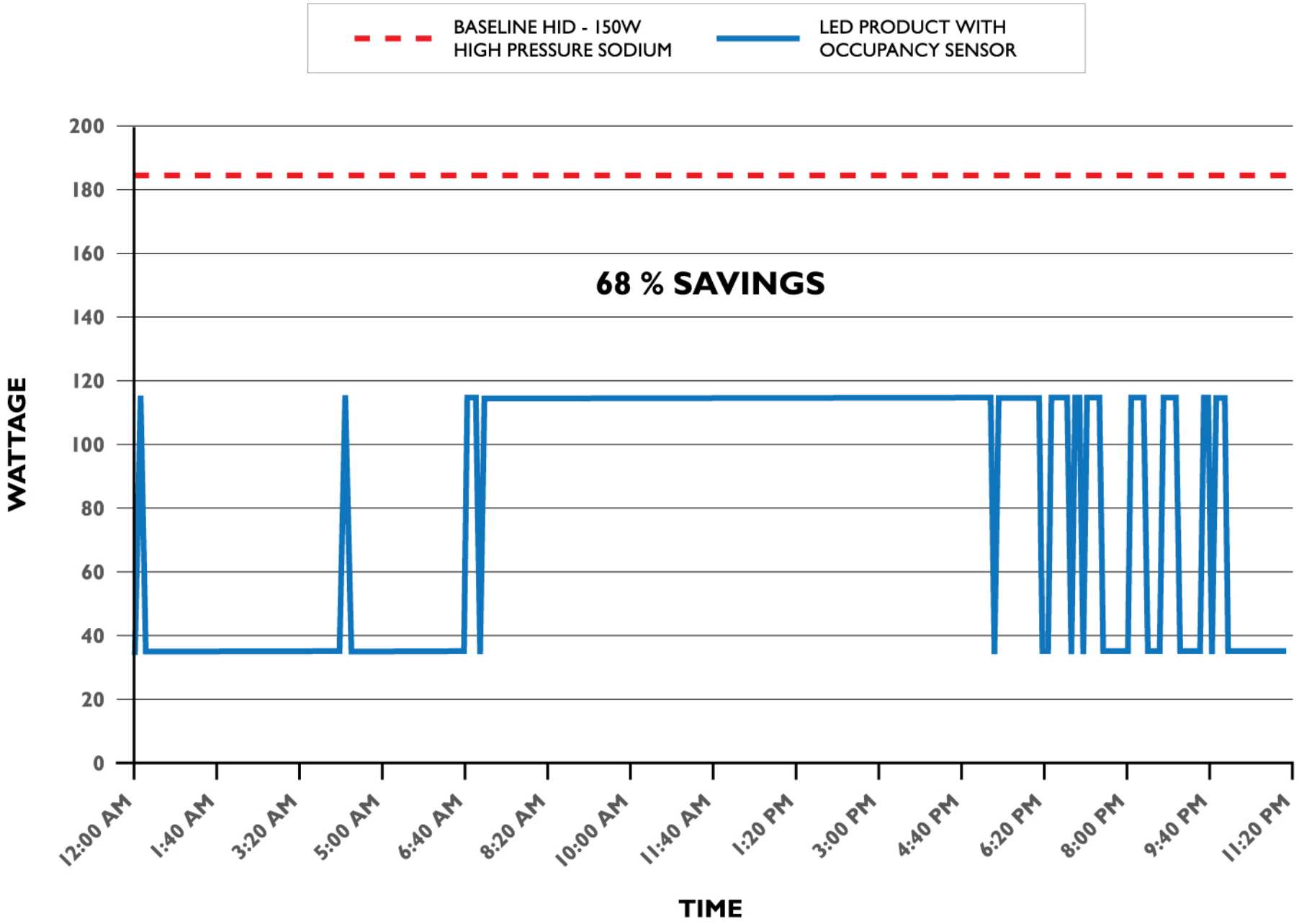
Induction Smart Parking Garage Lighting

- Bi-level garage luminaire with a high and low mode
- 80 W in high mode and 40 W in low mode
- Controls reduce energy use by 30–40%
- Induction can last up to 100,000 hours

LED Smart Parking Garage Lighting

- Before: 175 W metal halide
- After: Bi-level 115 W in high mode and 35 W in low mode LED
- Can set sensor from 30 seconds – 30 minutes
- Savings up to 80%

LED BI-LEVEL SMART GARAGE VS. BASELINE HID TECHNOLOGY

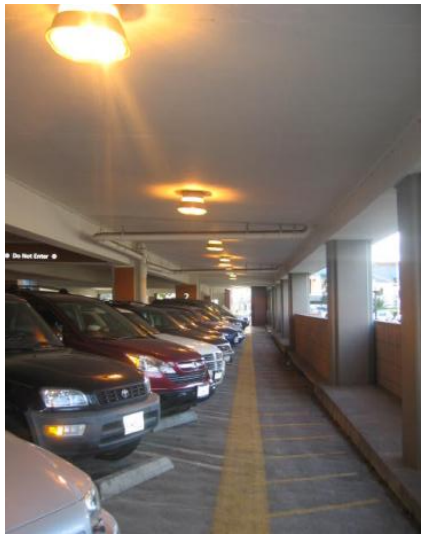


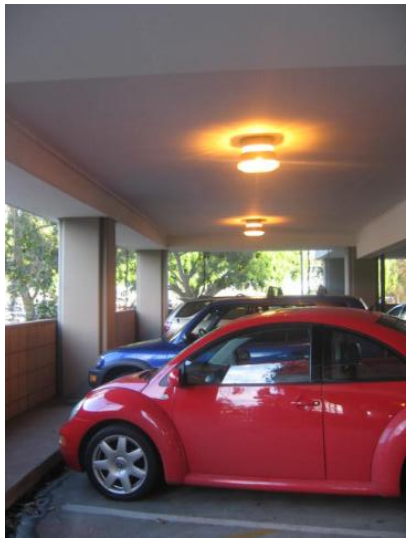
Bi-level induction luminaires with wireless daylighting controls

- Controls are key: reduce energy use by 30–40%
- Bi-level occupancy controls, wireless RF daylighting controls
- Broad spectrum source, high CRI and CCT
- 80W high mode, 40W low mode
- Induction lamps can last up to 100,000 hours
- Demonstrated energy savings: 65%

Before

- 150W HPS lamps, 170W system
- Continuous operation, 24 hours per day
- Average maintained illuminance at grade: 8.5 fc
- Annual energy consumption: 268,000 kWh
- Annual electricity cost: $34,300





After

- 70W induction lamp, 80W system
- Wireless daylighting controls reduce operating hours by half
- Estimated annual energy savings for full facility retrofit: 174,000 kWh
- Estimated electricity cost savings for full facility retrofit: $22,700
- Estimated project cost after partnership incentive: $108,000
- Simple payback on capital investment: 4.75 years

Bi-level Bollards
Arcade Creek park
California Department of Public Health

Bollards operated in low mode 85% of the time and consumed
78% less energy than the original luminaires

Measured Occupancy Rates

Site	Garage	Lot	Street
Sacramento State	38%		
Cal Poly SLO		32%	60%
Davis	40%	23%	
Santa Barbara	41%		
San Francisco		in progress	75%
Various	in progress	in progress	
California Department of Public Health, Richmond		13%	
City of San Marcos	in progress		

CA Title 24

First Proposal:
Section A5.204 Prescriptive approach
Outdoor lighting controls
One (1) Credit if all applicable outdoor luminaires are controlled as follows

Controls for Outdoor Lighting. For lighting of parking lots, parking garages, sales and non-sales canopies, and all outdoor sales areas, but not including outdoor sales frontage, motion sensor(s) shall be installed that has the capability to reduce the input power (in Watts) of each luminaire by a minimum of **40 % when there is no activity adjacent to each luminaire or grouping of luminaires**. A single motion sensor may control a grouping of luminaires serving no more than 10,000 square feet of area.

ASHRAE

Parking Garage Lighting Control. Lighting for parking garages shall comply with the following requirements:

Comply with Section 9.4.1.1.

Lighting shall be controlled by one or more devices that automatically reduce lighting power of each luminaire by a minimum of 30% when there is no activity detected within a lighting zone for no more than 30 minutes. Lighting zones for this requirement shall be no larger than 3,600 sf,

Daylight transition zone lighting, as described in Section 9.2.2.3 exception r, shall be separately controlled by a device that automatically turns lighting on during daylight hours and off at sunset.

For luminaires within 20 feet of any perimeter wall structure that has a net opening to wall ratio of at least 40% and no exterior obstructions within 20 feet, the power shall be automatically reduced in response to daylight.

Exceptions:

Daylight transitions zones and ramps without parking are exempt from sections b and d above.

Applications using HID of 150 watts or less or Induction lamps are exempt from section b above.

Recommendations

- **Install bi-level controls**
  - Energy savings
  - Shorter payback
  - Reduced lifecycle cost
- **Carefully select light sources & luminaires**
  - Install alternatives and evaluate
  - Get feedback from all affected
    - Installers
    - Maintenance
    - Neighbors
    - …

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Thank you!

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