

**City of San Diego
Broad Spectrum Lighting Program**

Brought to you by:
**CPUC-funded Local Government Partnerships
EECBG, CEC and QECB**

Tom Cartier and Linda Giannelli Pratt




2002: Conversion to HPS

HPS **LPS**



2



Dark Sky Society

Maintain 30 mile
LPS radii
around Mt.
Palomar and
Mt. Laguna

San Diego's Road to Recovery

*Unexpected results from a routine Library
Interior Lighting Retrofit—*

**We KNEW that the White Light (Broad
Spectrum) Saves Energy.**

**We DISCOVERED that it also provides
better visual performance.**

Why?

TRUE COLORS

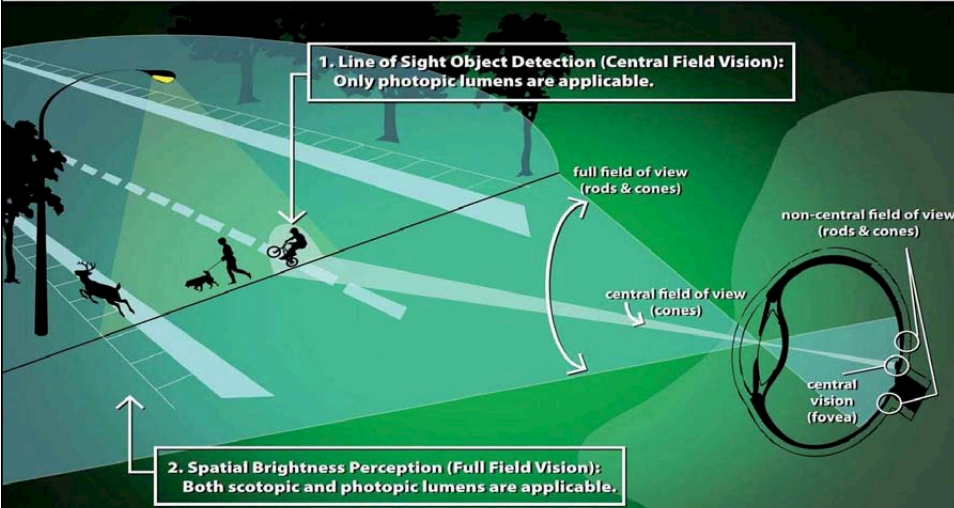
Monochromatic prohibits color rendition.
Boring... and a concern for public safety.



5

Scotopic versus Photopic Light and Vision

White Paper by Dr. Jack Josefowicz and Ms. Debbie Ha, LED Roadway Lighting Ltd.



1. Line of Sight Object Detection (Central Field Vision):
Only photopic lumens are applicable.

full field of view (rods & cones)

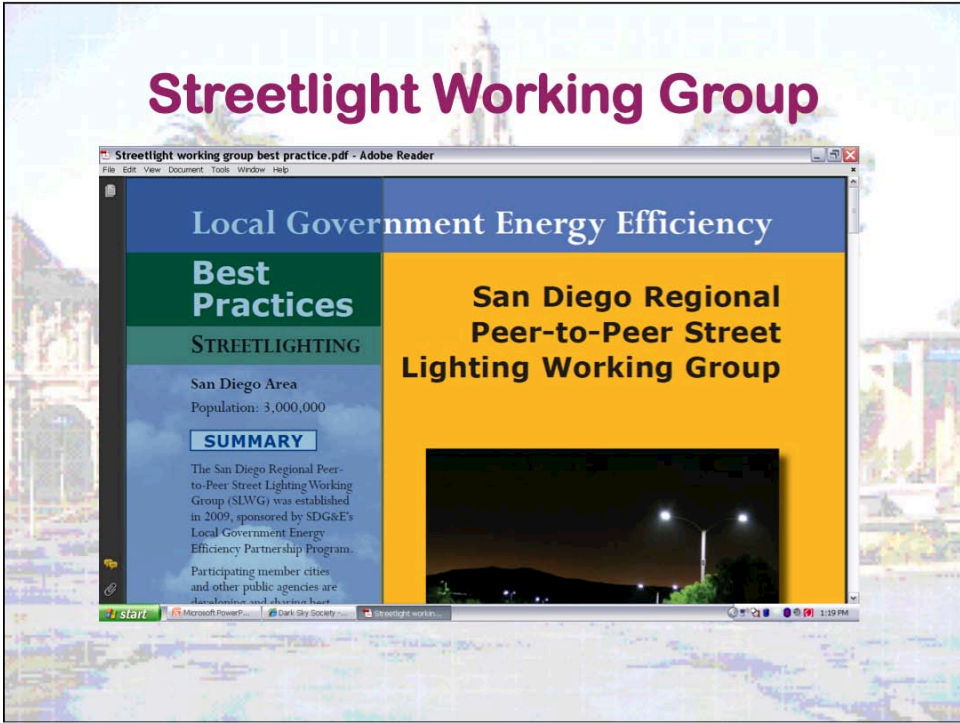
non-central field of view (rods & cones)

central field of view (cones)

central vision (fovea)

2. Spatial Brightness Perception (Full Field Vision):
Both scotopic and photopic lumens are applicable.

To the extent that centrally viewed objects are a prime visual task for roadway lighting application, photopic lumens established in standard lighting practice as criterion values, need to be maintained by a designed roadway lighting system. Otherwise, central vision could be compromised. As such, scotopic lumens cannot be used as a substitute for or added to photopic lumens when central vision is used for the task Line of Sight Object Detection.



“We have taken a technology-agnostic approach, since there is no one-size-fits-all solution.”

CleanTECH San Diego is a nonprofit membership organization formed to accelerate San Diego as a world leader in the clean technology economy, and co-leads the SLWG.

www.cleantechsandiego.org/streetlight-working-group.html

City of San Diego's Street Lighting Needs

- Nearly 38,000 streetlights to retrofit
- Comply with Dark Sky guidelines
 - Decide on technologies
- Identify specific requirements/
criteria
 - Develop an RFP
- Provide Public Outreach

6th Avenue Lighting Study



SDG&E-Sponsored Study Parameters

- Luminance (Ft Candles)
- Reaction Time (Test Vehicle)
- Subjective Public Evaluation

Street Light Working Group was a tremendous success- CleanTech, SDGE and many municipalities



Preliminary Results

- **No** significant difference between the existing 250 Watt High Pressure Sodium (HPS) and the 170 Watt Broad Spectrum Lights
- How do we choose between LED and Induction?

Decision: Broad Spectrum Lighting

- **Equal or Better Visual Performance**
- **Energy Saving 40% to 60%**
- **Maintenance Savings - Especially in right-of-way**

Life Cycle Cost Analysis

Consider all the costs during a twenty year product life, including:

- **Inflation as a variable**
- **Maintenance Costs**
- **Energy Costs converted to Simple Payback (Years) for Financing**

Street Lighting 20 Year Economic Life Cycle Analysis				
Line #	<u>Data</u>	250 Watt HPS	165 Watt Induction	198 Watt LED
2	Lamp & Fixture Costs (Material Only)	\$ 175.00	\$ 515.00	\$ 1,071.00
5	Monthly Energy Rate	\$ 13.16	\$ 6.59	\$ 7.91
	<u>Calculations</u>			
9	Annual Energy Costs	\$ 158	\$ 79	\$ 95
10	Years to Replace Lamp	5.77	24.04	12.02
11	No. of Lamp Replacements in 20 years	3.5	0.83	1.66
13	<u>Life Cycle Costs</u>			
14	Initial Cost of Fixture (Matl & Labor)	\$ 214	\$ 554	\$ 1,110
15	20 Year Energy Costs (No Inflation)	\$ 3,158	\$ 1,582	\$ 1,898
16	20 Year Energy Costs (with Inflation)	\$ 4,135	\$ 2,071	\$ 2,485
17	20 Year Lamp Maintenance Costs	\$ 209	\$ 202	\$ 2,264
18	20 Year Life Cycle Costs	\$ 4,558	\$ 2,827	\$ 5,860
19	Annual LC Costs	\$ 228	\$ 141	\$ 293
	Inflation Factor	250 Watt	165 Watt	198 Watt
	2.5%	HPS	Induction	LED

9/1/2009

**Payback Compared with 250 Watt HPS
(Years)**

<u>Induction</u>	
LCA Payback 165 Watt 6.4	Simple Payback 165 Watt 7.0
<u>LED</u>	
LCA Payback 198 Watt (17.1)	Simple Payback 198 Watt 17.6

H:\A My Files\Street Lighting\2009\Life Cycle\To Send\CCAC LCA FOR PPT.xls

Example of Cobra-Head Lighting



Projections for Energy Savings from Streetlights conversion:

16,000,000 kWh = 16,000 MWh

Which is approximately equal to:

- **2,266 cars removed**
- **1,450,000 gallons of gas saved**
- **4,426 homes off the grid**

