

DOCKET 07-BSTD-1
DATE _____
RECD. APR 29 2008

2008 Title 24 Nonresidential CASE Indoor Lighting Proposal

Integrated Lighting Concepts

In support of

PG&E, SCG and SDG&E
Codes & Standards Programs



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Codes & Standards Enhancement Project



Proposal Scope

- Reduce Lighting Power Density (LPD)
- Target - Nonresidential Buildings
- Reduce daily lighting power consumption...
...while meeting visual performance criteria
- Focus on the Tailored Method of Title 24
 - Reduce lighting power allowances
 - Increase enforceability
- Some area category recommendations too



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Focus & Highlights

- Accent & Wall Display – Reduced LPD
- Eliminate Mounting Height Factors for Retail
- Redefine Wall vs. Floor Lighting Criteria
- Trade-off between wall and floor display
- Wall Display – Multiple Shelf Component
- Mandate Expanded Lighting Controls
- Expand Daylight Harvesting Requirement
- Reduce ambiguity in general lighting calc.



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Benefits

- Energy Benefits – Yearly Savings
- Non-energy Benefits
 - Reduced Air emissions
 - Enhanced Lighting Quality
 - Improved Lighting Performance



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Technology Issues

- Fixtures and Lamps Now Available
- Major Lamp Technology Improvements
- Increased First Cost of New Technology
 - Fixtures More Costly – Prices are dropping
 - Lamps More Costly – Prices are dropping
 - Analysis based on current costs
- First Cost Offset by Energy and Operational Cost Reductions



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Methodology

- Interviews with Designers, Contractors
- Life Cycle Cost Analysis of Efficient Designs
- Visual Observation of Current Spaces
- Computer Modeling of Retail Spaces
 - Big Box Retail
 - High Center Atrium
 - Precious Jewelry
 - Designer Furs and Dresses

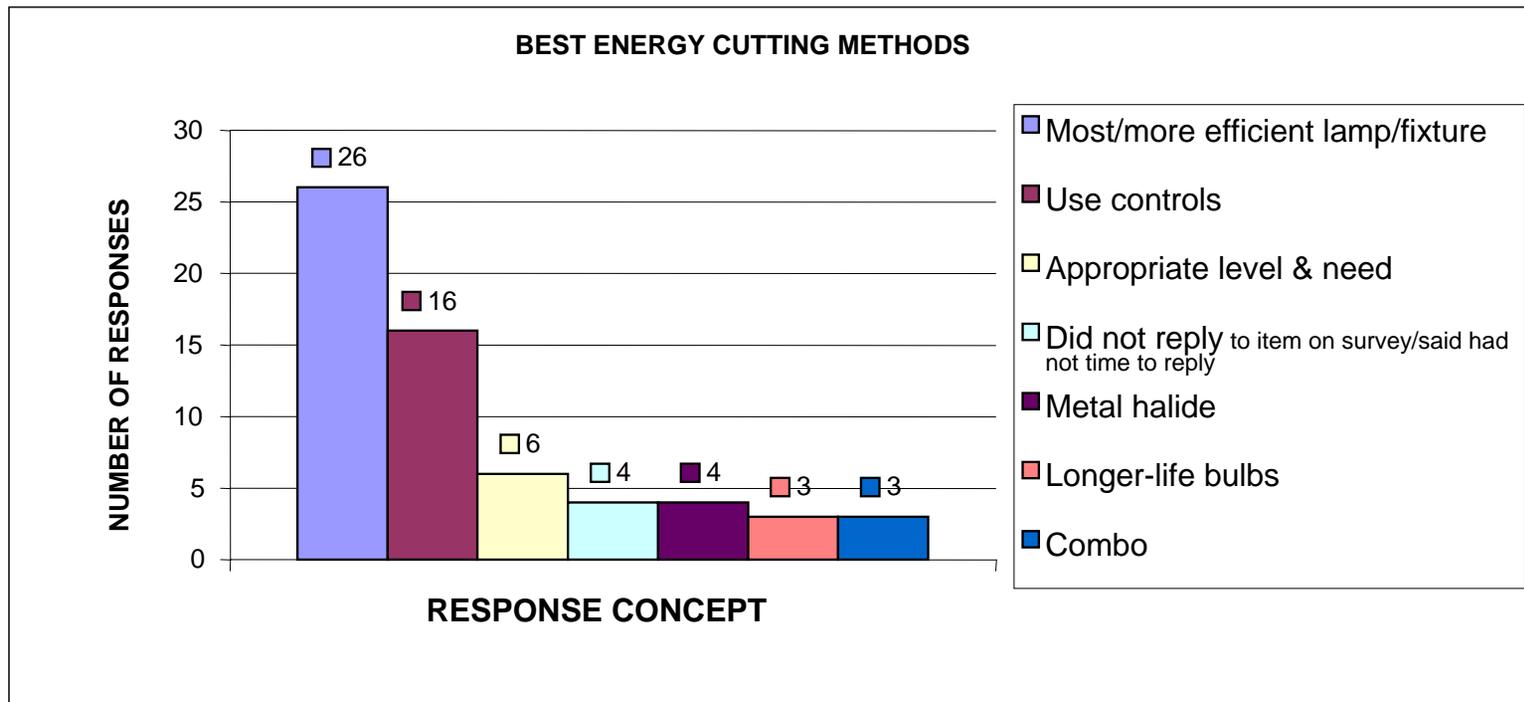


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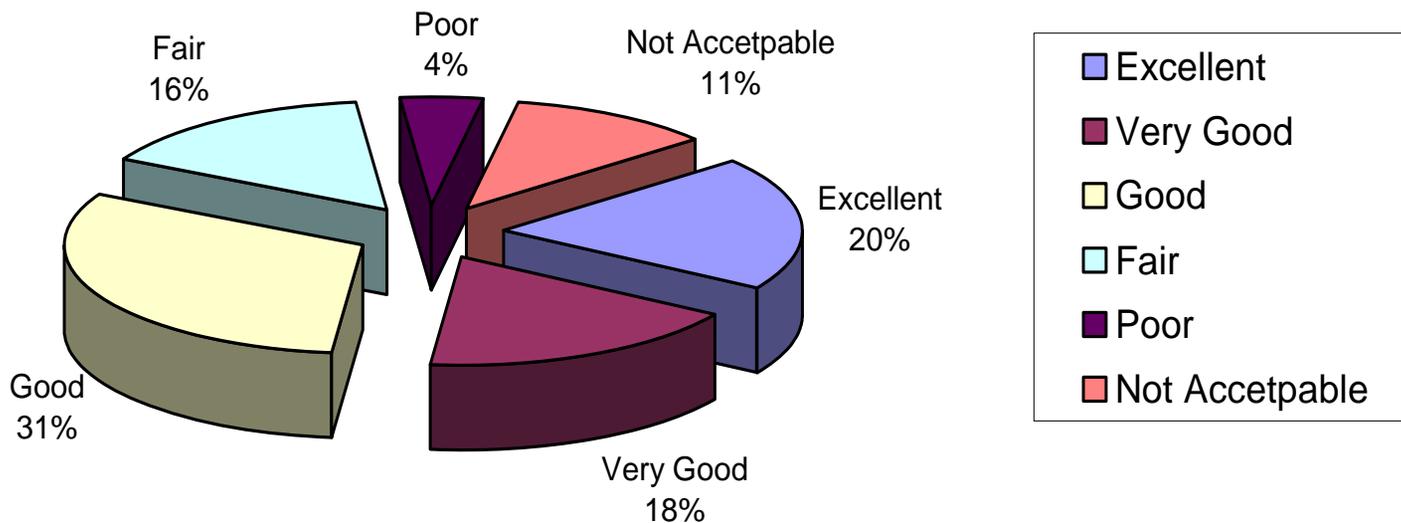
Survey results – What are your top recommendations to save energy?

- 47 interviews with Designers, Contractors, Manufacturers, and End Users



Survey – Is CMH a feasible alternative to halogen by 2008?

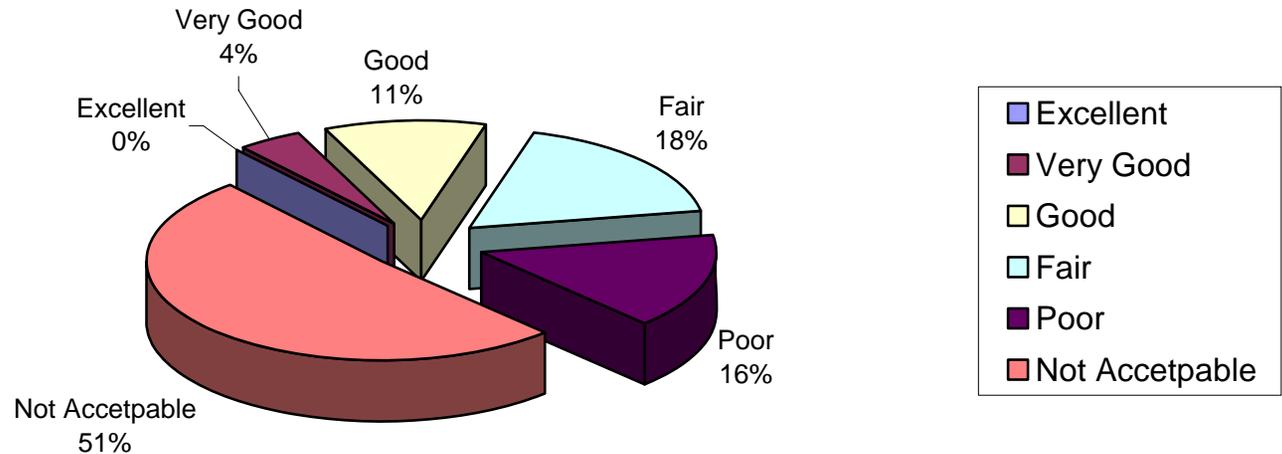
- Ceramic Metal Halide lighting feasible alternative to halogen lighting for commercial/retail by 2008?
- 69% saying CMH is “good or better”



Survey – Energy savings in T-24 by reducing exceptions?

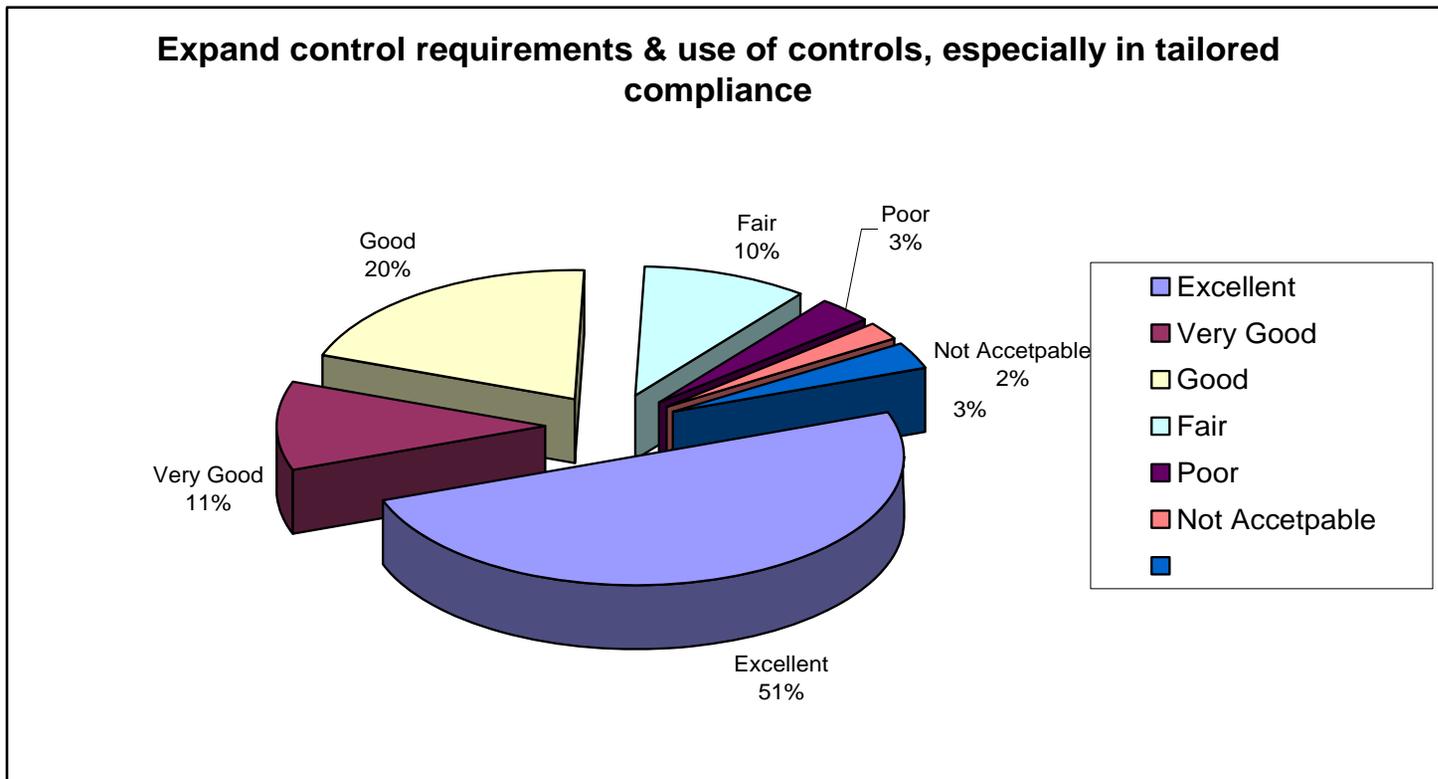
- 67% consider this a poor or unacceptable idea

Eliminate or at minimum substantially reduce most exemptions for special applications



Survey – Controls means of saving energy in T-24

- 72% think expanding the use of controls is a good or better way of increasing savings

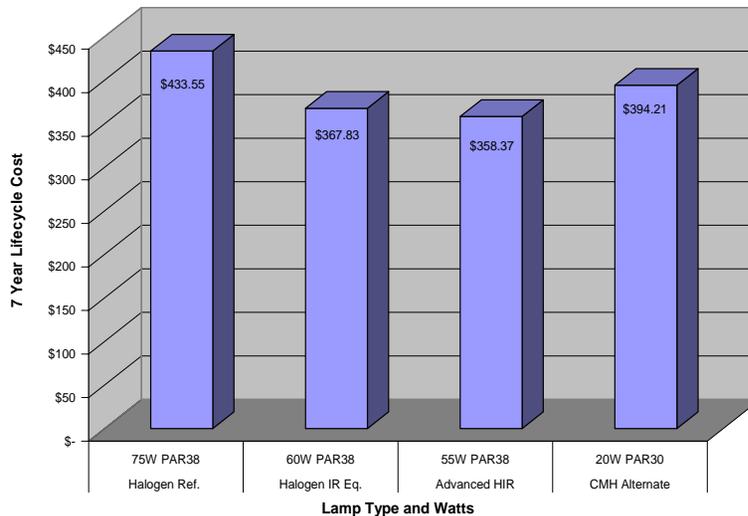


Life Cycle Costing 20W and 39W Ceramic Metal Halide versus Halogen

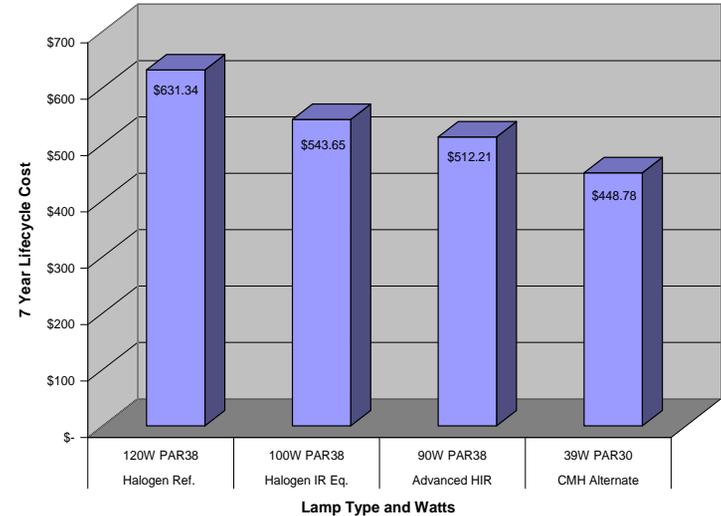
■ LCC with 75W Halogen Reference

■ LCC with 120W Halogen Reference

CMH 7 YEAR LIFECYCLE COST ANALYSIS - 75 WATT REFERENCE



CMH 7 YEAR LIFECYCLE COST ANALYSIS - 120 WATT REFERENCE

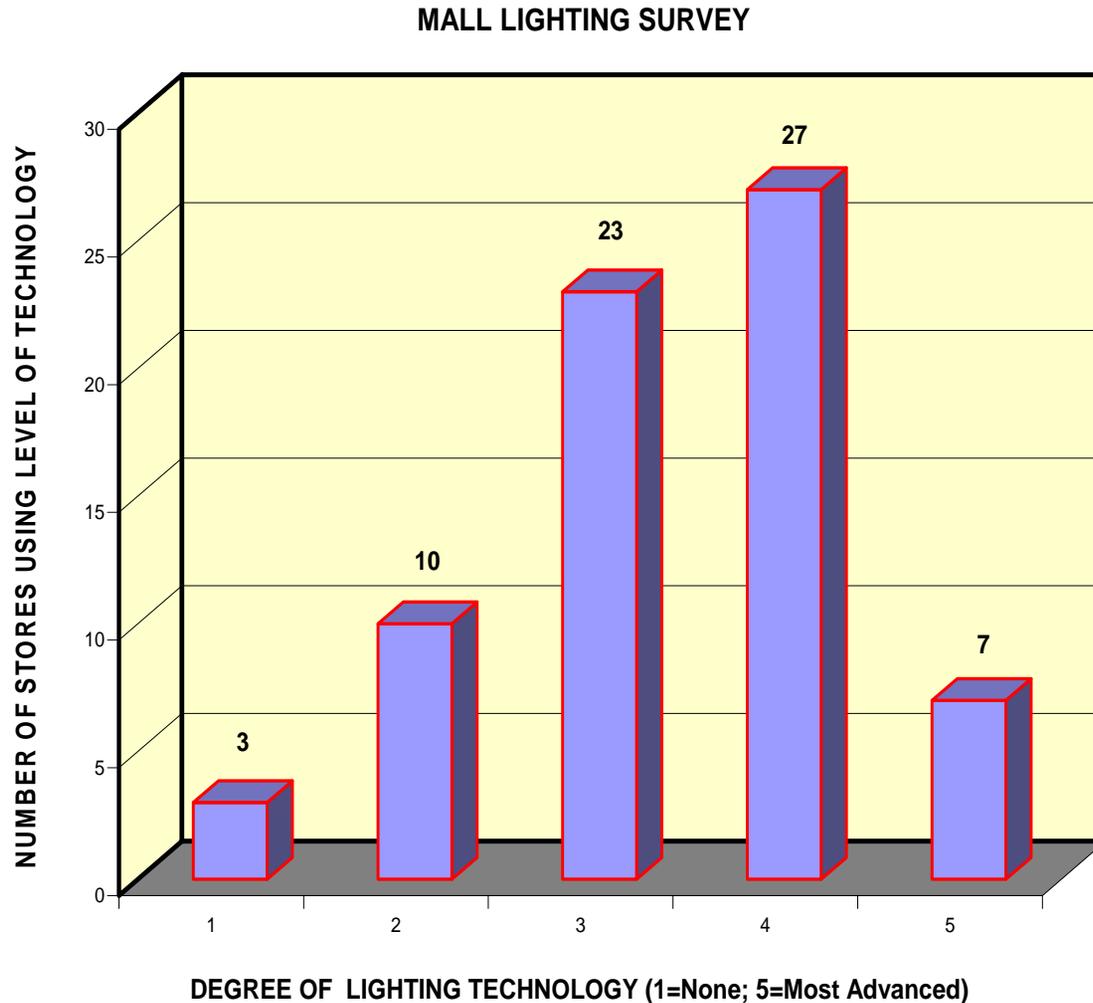


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New Mall use of Efficient Technology - Survey of 70 Stores

1 - None, 5 - Most Advanced



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Analysis Tools

- AGi32 lighting software – Lighting design models
 - Detailed lighting analysis
 - Comprehensive lighting modeling
- Excel Spreadsheets
 - Set power densities by space/task with current technologies. Build on spreadsheets used in the developing the 2005 standards.
 - Evaluate models under 05 versus proposed 08 standard
 - Analysis/comparisons - cost effectiveness and benefits



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Model B

large store with a high center atrium



LPD Recap

General Lighting: 1.02W
Floor Display: 0.33W
Wall Display: 11.8W
Ornamental: 0.39W

Area Method: 1.69W (1.70W)



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Model C

high end jewelry store



LPD Recap

General Lighting: 0.52W
Floor Display: 0.30W
Wall Display: 6.2W
Valuable Display: 11.0W



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Model D designer shop within a larger store



LPD Recap

General Lighting: 0.57W
Floor Display: 0.85W
Wall Display: 10.5W



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LPD: T-24/05 versus Proposed T-24/08

- Comparison of proposed Title 24-2008 using new technology and current Title 24-2005 compliance

DESIGN COMPARISON OF TITLE 24-2005 and PROPOSED TITLE 24-2008 OF RETAIL STORE MODELS

MODEL	TITLE 24 CALCULATION METHOD	TITLE 24-2005 DESIGN LIGHTING POWER DENSITY			TITLE 24-2005 MAXIMUM ALLOWED POWER DENSITY FOR EACH MODEL GEOMETRY		TITLE 24-2008 DESIGN LIGHTING POWER DENSITY			TITLE 24-2008 (Proposed) MAXIMUM ALLOWED POWER DENSITY FOR EACH MODEL GEOMETRY	
		Watts	Square Feet	W/SqFt	Watts	W/SqFt	Watts	Square Feet	W/SqFt	Watts	W/SqFt
Big Box	AREA	218,134	124,222	1.76 ^{*1}	186,333	1.70	150,039	124,222	1.21	186,333	1.24
High Center Atrium	TAILORED	51,121	30,227	1.69	80,300	2.66	48,675	30,227	1.61	62,047	2.05
High End Jewelry	TAILORED	20,301	3,940	5.15	25,556	6.49	7,995	3,940	2.03	17,826	4.52
Designer (High End Retail)	TAILORED	4,535	932	4.87 ^{*2}	4,013	4.31	2,470	932	2.65	3,236	3.47
Location Average:		73,523	39,830	3.37	74,051	3.74	52,295	39,830	1.87	67,361	2.82

*1: Control credits not included, design complies with control credit

*2: 13% over as stand-alone, complies however when averaged with other space within the project and total project control credits applied



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2005 versus 2008 Wall Model Results – with options

- 60W/55W/HIR advanced and MR16/IRC models
- Maximum Efficiency CMH & T5 Model

Design	Illumination	Lineal LPD	Cost Adder	Cost Effect
60/HIR & T8-2005	Base Level	30.0W (21.0W)*	Base Level	Base Level
55/HIR & T5-2008	Equivalent	25.0W (17.5W)*	Low	Less than 2 yr
55/HIR & T5 (alt. 1)	(10%)	23.7W (16.5W)*	Low	Less than 2 yr
50MR/IR & T5 (alt. 2)	(10%)	23.7W (16.5W)*	Low	Less than 5 yr
20W/CMH & T5	Equivalent	15.4W (10.8W)*	High	Limited -7 yr +

* Allowed wall LPD per lineal foot based on 70% of actual (modeled) merchandised wall lighting



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Wall Display

LPD Recommendation

- Wall Display LPD lowered from **21.0W** to **16.5W**
- Logic for recommendation
 - Achievable with use of high efficiency T5 and latest IR/IRC lamping with only a 10% (minor) light loss
 - Alternate light loss designs still comply with IES-RP-2 standards for display lighting.
 - CMH not required to reach compliance in lower ceilings and/or at lower light levels
- Designs desiring significantly higher illumination or with high ceilings can use CMH



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Floor Display Model

Compact Triple Tube with 55W/HIR accent

- 0.90W General & 1.35W Accent = 2.25W
- Ambient: 44FC Average: 75FC Accent: 360FC



IESNA RP-2 Compliant Design – 2005 Model Upscale Retail



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Floor Display Model

2x4 T8 Troffer with 55W/HIR accent

- 0.60W General & 1.35W Accent = 1.95W
- Ambient: 40FC Average: 72FC Accent: 362FC



IESNA RP-2 Compliant Design – 2008 Model – Ma & Pop

Floor Display LPD Recommendation

- Floor Display LPD lowered from **1.5W** to **1.05W**
- Logic for recommendation
 - 2008 Model (Mom & Pop) allows for RP-2 compliant lighting without use of CMH
 - 2008 Model more representative of typical strip/independent retail space.
 - Lower General lighting LPD in 2008 model can supplement accent allowing 55W/IR versus CMH
- Designs with less efficient general lighting and desired higher light levels can use CMH

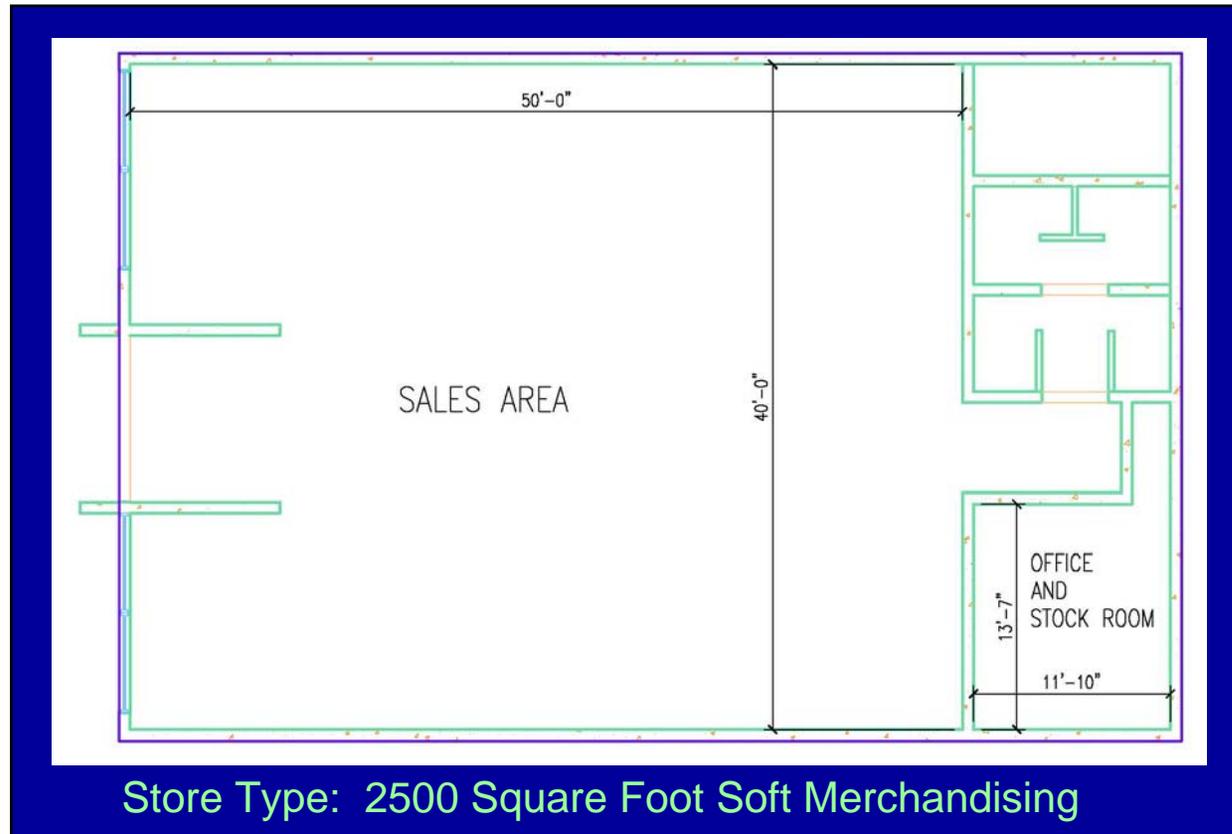


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Lighting Controls Cost-effectiveness

ADVANCED LIGHTING CONTROLS ANALYSIS MODEL



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Lighting Controls Cost-effectiveness

- **Advanced Controls Versus Basic Time Clock**
 - Modeled 2500 foot (Mom & Pop) retail space
 - Includes multi task/zone and multi level control with sensors and load shed ability
- **Cost-effectiveness Recap and Summary**

Annual Savings Using Advanced Controls	\$1,946.22
Cost over Minimum Control (Time Clock)	\$4,200.00
SIMPLE PAYBACK PERIOD	2.2 Years



Proposed Code Language – LPD's

Retail Merchandise Sales

Tailored LPD's	T24-05	T24-08
General Lighting	0.90W sq. ft.	0.90W sq. ft.
Floor Display	1.50W sq. ft.	<u>1.05W sq. ft.</u>
Wall Display	21.0W lin. ft.	<u>16.5W lin. ft.</u>
Effects Lighting	0.70W sq. ft.	<u>0.60W sq. ft.</u>
Valuable Mech. Area	1.30W sq. ft.	<u>0.90W sq. ft.</u>
Valuable Mech. Tops	20.0W sq. ft.	<u>15.0W sq. ft.</u>



Proposed Code Language

Mandatory Controls for Tailored Spaces

- **Egress & Security** – All lights off except egress/security
- **Housekeeping Controls** – Uniform lighting with LPD no greater than allowed general lighting LPD for space
- **Demand Response** – Turn off selective lights as governed by local utility
- **Display Window Lighting** – Separately controlled with potential to respond to daylight and evening conditions



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Acknowledgements

Sponsored by California Ratepayers through Codes & Standards programs at:

- Pacific Gas & Electric Company
 - Steve Blanc SLB4@pge.com
- Southern California Gas Company & San Diego Gas & Electric Company
 - Jerine Ahmed jahmed@semprautilities.com
- Project management by Heschong Mahone Group
 - Jon McHugh mchugh@h-m-g.com



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