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2008 Title 24 Nonresidential CASE Sign Lighting Proposal

July Staff Workshop

M. Neils Engineering, Inc.

In support of

PG&E Codes & Standards Program



**Pacific Gas and
Electric Company**

2008 Title 24 Nonresidential CASE Sign Lighting Proposal

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Overview of Proposal

- Require automatic time and daylight responsive lighting controls for all outdoor signs
- Require automatic dimming controls for outdoor signs that are illuminated during daytime hours

Overview of Proposal

- Mandate use of high efficiency power supplies for neon and cold cathode sources in accordance with limitations of the technology
- Mandate high efficiency power supplies for LED signs



Automatic time schedule lighting controls

- Compared proposed measure to base case with photoelectric controls
- Used Southern California Edison sign survey completed in November 2005 (Phase 1) and June 2006 (Phase 2) as the baseline for existing sign operation



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Astronomic Time Switch Control / Photoelectric (PE) Control

- Compared astronomic time switch control to photoelectric switch control
- Additional savings based on scheduling sign for owner's needs
- 500 Watt load is cost-effective



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Automatic time schedule lighting controls

Life Cycle Cost Analysis

Sign Measure	Size	Energy Savings		Cost Savings			Incremental Cost	Benefit / Cost Ratio
	kW	Total kWh	TDV kBtu	Energy Cost PV \$	Maint. PV \$	Total PV \$	PV \$	
Astronomic Time Switch Control / PE	0.5	730	10,846	\$915	-\$39	\$876	\$800	1.1

Automatic dimming controls

- Evaluated reduction from 100% to 35% output for LED message centers operated during daytime
- Base case – 100% output 24 hours / day
- Proposed case – 35% output dusk / dawn
- 3 cases - 240 to 960 Watt load
 - Two 4-module signs rated 240 watts and one 8-module sign rated 960 watts



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Life Cycle Cost Analysis

Automatic dimming controls

Sign Measure	Size	Energy Savings		Cost Savings			Incremental Cost	Benefit / Cost Ratio
	kW	Total kWh	TDV kBtu	Energy Cost PV \$	Maint . PV \$	Total PV \$	PV \$	
1 x 4 LED Monochromatic Short Range Dimming	0.24	625	10,539	\$889	\$172	\$1,061	\$1,000	1.1
1 x 4 LED Monochromatic Medium Range Dimming	0.24	625	10,539	\$889	\$172	\$1,061	\$1,000	1.1
1 x 4 LED Mono Long Range Dimming	0.96	2,501	42,156	\$3,556	\$498	\$4,054	\$1,000	4.1



Demand response controls

- Evaluated use of demand response controls for economic and emergency dispatch
- Economic dispatch
 - 4 hours / day, 10 days per year
- Emergency dispatch
 - 2.4 hours / year



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Demand response controls

- Indoor Cabinet Signs
- Base case – sign on
- Proposed case – 30% power reduction
- Economic dispatch load – 8.0 kilowatt
- Economic + Emergency dispatch load – 3.2 kilowatt

Demand response controls

- Outdoor LED message centers
- Base case – 100% output
- Proposed case – 30% output reduction
- Economic dispatch load – 20 kilowatt
- Economic + Emergency dispatch load – 8.1 kilowatt

Demand Response Controls

DR Cost Savings

DR Schedule	Dispatch Strategy	Cost Savings \$ PV
Economic Value	1:00 to 5:00 pm 10 days / year	\$250 / kW
Economic + Emergency Response	Economic + 2.4 hours / year	\$616 / kW

Demand Response Controls

Cost Effective Threshold @ 1.5 B/C Ratio

Sign Measure	% Off	Implementation Cost	Economic Value kW	Economic + Emergency kW
Cabinet Sign	30%	\$400	8.0	3.2
LED Message Center	30%	\$1,000	20	8.1



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Demand Response Controls

Sign Size

			Sign Size	
Sign Measure	% Off	Implementation Cost	Economic Value SF	Economic + Emergency SF
Cabinet Sign	30%	\$400	666	271
LED Message Center	30%	\$1,000	399	162

High efficiency neon power supplies

- Evaluated electronic neon power supplies as an alternative to ferromagnetic transformers.
- Limited to climate zones and cases where electronic neon power supplies could be applied properly within allowable temperature ranges (-30° to 122° F).



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High efficiency neon power supplies

- Evaluated use of electronic neon power supplies for group of 6 outdoor signs
 - Different sizes and wattages
- Two schedules – 24 hour and dusk / dawn
- Load (11% decrease)
 - Base case – 1.64 kilowatt
 - Proposed case – 1.47 kilowatt



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Life Cycle Cost Analysis

High efficiency neon power supplies

Sign Measure	Size	Energy Savings		Cost Savings			Incremental Cost	Benefit / Cost Ratio
	kW	Total kWh	TDV kBtu	Energy Cost PV \$	Maint. PV \$	Total PV \$	PV \$	
Neon Electronic Power Supply – 24 hr	1.64	1,480	28,621	\$2,415	-\$498	\$1,917	-\$225	Immediate
Neon Electronic Power Supply – Night	1.64	677	11,417	\$4,294	-\$800	\$163	-\$225	Immediate



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High Efficiency LED (Light Emitting Diode) Power Supply

- Evaluated use of 60 and 100 watt switching power supplies for outdoor signs
 - 60% efficiency for low efficiency power supplies,
 - 70% & 85% efficiencies for high efficiency power
- 24 hour operation
- Load (14% and 30% decrease)
 - Base cases – 100 and 167 watt inputs
 - Proposed cases – 86 and 117 watt inputs



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Life Cycle Cost Analysis

LED (Light Emitting Diode) Power Supply

Sign Measure	Size	Energy Savings		Cost Savings			Incremental Cost	Benefit / Cost Ratio
	kW	Total kWh	TDV kBtu	Energy Cost PV \$	Maint. PV \$	Total PV \$	PV \$	
Switched 60 Watt LED Power Supply	0.06	125	2,419	\$204	-\$14	\$190	\$20	9.5
Switched 100 Watt LED Power Supply	0.1	435	8,411	\$710	-\$21	\$689	\$30	23.0



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Proposed Mandatory Requirements

- Require time schedule, daylight responsive lighting controls for all outdoor signs.
- Require automatic dimming controls for outdoor signs that are illuminated during daytime hours.
- Mandate use of high efficiency power supplies for neon and cold cathode sources in accordance with limitations of the technology.
- Mandate use of high efficiency electronic power supplies for LED sources.



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Test standards for defining efficiency

- Metal Halide Ballasts - ANSI C82.6-2005
- Neon and LED power supply–Title 20 Section 1604 (u)



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Acknowledgements and Contacts

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Proposed Prescriptive Standards Language

- Original standards language is in black font, the proposed deleted text is **in red text with hard strikeouts** and added language contained is in blue font and underlined



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SECTION 132 – OUTDOOR LIGHTING CONTROLS AND EQUIPMENT

(c) Controls for Outdoor Lighting

1. All permanently installed outdoor lighting shall be controlled by a photocontrol or astronomical time switch that automatically turns off the outdoor lighting when daylight is available.

SECTION 132 – OUTDOOR LIGHTING CONTROLS AND EQUIPMENT

EXCEPTIONS to Section 132 (c) 2:

~~6. Internally illuminated, externally illuminated, and unfiltered signs.~~

SECTION 133 – OUTDOOR SIGN LIGHTING CONTROLS

- (a) Designation of Daytime Use. If an outdoor sign is planned to be illuminated by electric lighting for more than 1 hour per day while the sun is above the horizon, the sign shall be designated as “Normally On during Daytime.” Any outdoor sign that is not designated as “Normally On during Daytime,” shall be designated as “Normally Off during Daytime.”

SECTION 133 – OUTDOOR SIGN LIGHTING CONTROLS

- Controls for Outdoor Signs Normally Off during Daytime. All permanently installed outdoor signs that are designated normally off during daytime shall be controlled by an photocontrol and 24-hour time switch or astronomical time switch, complying with Section 119(j), that automatically turns off the outdoor signs when daylight is available.



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SECTION 133 – OUTDOOR SIGN LIGHTING CONTROLS

- EXCEPTION to Section 133 (b): Outdoor signs in parking garages, tunnels, and large covered areas that require illumination during daylight hours.

SECTION 133 – OUTDOOR SIGN LIGHTING CONTROLS

- (c) Controls for Outdoor Signs Normally On during Daytime. All permanently installed outdoor signs that are designated Normally On during Daytime shall be controlled by a photocontrol and 24-hour time switch or an outdoor astronomical time switch, complying with Section 199(j), that automatically dims and reduces sign power draw by 65% between the times of 30 minutes after sunset and 30 minutes before sunrise.



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SECTION 133 – OUTDOOR SIGN LIGHTING CONTROLS

- **EXCEPTION to Section 133 (c):** Outdoor signs in parking garages, tunnels, and large covered areas that require illumination during daylight hours.
- **d) Controls for All Signs:** All permanently connected signs shall have an automatic time switch control that complies with Section 119(c).

SECTION 148 – REQUIREMENTS FOR SIGNS

- This section applies to all internally illuminated, and externally illuminated and unfiltered signs, both indoor and outdoor. Each sign shall comply with either subsection (a) **or** (b), as applicable, ~~or with one of the alternatives that immediately follow subsection (b).~~

SECTION 148 – REQUIREMENTS FOR SIGNS

- (a) For internally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 12 watts per square foot. For double-faced signs, only the area of a single face shall be used to determine the allowed lighting power.

SECTION 148 – REQUIREMENTS FOR SIGNS

- ~~(b)~~ For externally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 2.3 watts per square foot. Only areas of an externally lighted sign that are illuminated without obstruction or interference, by one or more luminaires, shall be used.

SECTION 148 – REQUIREMENTS FOR SIGNS

- ~~ALTERNATIVE to 148(a) and (b):~~
- (b) The sign complies with this Section if it is:
 1. Equipped
equipped only with one or more of the following light
sources:
- ~~high pressure sodium, pulse start and ceramic metal halide, neon, cold cathode, light emitting diodes, barrier-coat rare earth phosphor fluorescent lamps, or compact fluorescent lamps that do not contain a medium base socket (E24/E26), or~~
- ~~Equipped only with electronic ballasts with a fundamental output frequency not less than 20 kHz.~~

SECTION 148 – REQUIREMENTS FOR SIGNS

- 1. high pressure sodium lamps,
- 2. pulse start ceramic metal halide lamps served by a ballast with a minimum efficiency of 88%,
- 3. neon, with power supply having an efficiency of 85% or greater and a power factor of 90% or greater.

SECTION 148 – REQUIREMENTS FOR SIGNS

- 4. cold cathode or fluorescent lamps with barrier coat rare earth phosphors and equipped only with electronic ballasts having a fundamental output frequency not less than 20 kHz,
- 5. light emitting diodes with power supply having an efficiency of 85% or greater and a power factor of 90% or greater.
- 6. compact fluorescent lamps that do not contain a medium base socket (E24/E26)



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SECTION 148 – REQUIREMENTS FOR SIGNS (exceptions)

- Exception to Section 148(b) 2, 3, 4, 5 – the requirement for a high efficiency power supply does not apply in climate zones 10 through 16.
- Exception to Section 148(b) 5 –power supplies with a power factor less than 90% may be used in flashing applications and dimming applications where sign power is required to be reduced by Section 133(c).
- **EXCEPTION 1 to Section 148:** ~~Unfiltered signs and~~ traffic signs.