

Proposal Information Template for: **Portable Lighting Fixtures**

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Proposal Information Template – Portable Lighting Fixtures**2008 Appliance Efficiency Standards**

Steven Nadel, ACEEE, Jan. 25, 2008

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Purpose

This document is a report template to be used by researchers who are evaluating proposed changes to the California Energy Commission's (Commission) appliance efficiency regulations (Title 20, Cal. Code Regs., §§ 1601 – 1608) This report specifically covers portable lighting fixtures (e.g. floor and table lamps).

Background

Nationwide, residential lighting used about 208 TWh (billion kWh) in 2001, which is about 17% of residential sector electricity consumption in that year. About 90% of this energy consumption is by incandescent lamps (Navigant 2002). Energy use by incandescent lamps can be reduced by about 70% with use of compact fluorescent lamps (CFLs). Proponents of LEDs expect similar savings from their products in a few years time.

In order to capture some of these available savings, the CEC has addressed residential lighting use through specific Title 24 (building code) and Title 20 (equipment efficiency) standards. For example, Title 24 requires use of high efficiency hard-wired fixtures in kitchens, baths, garages, laundry rooms, and utility rooms with an exception provided for fixtures controlled by an occupancy sensor. Title 20 caps the Watts consumed by torchiere lighting fixtures at 190 Watts. The intent was to promote CFL-type fixtures, but in practice this standard has cut the power use of a typical torchiere from 300+ Watts to 150-180 Watts.

In addition, the federal Energy Independence and Security Act, adopted in December, 2007, sets efficiency standards for general service incandescent lamps, effective 2012-2014 (varying by lamp light output). Under these standards, conventional incandescent lamps will be phased out in favor of CFLs, LEDs and more efficient incandescent lamps (e.g. a 40-43 W lamp will replace today's 60 W lamp).

Still, despite these steps, a substantial number of conventional incandescent lighting fixtures continue to be sold in California. New updates of Title 24 can address many of the hard-wired fixtures; in this proposal we address portable fixtures, such as floor and table lamps.

Overview

An overview table is provided on the following pages.

Description of Standards Proposal	Portable lighting fixtures typically contain screw-in sockets for 1-3 lamps. Efficient alternatives include: (1) fixtures with LEDs or plug in CFLs (e.g. "PL-type" lamps) in lieu of screw-in sockets, and (2) use of screw-in CFLs in conventional fixtures. For the latter option, there are a range of options including (a) requiring that manufacturers include efficient lamps when fixtures are purchased and (b) including a circuit breaker or some other switch that prevents the fixture from operating if lamp wattage exceeds a preset value. Option 1 is the most expensive but ensures that efficient lamps are used throughout the life of the fixture. This also requires most fixtures now on the market to be redesigned. Option 2a is inexpensive, but will save significantly less energy because some consumers won't use the CFLs in the box, and other consumers will only use the CFL until it burns out, and then will replace it with an incandescent lamp. Option 2b is intermediate between the other two options, with a cost only a little higher than option 2a and savings approaching those of option 1 since, with the right wattage cap, most incandescent lamps cannot be used. This option will require addition of a circuit breaker to most current fixtures, something that torchiere manufacturers have recently done. Based on these options, we recommend the following standards approach: Tier 1, effective January 1, 2010 <i>A portable fixture may be sold in California only if it either is incapable of operating at a total demand exceeding 35 watts or meets the current Energy Star standard for portable fixtures.</i> Tier 2, effective January 1, 2012 Following the completion of additional research and analysis, we plan to propose a specific Tier 2 level for implementation in 2012. This refined proposal will be part of the Portable Fixtures CASE Report now under development. We are evaluating reductions in the 35 maximum demand requirement and a tightening of efficacy requirements beyond the now current Energy Star portable fixtures specification as possibilities. Note: the 35 watt limit is enough to permit two CFLs with combined light output equivalent to two conventional 60 W incandescent lamps or a 34 W CFL with light output midway between conventional 100 and 150 W lamps. The Tier 1 standard would inevitably fail if Option 2a is allowed as part of the compliance pathway for Tier 1. Again, we believe Option 2a will result in large savings losses because CFLs will either not be installed or not replaced in a significant proportion of fixtures complying under Option 2a. Thus, we discard the Option 2a compliance pathway from our Tier 1 proposal. The proposed standard will have large energy savings (since most conventional incandescent lamps cannot be used) but costs will be modest since we expect many fixtures to use low-cost circuit breakers rather than the Energy Star fixture approach
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California Stock and Sales	Current California stock is about 65 million units, with stock projected to be about 85 million units in 2030. Annual sales are about 4.2 million units. Details are provided in the appendix.
Energy Savings and Demand Reduction	Estimated average per unit savings are 21 kWh/year and 2 W coincident peak savings from fixtures that will not be CFL in the basecase. After stock turnover, statewide savings will be 871 GWh/year and 83 MW coincident peak, counting only half the fixtures (estimate the other half will be CFL in basecase) and only crediting savings beyond the new federal incandescent lamp standard. Details are in the appendix. These savings are for the proposed Tier 1 standard allowing either a) a 35 Watt cap or b) Energy Star certified fixtures (e.g., pin based fixtures).
Economic Analysis	Depending on the compliant fixture selected, net lifetime benefits per fixture will be between \$20 and \$57. The benefit-cost ratio ranges from 1.5 to 7.1. These standards will be easy to meet and will not have a significant impact on jobs.
Non-Energy Benefits	The improved fixtures will use longer-life lamps, reducing the inconvenience of having to regularly replace bulbs.
Environmental Impacts	The proposed regulation will increase use of CFLs and LEDs. Net environmental impacts will be positive due to avoided emissions, including avoided emissions of mercury. However, CFLs do contain some mercury and need to be disposed of properly.
Acceptance Issues	Proposed standards will require moving toward CFL, LED or other high-efficiency technologies. While most consumers accept these light sources, some consumers prefer incandescent lights. If the Watt cap compliance pathway is used by a manufacturer for a product (e.g., a 35 Watt circuit breaker is used in conjunction with a medium screw base), some consumers may be confused when the fixture does not operate if they use a high-wattage conventional bulb. To address this, manufacturers, utilities and others should provide educational information. This educational effort should also address proper disposal of CFLs.

AB 1109 (California Lighting Efficiency and Toxics Reduction Act)	Average savings per home will be 105 kWh/year and a coincident peak reduction of 10 W. This is based on 5 fixtures per household. This estimate assumes 7% of lamps are on at the time of system peak. Sources are noted in the appendix. Lighting Measure Availability and Cost: Energy Star fixtures are available from many manufacturers with a list on the Energy Star website. In addition, any other fixture can be easily adapted by adding a circuit breaker, as torchiere manufacturers are now doing. Based on the torchiere experience, manufacturers will need approximately one year to modify products and get them to market in large quantities. There are probably more than 100 portable fixture manufacturers and thousand so of different products.
Federal Preemption or other Regulatory or Legislative Considerations	Torchiere lighting fixtures are preempted but all other portable lighting fixtures are not. Interactions with the federal lamp standards affect savings, but there is not a preemption issue.

Methodology

The methodology is shown in the appendix and involves calculations using the best data from recent California lighting and energy studies.

Analysis and Results

The analysis is provided in the appendix. The results are summarized in the table above.

Recommendations

Effective January 1, 2010 (assuming this rule is completed in 2008), portable lighting fixtures (specifically defined) shall either be certified to meet the current Energy Star fixture specification or shall not consume more than 35 Watts of power and shall be incapable of operating with lamps that total more than 35 Watts.

Bibliography and Other Research

Heschong Mahone Group. 1999. *Lighting Efficiency Technology Report, Volume I, California Baseline*. Sacramento, CA: California Energy Commission.

Itron. 2006. *California Residential Efficiency Market Share Tracking: Lamps 2005*. Rosemead, CA: Southern California Edison.

Navigant Consulting. 2002. *U.S. Lighting Market Characterization, Volume I: National Lighting Inventory and Energy Consumption Estimate*. Washington, DC: Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy.

RLW Analytics. 2000. *Statewide Residential Lighting and Appliance Saturation Study*. Sonoma, CA: RLW Analytics.

Appendices

Data and calculations are shown on the next two pages.

Preliminary Calculations for Portable Lamp Standards

California Stock

13,174,378	Housing units in 2006 (Census Bureau estimate)
<u>5</u>	Portable fixtures/household (RLW 2000 estimates 4.52, HMG1999 estimates 5.2)
65,871,890	2006 stock
<u>1.28</u>	Ratio 2030 to 2006 population (Census Bureau projections)
84,397,837	2030 stock (20 years after a 2010 standard goes into effect)

California Annual Sales

<u>20</u>	ACEEE estimate of average portable fixture life
4,219,892	Average annual sales over 2006-2030 period

Current Energy Use and Peak Demand

60	Average Watts/lamp (derived from HMG 1999)
1.12	Number of lamps per portable fixture (derived from RLW 2000)
2.02	Average daily operating hours
<u>365</u>	Days/year
3,264	GWh/year 2006
<u>7%</u>	Lamps on at time of peak (derived from HMG 1999)
310	Peak MW 2006

Energy and Demand Savings

70%	Typical savings with CFL (e.g. 18 W CFL replaces 60 W incandescent)
<u>28%</u>	Savings from HIR lamps due to federal lamp standards (43 W HIR replaces 60 W)
42%	Net savings
50%	Will already be CFL due to utility programs and federal lamp standards (ACEEE est.)
128%	Adjustment for 2030 savings due to population growth (from above)
871	GWh savings in 2030
83	MW savings in 2030

Costs and Benefits

For scenario 1 – can use conventional fixtures with CFLs and a circuit breaker

\$3	Cost of CFL (ACEEE estimate) (can be another technology, we use CFLs for calculations)
1.12	Number of lamps/fixture (from above)
<u>1.84</u>	Number of lamps over 20 year life (8000 hour life, 2.02 operating hours/day)
\$6.19	Cost of CFLs
<u>\$3.00</u>	Cost of adding circuit breaker to current fixture designs (ACEEE estimate)
\$9.19	Total cost of meeting standard

\$1.50	Cost of avoided HIR (ACEEE estimate)
1.12	Number of lamps/fixture (from above)
	Number of lamps over 20 year life (3000 hour life, 2.02 operating
<u>4.92</u>	hours/day)
\$8.26	Cost of HIRs
\$0.14	Cost of electricity (placeholder for now)
20.6	kWh savings/fixture
\$2.89	Electricity cost savings/yr
\$57.80	Electricity cost savings over 20 years
\$56.87	Net savings (not discounted)
7.08	Benefit/cost ratio (not discounted)

For scenario 2 -- plug-in CFL fixture

\$85	Cost of plug-in CFL fixture (preliminary ACEEE estimate)
\$3	Cost of lamps (CFLs) (ACEEE estimate)
1.12	Number of lamps/fixture (from above)
	Number of lamps over 20 year life (8000 hour life, 2.02 operating
<u>1.84</u>	hours/day)
\$91.19	Cost of fixture and CFLs
\$45	Cost of conventional fixture (preliminary ACEEE estimate)
\$1.50	Cost of avoided HIR (ACEEE estimate)
1.12	Number of lamps/fixture (from above)
	Number of lamps over 20 year life (3000 hour life, 2.02 operating
<u>4.92</u>	hours/day)
\$53.26	Cost of fixture and lamps
\$0.14	Cost of electricity (placeholder for now)
20.6	kWh savings/fixture
\$2.89	Electricity cost savings/yr
\$57.80	Electricity cost savings over 20 years
\$19.87	Net savings (not discounted)
1.52	Benefit/cost ratio (not discounted)

ACEEE, Jan. 28, 2008