Proposal Information Template for:

# General Purpose Lighting:
## Adopting the federal Tier 1 standards a year early

Submitted to:
California Energy Commission
In consideration for the 2008 Rulemaking Proceeding on Appliance Efficiency Regulations,
Docket number 07-AAER-3

Prepared for:
Pacific Gas and Electric Company

Pat Eilert
Gary Fernstrom
Ed Elliot


Prepared by:
Chris Calwell and Paul Sheldon, Ecos Consulting

Last Modified: April 3, 2008

This report was prepared by Pacific Gas and Electric Company and funded by the California utility customers under the auspices of the California Public Utilities Commission.

**Proposal Information– General Purpose Lighting**

*2008 Appliance Efficiency Standards*

**CONTENTS**



## 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 general purpose lighting.

## Overview

| | |
|---|---|
| Description of Standards Proposal | This brief report covers general purpose lighting options for CEC. Given that newly-adopted federal standards essentially pre-empt California's Title 20 authority to regulate most general service lighting technologies, this document reviews potential energy savings and economic analysis of adopting the federal Tier 1 standards a year early. |
| California Stock | PG&E, through its sub-contractor, Ecos, has estimated that California has 437 million light sockets in residential dwellings in 2007. |
| Energy Savings and Demand Reduction | Federal standards call for increasing the number of lumens produced by 100, 75, 60, and 40 W light bulbs in 2012, 2013, 2014, and 2014 respectively. Potential energy savings from early implementation of federal standards are between 2,142 and 2,522 GWh; with corresponding demand reduction between 61.14 and 78.71 MW as detailed in Table 1, below. |
| Economic Analysis | Relative costs to consumers are between $.80 and $1.25 per bulb, with a cost of saved energy between $0.026 and 0.045, as detailed below, in Table 1. The standard is cost effective for all lumen ranges in both the optimistic and pessimistic scenarios. The lifecycle benefit / cost ratio ranges from 2.2 to 3.9. |
| Non-Energy Benefits | Non-energy benefits are diverse and well-documented elsewhere, including reduced pollution, longer-life lighting technologies, and life cycle cost savings. |

| | |
|---|---|
| Environmental Impacts | Adoption of efficient lighting technologies generally has positive impacts on landfill volume, but also some complex issues surrounding the mercury in CFLs. The mercury impact is more than offset by the reductions in mercury emissions from coal-fired power plants, even at California's relatively low use of coal. However, these reductions are outside of California, whereas some increase in mercury due to adoption of CFLs will occur within California. PG&E's sub-contractor, Ecos, has completed analyses of both landfill and mercury impacts via separately-funded research through the California Lighting Technology Center, and is working with PG&E to provide additional analysis and commentary on related issues. |
| Acceptance Issues | Acceptance issues will likely include up-front price, potential consumer perceptions due to dimming resulting from manufacturers' offering of compliant bulbs at the lower ranges of each lumen bin. |
| AB 1109 (California Lighting Efficiency and Toxics Reduction Act) | Meeting AB1109 requirements for indoor, residential lighting will probably require 50% or higher market penetration by CFLs. This could possibly be accomplished by early-adoption of federal Tier 1 lighting standards, if consumer trends move purchasing and implementation beyond the standards. Federal Tier 2 standards will not be in place in time to affect AB1109 requirements, even if adopted early. Outdoor residential lighting and commercial lighting have not been addressed in this document. |
| Federal Pre-emption or other Regulatory or Legislative Considerations | Federal pre-emption largely eliminates California's ability to adopt more stringent standards for lighting. However, early adoption of the federal standards would achieve significant savings of electricity. |

**Methodology**
PG&E's sub-contractors Energy Solutions and Ecos analyzed the potential benefits to California of adopting the federal EISA Tier 1 standards a year early. The numbers shown in Figure 1 (next page) are for the residential lighting sector only.

**Assumptions:**

Base case wattages reflect impact of California Tier 2 standards and prevalence of non-compliant and modified spectrum bulbs

Standards wattages reflect impact of complying with federal Tier 1 standards one year early, but some lapses in compliance and continued sales of exempted lamp models

Standards wattages rise in pessimistic scenario primarily to reflect bin jumping

Lamp lifetimes go up in the pessimistic scenario, because dimmer lamps last longer

Incremental costs are rough estimates, reflecting present cost of CFL and Halogena products and longer lifetimes of the efficient models than conventional incandescents, reducing the need to purchase more lamps in the future.

Residential electricity costs based on CEC rate forecast for 2011-2014

Previous Ecos modeling for PG&E yielded the estimate of 25% market share for CFLs in California, divided by lumen bin based on mfr-reported data at the CEC

Unit % sales of incandescents in the future estimated from lumen bin shares remaining the same in optimistic scenario, but shifting toward brighter lamps in the pessimistic scenario

Absolute unit sales estimated at 11% of national sales previously estimated for EPA based on internal Ecos model of lighting manufacturing and imports

Demand reduction estimates based on 7% of lamps operating during peak periods.

Note that only the 4th lumen bin's savings would occur in 2011, only the 3rd bin's savings would occur in 2012, and the 1st and 2nd bins savings would occur in 2013 from accelerating federal standards by one year.

**Table 1. Lifetime Energy Savings from One Year's Worth of Light Bulb Sales**

| | **Optimistic Scenario (Minimal Dimming, Bin Jumping, and Sales of Excluded Products)** | | | | |
|---|---|---|---|---|---|
| Lumen Ranges | 310 to 749 | 750 to 1049 | 1050 to 1489 | 1490 to 2600 | TOTAL |
| Avg. Base Case Bulb Watts | 38.5 | 58 | 72 | 96.5 | 65.9 |
| Avg. Standards Bulb Watts | 30 | 44 | 55 | 74 | 50.3 |
| Net Wattage Savings per Bulb | 8.5 | 14 | 17 | 22.5 | 15.6 |
| Average Inc Lifetime (hours) | 2,500 | 2,500 | 2,000 | 2,000 | 2296 |
| Avg. Lifetime Kwh Savings per Bulb | 21.25 | 35 | 34 | 45 | 35 |
| Incremental Cost | $0.80 | $0.90 | $1.00 | $1.25 | $1.00 |
| Cost of Saved Energy ($/kWh) | $0.038 | $0.026 | $0.029 | $0.028 | $0.028 |
| Lifetime Cost Savings (@ $0.010/kWh) | $2.13 | $3.50 | $3.40 | $4.50 | $3.49 |
| Lifecycle Benefit / Cost ratio | 2.7 | 3.9 | 3.4 | 3.6 | 3.5 |
| Unit Sales % Incandescent (2007) | 9.7% | 34.4% | 16.3% | 14.2% | 75% |
| Unit Sales % Incandescent (2011-13) | 9.1% | 32.3% | 15.3% | 13.3% | 70% |
| Absolute Unit Sales (millions/yr) | 9.40 | 33.33 | 15.79 | 13.76 | 72.27 |
| Total Lifetime Gwh Savings | 200 | 1,166 | 537 | 619 | 2,522 |
| Total MW Demand Impact | 5.59 | 32.66 | 18.79 | 21.67 | 78.71 |

| | **Pessimistic Scenario (Extensive Dimming, Bin Jumping, and Sales of Excluded Products)** | | | | |
|---|---|---|---|---|---|
| Lumen Ranges | 310 to 749 | 750 to 1049 | 1050 to 1489 | 1490 to 2600 | TOTAL |
| Avg. Base Case Bulb Watts | 38.5 | 58 | 72 | 96.5 | 69.4 |
| Avg. Standards Bulb Watts | 32 | 48 | 60 | 79 | 57.3 |
| Net Wattage Savings per Bulb | 6.5 | 10 | 12 | 17.5 | 12.1 |
| Average Inc Lifetime (hours) | 2,750 | 2,750 | 2,250 | 2,250 | 2511 |
| Avg. Lifetime Kwh Savings per Bulb | 17.9 | 27.5 | 27.0 | 39.4 | 29.6 |
| Incremental Cost | $0.80 | $0.90 | $1.00 | $1.25 | $1.04 |
| Cost of Saved Energy ($/kWh) | $0.045 | $0.033 | $0.037 | $0.032 | $0.034 |
| Lifetime Cost Savings (@ $0.010/kWh) | $1.79 | $2.75 | $2.70 | $3.94 | $2.96 |
| Lifecycle Benefit / Cost ratio | 2.2 | 3.1 | 2.7 | 3.2 | 2.9 |
| Unit Sales % Incandescent (2007) | 9.7% | 34.4% | 16.3% | 14.2% | 75% |
| Unit Sales % Incandescent (2011-13) | 6.5% | 30.0% | 15.0% | 18.5% | 70% |
| Absolute Unit Sales (millions/yr) | 6.71 | 30.97 | 15.49 | 19.10 | 72.27 |
| Total Lifetime Gwh Savings | 120 | 852 | 418 | 752 | 2,142 |
| Total MW Demand Impact | 3.05 | 21.68 | 13.01 | 23.40 | 61.14 |

## Recommendations

1. Adopt federal Tier 1 standards to take effect one year early, in 2011.

## Bibliography and Other Research

http://energy.ca.gov/appliances/2008rulemaking/documents/2008-01-15_workshop/presentations/Calwell_Chris_Presentation.pdf