CALIFORNIA
ENERGY
COMMISSION

UPDATE OF APPLIANCE EFFICIENCY REGULATIONS

PRELIMANARY DRAFT STAFF REPORT

May 2004

PUBLICATION # 400-04-007

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1. Legislative Criteria

Section 25402 (c) of the Public Resources Code has, since 1975, required the California Energy Commission to adopt standards for the energy efficiency of appliances whose use, as determined by the Commission, requires a significant amount of energy on a statewide basis. New and upgraded standards must be feasible and attainable and must not "result in any added total costs to the consumer over the designed life of the appliance." The added total cost is obtained by comparing the cost and performance of a typical model that the consumer would be expected to purchase with the proposed upgraded or new standard in effect, to the cost and performance of a typical model that the consumer would be expected to purchase without the proposed upgraded or new standard in effect.

2. Draft Proposed Standards

The draft proposed standards consist of five parts.

a. New or upgraded standards are being proposed for twenty groups of appliances. This report shows that these groups are ones whose use requires a significant amount of energy on a statewide basis, and that the proposed standards are feasible, attainable, and cost effective.

b. New reporting requirements are proposed for four additional groups of appliances for which additional information would be useful to consumers and the general public, but for which there is not currently adequate information to justify new or upgraded standards. This report shows that these groups are ones whose use requires a significant amount of energy on a statewide basis.

c. Several changes are proposed for maintenance of the current regulations. These changes consist of revising California regulations to conform with federal regulations, updating of references to test methods, deletion of wording that has become obsolete, and changes to clarify wording or correct errors.

d. This report also discusses a petition related to traffic signals, for which staff recommends no changes to the regulations. Staff recommends that the Commission formally declare that it does not intend to change the regulations in response to the petition.

e. This report also discusses a petition related to commercial clothes washers, for which staff recommends no changes to the regulations. Staff recommends that the Commission formally declare that it does not intend to change the regulations in response to the petition.

3. Significant Energy Use on a Statewide Basis

As mentioned above, the Public Resources Code requires that the Commission adopt standards for those appliances whose use, as determined by the Commission, requires a significant amount of energy on a statewide basis. The term "significant energy use" does not apply to individual appliances but to categories of appliances.

The following are the staff estimates of the statewide energy use for each of the categories under consideration:

Category	**Statewide Annual Energy Use**	
Name	**Millions of kWh**	**Millions of Therms**
Commercial refrigerators and freezers with doors	1,072	
Commercial refrigerators and freezers without doors	2,700	
Walk-in refrigerators and freezers	2,000	
Refrigerated bottled and canned beverage vending machines	1,385	
Water Dispensers	158	
Large packaged air-cooled commercial air conditioners (240,000 – 760,000 Btu/hour)	3,348	
Evaporative coolers	479	
Ceiling fans	820	
Whole house fans	190	
Residential exhaust fans	253	
Portable room air cleaners	1,620	
Residential air handler fans	2,146	

Name	Millions of kWh	Millions of Therms
Unit heaters and duct furnaces		235*
Residential pool pumps	2,695	
Portable electric spas	1,100	
Dishwasher pre-rinse spray valves		141**
State-regulated general service incandescent lamps	6,483	
State-regulated incandescent reflector lamps	4,490	
Traffic signal modules for pedestrian control	56	
Luminaires for metal halide lamps	6,000	
Under-cabinet fluorescent luminaire ballasts	490	
Commercial hot food holding cabinets	120	
External power supplies	1,187	
Audio and video Equipment	2,593	

* Estimate of statewide energy use by unit heaters only. No estimate of statewide energy use by duct furnaces is available, but such energy use is very small compared to that of unit heaters.
** For the purpose of this estimate, all commercial water heating is assumed to be using natural gas.

Staff recommends that the Commission determine that the use of each of these 24 categories of appliances requires a "significant amount of energy on a statewide basis."

4. Feasible and Attainable Proposed Standards

Of the twenty-four appliance categories listed above, new or upgraded standards are proposed for all except evaporative coolers, ceiling fans, whole house fans, and residential exhaust fans. Background information for each of the twenty-four appliance types has been provided in a series of reports prepared for the Pacific Gas and Electric Company. The reports, which will be entered in the rulemaking docket, indicate that products meeting all of the proposed new or upgraded standards are attainable and available on the market today, and are thus, not only feasible and attainable on the projected effective date (of January 1, 2006 or later), but are feasible and attainable today.

5. Cost Effectiveness and Projected Statewide Savings

Sections 6 through 30 of this report include tables that demonstrate that each proposed standard is cost effective, and provides estimates of statewide energy savings. Appendix A provides a discussion of cost-effectiveness calculations.

6. <u>Commercial Refrigerators and Freezers with Doors</u>

- This category includes commercial packaged refrigerators and freezers having either solid (opaque) or transparent doors.
- There are approximately 117,000 solid door refrigerators, 72,000 solid door freezers, and 72,000 transparent door refrigerators in California.
- The approximate annual California sales of: solid door refrigerators - 12,960; solid door freezers – 8,010; and transparent door refrigerators – 8,460.
- The average per-unit annual baseline energy use of: solid door refrigerators – 2,923 kWh; solid door freezers – 6,069 kWh; and transparent door refrigerators – 4,083 kWh.
- There are a number of different standard levels being proposed, depending on the specific type of refrigerator or freezer, and which efficiency tier level (effective date) is considered. See Tables 1A and 1B below.
- The average per-unit annual energy savings for the new efficiency standards are: solid door refrigerators – 777 kWh; solid door freezers – 586 kWh; and transparent door refrigerators – 1,354 kWh; and transparent door freezers – 2,647.

Table 1A - Present Value of Energy Savings for Commercial Refrigerators and Freezers with Doors

Refrigeration Type	Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings $	Annual Sales (units)	First-Year Statewide Energy Savings (1st year) (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
Solid door refrigerator Tier 3*	9	777	87.80	13,000	5.6 million**	121	789.64
Solid door freezer Tier 3*	9	586	66.22	8,000	2.1 million**	147	539.79
Transparent door refrigerator Tier 3*	9	1,354	153.00	8,000	9.8 million	128	1,458.89
Transparent door freezer Tier 3*	9	2,647	299.00	1,760	3.8 million	138	2,964.28

* Tiers 1 and 2 were adopted in a previous rulemaking

** Statewide savings do not include the 18-55% of sales that already meet the proposed standards (percentage varies with equipment type)

Table 1B - Simple Payback for Commercial Refrigerators and Freezers with Doors (see endnote vii)

Refrigeration Type	Added First Cost per unit ($)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($) Based on .113/kWh	Design Life (years)	Simple Payback Period (years)
Solid door refrigerator Tier 3*	121	777	87.80	9	1.38
Solid door freezer Tier 3*	147	586	66.22	9	2.22
Transparent door refrigerator Tier 3*	128	1,354	153.00	9	0.84
Transparent door refrigerator Tier 3*	138	2,647	299.00	9	0.46

* Tiers 1 and 2 were adopted in a previous rulemaking

7. Commercial Refrigerators and Freezers Without Doors

Proposed standards for commercial refrigerators without doors (also termed “open case”) are divided into two groups; those designed for the display and sale of bottled or canned beverages, and those that are not designed for bottled or canned beverages. The former group serves an identical purpose as commercial refrigerators with transparent doors that are specifically designed for the display and sale of bottled or canned beverages. Staff therefore recommends that the same minimum performance standards be applied to both types of unit. The proposed standards for all other models of commercial refrigerators and freezers without doors are limited to provisions related to lighting efficiency.

- There are approximately 178,000 open case refrigerators and freezers in use throughout California.
- Approximately 17,800 open case refrigerators and freezers are sold each year in California.
- The average annual per-unit energy use of open case refrigerators and freezers is 15,000 kWh.
- The proposed standard for open case refrigerators and freezers is a high-efficiency lighting standard requiring the use of T-8 fluorescent lamps with electronic ballasts or a lighting system with equal or higher efficacy.
- The annual per-unit energy savings resulting from the proposed standard is 250 kWh.
- The statewide first-year energy savings resulting from the proposed standard is 222,500 kWh*

Table 2A - Present Value of Energy Savings for Commercial Refrigerators and Freezers without Doors

Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-Year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
10	250	28.75 @ $0.115/kWh	17,800	222,500*	36.40	224.10

*This first-year statewide energy savings assumes that 95% of the existing installed base already complies with the proposed standard.

Table 2B - Simple Payback for Commercial Refrigerators and Freezers without Doors (see endnote vii)

Added First Cost per unit ($)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
36.40	250	28.75 @ $0.115/kWh	10	1.26

8. Walk-In Refrigerators and Freezers

- Walk-in refrigerators and walk-in freezers are refrigerated spaces that can be walked into. Walk-ins can range from less than 50 square feet of floor space to several thousand square feet of floor space, with ceiling heights from 8 to thirty feet.
- There are approximately 100,000 walk-in refrigerators and freezers in California.
- Approximately 3,960 walk-in refrigerators and 2,040 walk-in freezers are sold in California each year.
- The average per-unit baseline energy use for walk-in refrigerators is 42,400 kWh per year for a 240 square foot structure, and for walk-in freezers it is 15,600 kWh per year for an 80 square foot structure.
- There are a number of design standards being proposed for walk-in refrigerators and walk-in freezers. These include:
    - automatic door closers;
    - triple-pane glass with reflective treated glass or gas fill for transparent doors;
    - anti-sweat heater controls for transparent doors;
    - envelope insulation of at least R-28 for refrigerators and R-36 for freezers;
    - electronically commutated evaporator fan motors or evaporator fan motors having the same or better efficiency as an electronically commutated fan motors, or evaporative fan controllers for shaded pole evaporator fan motors; and
    - ECM type motors or motors of equivalent efficiency for all self-contained compressor /condenser units that are dedicated to the walk-in cabinet.
- There is a potential per-unit annual savings of 13,377 kWh for walk-in refrigerators and 5,097 kWh for walk-in freezers.
- First-year statewide energy savings are 53 million kWh for walk-in refrigerators and 10.4 million kWh for walk-in freezers.

Table 3A - Present Value of Energy Savings for Walk-In Refrigerators and Freezers

Walk-In Type	Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-Year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
Refrigerators	10	13,377	1,538 @ $0.115/kWh	3,960	53 million	1,321	15,694.54
Freezers	10	5,097	586 @ $0.115/kWh	2,040	10.4 million	1,344	5,139.38

Table 3B - Simple Payback for Walk-In Refrigerators and Freezers(see endnote vii)

Walk-In Type	Added First Cost per unit ($)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
Refrigerator	1,321	13,377	1,538 @ $0.115/kWh	10	0.9 year
Freezer	1,344	5,097	586 @ $0.115/kWh	10	2.3 years

9. Refrigerated Bottled and Canned Beverage Vending Machines

- Refrigerated beverage vending machines are self-contained appliances with a refrigerated compartment designed to hold and dispense canned or bottled beverages upon payment.
- There are approximately 450,000 beverage vending machines in service in California.
- Approximately 37,500 beverage vending machines are sold annually in California.
- The average per-unit energy use of beverage vending machines is 3,077 kWh per year.
- The proposed standard for beverage vending machines allows a maximum daily energy consumption of 0.005*C + 4.76, where C = the rated capacity of 12 ounce cans.
- There is a potential annual per-unit energy savings of 308 kWh.
- First-year statewide energy savings are 12.6 million kWh.

Table 4A - Present Value of Energy Savings for Refrigerated Canned and Bottled Beverage Vending Machines

Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
10	308	35.42 @ $0.115/kWh	41,000	12.6 million	56	335.78

Table 4B - Simple Payback for Refrigerated Canned and Bottled Beverage Vending Machines (see endnote vii)

Added First Cost per unit $	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
56	308	35.42 @ $0.115/kWh	10	1.6 years

10. Automatic Commercial Ice Makers

- This type of equipment typically consists of a case, insulation, a refrigeration system, and a water supply. Some models also include an ice storage bin, although most systems are installed on top of a separate insulated ice storage bin.
- There are approximately 173,000 commercial ice makers in service throughout California.
- Approximately 23,000 commercial ice makers are sold in California each year.
- The average annual per-unit energy consumption of commercial ice makers is 4,374 kWh.
- The proposed standards for this equipment include both maximum energy use in kWh/100 pounds of ice and maximum water consumption for water-cooled ice makers in gallons per 100 pounds of ice.
- The estimated annual per-unit reduction of energy use ranges from 142 kWh to 1,714 kWh, depending on the equipment type.
- The total statewide first-year energy savings resulting from the proposed standards is 6.6 million kWh.

Table 5A - Present Value of Energy Savings for Commercial Ice Makers

Unit Type	Harvest Rate (100 lbs ice/24 hours)	Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)	Increment-al Cost of Improve-ment per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
Ice-making head, water cooled	<500	8.5	316	36.34 @ 0.115/kWh	7,867	5.2 million	58	279.49
	>=500	8.5	1,606	184.69 @ 0.115/kWh			104	1,611.21
Ice-making head, air cooled	<450	8.5	349	40.14 @ 0.115/kWh			57	315.73
	>=450	8.5	598	68.77 @ 0.115/kWh			102	536.66
Remote-condensing, air cooled	<1000	8.5	552	63.48 @ 0.115/kWh			76	513.54
	>=1000	8.5	1,714	197.11 @ 0.115/kWh			124	1,706.55
Self-contained, water cooled	<200	8.5	152	17.48 @ 0.115/kWh	12,486	1.4 million	61	101.34
	>=200	8.5	156	17.94 @ 0.115/kWh			72	94.61
Self-contained, air cooled	<175	8.5	142	16.33 @ 0.115/kWh			61	90.66
	>=175	8.5	145	16.68 @ 0.115/kWh			72	82.86

H= harvest rate in 100 lbs of ice per 24 hours

* = In addition, the maximum water use (gallons per 100 lbs of ice) shall be 200-0.022H or less.

** =In addition, the maximum water use (gallons per 100 lbs. ice) shall be 191-0.0315H or less.

Table 5B - Simple Payback for Commercial Ice Makers (see endnote vii)

Unit Type	Added First Cost per unit ($)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
Ice-making head, water cooled <500	58	316	36.34 @ 0.115/kWh	8.5	1.6 years
Ice-making head, water cooled >=500	104	1,606	184.69 @ 0.115/kWh	8.5	0.6 year
Ice-making head, air cooled <450	57	349	40.14 @ 0.115/kWh	8.5	1.4 years
Ice-making head, air cooled >=450	102	598	68.77 @ 0.115/kWh	8.5	1.5 years
Remote-condensing, air cooled <1000	76	552	63.48 @ 0.115/kWh	8.5	1.2 years
Remote-condensing, air cooled >=1000	124	1,714	197.11 @ 0.115/kWh	8.5	0.6 years
Self-contained, water cooled <200	61	152	17.48 @ 0.115/kWh	8.5	3.5 years
Self-contained, water cooled >=200	72	156	17.94 @ 0.115/kWh	8.5	4.0 years
Self-contained, air cooled <175	61	142	16.33 @ 0.115/kWh	8.5	3.7 years
Self-contained, air cooled >=175	72	145	16.68 @ 0.115/kWh	8.5	4.3 years

11. Water Dispensers

- This category of appliance includes both bottle-type and point-of-use water dispensers that are freestanding and dispense both hot and cold water.
- There are approximately 184,800 water dispensers in California.
- The annual sales of water dispensers in California are approximately 23,100.
- The average daily energy consumption of water dispensers is 2.3 kWh.
- The proposed standard is a maximum daily standby loss of 1.2 kWh.
- The proposed standby loss standard would result in a per-unit savings of 266 kWh annually.
- First-year statewide savings are 6.1 million kWh.

Table 6A - Present Value of Energy Savings for Water Dispensers

Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-Year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
8	266	30.6 @ $0.115/kWh	23,100	6.1 million	12	272.09

Table 6B - Simple Payback for Water Dispensers (see endnote vii)

Added First Cost per unit ($)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
12	266	30.6 @ $0.115/kWh	8	0.4 years

12. Large Packaged Air-cooled Commercial Air Conditioners (240,000 – 760,000 Btu/hour)

- This equipment includes commercial air-cooled air conditioners with cooling capacities between 240,000 Btu/hour and 760,000 Btu/hour, which contain all components within a single unit.
- There are approximately 54,000 large packaged air-cooled commercial air conditioners in California.
- The annual sales of this category of equipment are approximately 3,600 units.

- The average annual baseline energy use of this equipment is 62,000 kWh per unit.
- The proposed two-tiered standard for this category of equipment is a minimum EER of 10.0 for the first tier and 10.5 EER for the second tier.
- The per-unit reduction of energy use relative to the base-case for the proposed standards is 3,742 kWh for the tier 1 standard and 6,533 for the tier 2 standards.
- The statewide first-year savings resulting from the tier 1 standard is 13.5 million kWh and the first-year savings resulting from the tier 2 standard is 23.5 million kWh (e.g., Tier 2 saves 10.0 million kWh per year in addition to Tier 1 savings).

Table 7A - Present Value of Energy Savings for Large Packaged AC

Proposed Standard	Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-Year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
Tier 1 10.0 EER	15	3,742	430.3 @ $0.115/kWh	3,600	13.5 million	504	4,798.41
Tier 2 10.5 EER	15	6,533	751.3 @ $0.115/kWh	3,600	23.5 million	924	8,333.26

Table 7B - Simple Payback for Large Packaged AC (see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
Tier 1 $504	3,742	430.3 @ $0.115/kWh	15	1.2 years
Tier 2 $924	6,533	751.3 @ $0.115/kWh	15	1.2 years

13. Evaporative Coolers

- This equipment uses the process of introducing moisture into a non-saturated air stream as a means of cooling, combining a fan, water supply, controls, and an evaporative media through which air travels to deliver moist cooler air. The scope of this product excludes portable spot evaporative coolers.

- There are approximately 1 million evaporative coolers in use in California.
- Approximately 100,000 evaporative coolers are sold each year in California.
- The average baseline energy use for evaporative coolers is 479 kWh per year.
- No minimum efficiency level is being proposed for evaporative coolers at this time. The standards propose the testing and certification of this equipment to the Commission.

14. Ceiling Fans

- Ceiling fans are non-oscillating (fixed-axis) fans suspended from the ceiling, which are used to circulate air through the rotation of fan blades. Ceiling fans may or may not include a light kit.
- There are an estimated 10.8 million ceiling fans in service statewide.
- Annual sales of ceiling fans are estimated to be 42,000 in California.
- The average annual per-unit power consumption of ceiling fans in California is 76 kWh.
- No minimum efficiency level is being proposed for ceiling fans at this time. The standards propose the testing and certification of this equipment to the Commission.

15. Whole House Fans

- Whole house fans are high air volume exhaust fans mounted in the ceiling of a residence for the purpose of providing ventilation and cooling.
- There are approximately 680,000 whole house fans in service throughout California.
- Approximately 68,000 whole house fans are sold in California each year.
- Average annual per-unit energy use is 280 kWh.
- No minimum efficiency level is being proposed for whole house fans at this time. The standards propose the testing and certification of this equipment to the Commission.

16. Residential Exhaust Fans

- Residential exhaust fans are permanently installed in bathrooms, kitchens, and utility rooms, either in the ceiling or wall. Their intended purpose is to remove moisture, odors, cooking fumes, and other objectionable air from the inside of a home to the outside.
- There are approximately 10.3 million residential exhaust fans in service throughout California.

- Approximately 1.1 million residential exhaust fans are sold in California each year.
- The annual per-unit energy consumption for residential exhaust fans ranges from 15 kWh to 416 kWh, depending on duty cycle and CFM rating of the fan.
- No minimum efficiency level is being proposed for residential exhaust fans at this time. The standards propose the testing and certification of this equipment to the Commission.

17. Portable Room Air Cleaners

- Portable room air cleaners are plug-in, portable units designed to clean the air in a space through filtration.
- There are approximately 2.7 million portable room air cleaners in service throughout California.
- Approximately 250,000 portable room air cleaners are sold in California each year.
- The average annual energy consumption of portable room air cleaners is 600 kWh per year.
- The proposed standard is a minimum efficiency level of 2.5 CADR (Clean Air Delivery Rate) per Watt of energy consumption.
- The annual per-unit savings based on the proposed standard is 95 kWh.
- The statewide first-year savings resulting from the proposed standard would be 17.25 million kWh.
- As no correlation was found between the unit cost and efficiency of 20 portable room air cleaners on the market, we have determined that there is no significant increase in cost for energy efficient models.

Table 8A - Present Value of Energy Savings for Portable Room Air Cleaners

Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
8.5	69	10.93 @ $0.115/kWh	250,000	17.25 million	0	79.14

Table 8B - Simple Payback for Portable Room Air Cleaners (see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
0	69	10.93 @ $0.115/kWh	8.5	N/A

18. Residential Air Handler Fans

- Residential air handler fans are provided for both central cooling and heating systems. They are composed of a cabinet enclosing a fan motor, blower assembly, and controls.
- There are approximately 7.4 million air handler fans in service throughout California.
- Approximately 350,000 air handler fans are sold in California each year.
- The average annual per-unit energy use for air handler fans is 290 kWh.
- The proposed efficiency requirements for residential air handler fans are based on maximum fan energy ratios.
- The average annual per-unit energy saving based on the proposed standard levels is 160 kWh.
- The first-year statewide energy savings resulting from the proposed standard levels is 56 million kWh.

Table 9A - Present Value of Energy Savings for Residential Air Handler Fans

Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-Year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
20	160	18.40	350,000	56 million	133	131.00

Table 9B - Simple Payback for Residential Air Handler Fans (see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
$133	160	18.40	20	7.2 years

19. Unit Heaters and Duct Furnaces

- Unit heaters and duct furnaces are both non-ducted space heaters, but duct furnaces do not have an integral fan or blower as unit heaters typically do.
- There are approximately 840,000 unit heaters and duct furnaces in California.
- Approximately 42,000 unit heaters and duct furnaces are sold throughout California each year.
- The average annual energy use for unit heaters and duct furnaces is 1,056 therms per unit per year.
- The proposed standards for unit heaters and duct furnaces is a design standard to include either a power vent or automatic flue damper.
- Approximately 190 therms per unit per year will be saved through the proposed design standard.
- The first-year statewide energy savings resulting from the proposed design standard are approximately 8 million therms.

Table 10A - Present Value of Energy Savings for Unit Heaters and Duct Furnaces

Design Life (years)	Annual Unit Energy Savings (therms)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (therms)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
15	190	104.50 @ $0.55/therm	42,000	8 million	550	1,074.69

Table 10B - Simple Payback for Unit Heaters and Duct Furnaces (see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (therms)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
$550	190	104.50 @ $0.55/therm	15	5.3 years

20. Residential Pool Pumps

- Residential pool pumps are pump and motor combinations that are used to circulate and assist in the filtration of swimming pool water.
- There are approximately 1.1 million residential pool pumps in service throughout California.
- Approximately 143,000 residential pool pumps are sold in California annually.
- The average annual residential pool pump energy consumption is 2,450 kWh.
- Design standards are being proposed for residential pool pumps, including the limiting of pool pump motor's service factor (a multiplier which, when applied to the rated horsepower, indicates a permissible horsepower loading which may be carried); requiring two-speed motors; and requiring that pool pump motor controls are capable of controlling two-speed pool pump motors.
- The estimated annual per-unit energy savings resulting from the proposed design standards is 931 kWh.
- The statewide first-year energy savings resulting from the proposed design standards is 133 million kWh.

Table 11A - Present Value of Energy Savings for Residential Pool Pumps

Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-Year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
10	931	107 @ $0.115/kWh	143,000	133 million	579	346.41

Table 11B - Simple Payback for Residential Pool Pumps (see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
$579	931	107 @ $0.115/kWh	10	5.4 years

21. Portable Electric Spas

- Portable electric spas are pre-fabricated, self-contained units that are electrically heated.
- There are approximately 440,000 portable electric spas in service throughout California.
- Approximately 48,000 portable electric spas are sold in California each year.
- The average annual per-unit energy consumption of portable electric spas is 2,500 kWh.
- The proposed standard is a maximum standby loss.
- The average annual per-unit energy savings gained through the proposed standard is 500 kWh.
- The statewide first-year energy savings resulting from this standard is 24 million kWh.

Table 12A - Present Value of Energy Savings for Portable Electric Spas

Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
10	500	57.50 @ $0.115/kWh	48,000	24 million	300	197.00

Table 12B - Simple Payback for Portable Electric Spas (see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
$300	500	57.50 @ $0.115/kWh	10	5.2 years

22. Dishwasher Pre-Rinse Spray Valves

- Commercial pre-rinse spray valves are mechanical valves installed over a sink that dispense hot water under pressure to clean food items off of plates and other kitchen items prior to being placed in the dishwasher.

- There are approximately 90,000 pre-rinse spray valves in use in food service establishments throughout California, where each spray valve results in the use of 1,566 therms of gas for water heating each year.
- Annual statewide sales of pre-rinse spray are around 18,000 units.
- The average baseline water usage for pre-rinse spray valves is 3.15 gallons-per-minute (gpm) at 60 psi of water pressure. The proposed efficiency standard would reduce the flow rate of these valves to a maximum of 1.6 gpm, while also requiring the valve to pass a cleanability test. This water efficiency standard will result in an annual water savings of 143,748 gallons per unit.
- This reduction in water use will result in reduced water heating requirements and an energy savings of 820 therms per valve per year.
- The statewide first-year energy savings resulting from this standard is 14.8 million therms.

Table 13A - Present Value of Energy Savings for Dishwasher Pre-Rinse Valves

Design Life (years)	Annual unit Energy Savings (therms)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (therms)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
5	820	$541 (based on $0.67/therm)	18,000	14.8 million	5	2,815.80

Table 13B - Simple Payback for Dishwasher Pre-Rinse Valves (see endnote vii)

Added First Cost per unit	Annual Unit Reduction in Energy Use	Annual Unit Reduction in Water Use	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
$5	820 therms	143,748 gallons	$541 (based on $0.67/therm)	5	< 1 month

23. State Regulated General Service Incandescent Lamps

- The general service incandescent lamps covered by the proposed standard include those that are non-reflector, medium screw based incandescent lamps intended for general ambient lighting. The wattage range for the proposed standard is from 25 Watts to 150 Watts.

- There are approximately 100 million general service incandescent lamps covered by the proposed standard in service throughout California.
- Approximately 74 million lamps covered by the proposed standards are sold each year in California.
- The average annual per-unit energy consumption is 60 kWh.
- The proposed two-tiered efficiency standards, which limit the power use based on lamp type, apply to three categories of general service incandescent lamps.
- The average annual per-unit energy reduction resulting from tier-1 standards would be 2.2 kWh. The average annual per-unit energy reduction resulting from tier-2 standards would be 6 kWh.
- The statewide first-year energy savings resulting from the tier-1 standards would be 163 million kWh. The statewide first-year energy savings resulting from the tier-2 standards would be 444 million kWh.

Table 14A - Present Value of Energy Savings for General Service Incandescent Lamps

Proposed Standard	Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
Tier 1	1	2.2	0.25 @ $0.115/kWh	74 million	163 million	0	0.25
Tier 2	1	6.0	0.69 @ $0.115/kWh	74 million	444 million	0.50	0.19

Table 14B - Simple Payback for General Service Incandescent Lamps(see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
Tier 1 $0	2.2	0.25 @ $0.115/kWh	1	N/A
Tier 2 $0.50	6	0.69 @ $0.115/kWh	1	0.7 years

24. State Regulated Incandescent Reflector Lamps

- This category of lamp is designed to direct light in an arc that measures less than 180 degrees. These lamps are commonly used as “downlights” in recessed lighting fixtures and in other applications where light is required to be aimed in a particular direction.
- There are approximately 40 million incandescent reflector lamps in service throughout California.
- The annual sales of incandescent reflector lamps in California are approximately 18.9 million (10.1 million for the residential sector, 18.8 million for the commercial sector).
- The annual per-unit energy use for incandescent reflector lamps used in the residential sector is approximately 61 kWh. In the commercial sector, the annual per-unit energy use is approximately 266 kWh.
- The proposed standards require minimum efficacy levels for different lamp wattage ranges.
- The proposed standards will result in an annual per-unit energy savings of 11 kWh for lamps used in the residential sector and 47.8 kWh for lamps used in the commercial sector.
- Statewide first-year energy savings will be 81 million kWh for the residential sector and 158 kWh for the commercial sector.

Table 15A - Present Value of Energy Savings for Incandescent Reflector Lamps

End Use	Design Life (years)*	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)**	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
Residen-tial	3.4	11.0	1.27 @ $.115/kWh	10.1 million	81 million	2.36	1.57
Comme-rcial	0.8	47.8	5.50 @ $.115/kWh	8.8 million	158 million	3.15	2.35

* = Based on an average lamp life of 2,864 hours

** = Statewide energy savings do not include current sales that already meet the proposed standards.

Table 15B - Simple Payback for Incandescent Reflector Lamps (see endnote vii)

End Use	Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
Residential	$2.36	11.0	1.27 @ $.115/kWh	3.4	1.9 years
Commercial	$3.15	47.8	5.50 @ $.115/kWh	0.8	0.6 year

Note: In addition to energy savings, the more efficacious lamps typically have longer lives, reducing relamping costs, particularly for commercial customers where changing bulbs usually involves labor costs. This chart only shows savings and the resulting payback period resulting from energy savings.

25. Traffic Signals for Pedestrians

- Pedestrian traffic signals are internally illuminated units used to give instructions to pedestrians at intersections. These signals include a red “hand” symbol to indicate that the pedestrian should not enter the intersection and a white “walking person” symbol to indicate to the pedestrian that it is safe to cross the intersection. These two symbols are usually combined into a single housing.
- California has approximately 150,000 pedestrian signals within the state.
- Approximately 30,000 non-LED pedestrian signals are replaced throughout California each year.
- The baseline energy use for incandescent pedestrian signals is 544 kWh per unit per year. The baseline energy use for LED pedestrian signals is 78.8 kWh per unit per year.
- The proposed standards would restrict the energy consumption of the “hand” symbol to a maximum of 10 Watts at 25^o C and 12 Watts at 74^o C and the energy consumption of the “walking person” symbol to a maximum of 9 Watts at 25^o C and 12 Watts at 74^o C.
- The proposed standards reduce the per-unit energy consumption from 69 Watts for incandescent lamps to 10 Watts for LED modules. This results in an annual per-unit savings of 465 kWh.
- The statewide first-year energy savings based on the proposed standard are 14 million kWh.

Table 16A - Present Value of Energy Savings for Traffic Signals for Pedestrians

Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
7	465	53	30,000	14 million	$110 ($95 parts & $15 labor)	252.24

Table 16B - Simple Payback for Traffic Signals for Pedestrians (see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
$110 ($95 parts & $15 labor)	465	53	7	2.1

26. Luminaires for Metal Halide Lamps

- The luminaires for metal halide lamps contain a ballast that is designed to provide the required starting voltage and to regulate the starting and operating current for proper metal halide lamp operation. These ballasts may be either probe-start or pulse-start.
- There are approximately 3.1 million metal halide luminaries in California.
- Approximately 363,000 metal halide luminaires are sold each year in California.
- The average annual per-unit energy consumption for metal halide luminaries is 2,015 kWh.
- The proposed standards contain a design standard requiring the use of a pulse-start ballast and a minimum ballast system efficiency.
- Relative to the base-case of a probe-start lamp and magnetic ballast, the proposed standards requirement for pulse-start ballasts would reduce energy consumption by 307 kWh per unit. The proposed standards requirement for minimum ballast system efficiency would further reduce energy consumption by 219 kWh, resulting in a total savings of 526 kWh.
- First-year savings are approximately 61 million kWh for vertical-position pulse-start and an additional 76 million kWh for electronic ballasts and other orientation luminaires (for a total annual savings of 137 million for pulse-start lamps and electronic ballasts.

Table 17A - Present Value of Energy Savings for Luminaires for Metal Halide Lamps

Proposed Standard	Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
Tier 1 – Pulse-start MH Ballast (vertical orientation)	13	307	35.31 @ $0.115/kWh	248,000	76 million	30	446.16
Tier 2 – Minimum Ballast System Efficiency and Pulse-Start for Other Fixtures (all orientations)	13	219	25.19 @ $0.115/kWh	335,000	73 million	30	309.67
Tiers 1 & 2 Total	13	526	60.49 @ $0.115/kWh	583,000	149 million	60	755.83

Table 17B - Simple Payback for Luminaires for Metal Halide Lamps (see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
Tier 1 $30	307	35.31 @ $0.115/kWh	20	0.85 years
Tier 2 $30	219	25.19 @ $0.115/kWh	20	1.19 years
Tier 1 + Tier 2 $60	526	60.49 @ $0.115/kWh	20	1 year

27. Under-Cabinet Fluorescent Lamp Luminaires

- This category of luminaire typically consists of T-12 type fluorescent task lighting included with modular office furniture.
- There are approximately 5.3 million under-cabinet luminaires in California that could be affected by the proposed standards.
- Approximately 240,000 under-cabinet luminaires are sold throughout California each year.
- The typical T12 magnetic ballast-based under-cabinet luminaire uses 86 kWh per year, and the typical T8 magnetic ballast-based under-cabinet luminaire uses 70 kWh per year. A majority of the affected under-cabinet lighting (86%) is comprised of T12 with magnetic ballasts.
- A minimum ballast efficacy is proposed for single and two-lamp under-cabinet luminaires.
- The proposed standards will save an average of 16 kWh per unit annually.
- The statewide first-year energy savings are 760,000 kWh.

Table 18A - Present Value of Energy Savings for Under-Cabinet Fluorescent Lamp Luminaires

Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
15	16	1.84 @ $0.115/kWh	240,000	760,000	5	22.58

Table 18B - Simple Payback for Under-Cabinet Fluorescent Lamp Luminaires (see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
$5	16	1.84 @ $0.115/kWh	15	2.7 years

28. Commercial Hot Food Holding Cabinets

- Commercial hot food holding cabinets are used in the commercial foodservice industry primarily for keeping food at the correct serving temperature, without drying it out or further cooking it. These are electrically-powered, freestanding, metal cabinets with internal supports for holding food trays.

- Approximately 50,000 hot food holding cabinets are in service throughout California.
- Approximately 3,300 hot food holding cabinets are sold in California each year.
- The average annual per-unit energy use of hot food holding cabinets is 2,402 kWh.
- The proposed standard is a maximum standby energy consumption of 42 Watts per cubic foot of measured interior volume.
- The average per-unit energy savings resulting from the proposed standards is 454 kWh.
- The statewide first-year energy savings resulting from the proposed standards is 1.5 million kWh.

Table 19A - Present Value of Energy Savings for Commercial Hot Food Holding Cabinets

Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
15	454	52.21 @ $0.115/kWh	3,300	1.5 million	453	329.70

Table 19B - Simple Payback for Commercial Hot Food Holding Cabinets (see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
$453	454	52.21 @ $0.115/kWh	15	8.7 years

29. External Power Supplies

- External power supplies convert alternating current at line voltage to low-voltage direct current within an enclosure external to the direct current-using product itself. The main types of external power supplies are termed linear power supplies (which use transformers) and switching power supplies (which use solid-state electronics). Switching power supplies are inherently more efficient than linear power supplies.
- We estimate that there are approximately 100 million external power supplies in service throughout California.

- Approximately 9.9 million linear and 11.4 switching external power supplies are sold each year throughout California.
- The statewide energy use of this product is 1.2 million kWh.
- The proposed efficiency standards apply to both the active mode and the no-load mode of external power supplies.
- The annual reduction in per-unit energy use based on the proposed standards is approximately 8.93 kWh for the tier 1 efficiency requirements and 9.77 kWh for the tier 2 efficiency requirements.
- The first-year statewide energy savings are 88.4 million kWh for the Tier 1 standards and 96.7 million kWh for the Tier 2 standards.

Table 20A - Present Value of Energy Savings for External Power Supplies

Proposed Standard	Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
Tier 1	7	8.93	1.03 @ $0.115/kWh	9.9 million	88.4 million	0.54	6.13
Tier 2	7	9.77	1.12 @ $0.115/kWh	9.9 million	96.7 million	0.90	6.40

Table 20B - Simple Payback for External Power Supplies (see endnote vii)

Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
Tier 1 - $0.54	8.93	1.03 @ $0.115/kWh	7	0.52 year
Tier 2 - $0.90	9.77	1.12 @ $0.115/kWh	7	0.80 year

30. Audio and Video Consumer Electronics

- This equipment includes compact audio systems, televisions, and DVD consumer electronics that use an internal power supply.
- There are an estimated 7.8 million compact audio systems, 21.8 million televisions, and 3 million DVD players in use throughout California.
- The approximate annual sales in California are 1.1 million compact audio systems, 2.5 million televisions, and 1.5 million DVD players.

- The average annual per-unit standby energy use is 64.4 kWh for compact audio systems, 97.5 kWh for televisions, and 26.5 kWh for DVD players.
- The proposed standards are maximum allowed standby energy use for compact audio systems, televisions, and DVD players.
- The estimated average annual per-unit reduction in energy is 51 kWh for compact audio systems, 27 kWh for televisions, and 8 kWh for DVD players.
- The first-year statewide energy savings is 56.1 million kWh for compact audio systems, 67.5 million kWh for televisions, and 12 million kWh for DVD players.

Table 21A - Present Value of Energy Savings for Audio and Video Consumer Electronics

Proposed Standard	Design Life (years)	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Annual Sales (units)	First-year Statewide Energy Savings (kWh)	Incremental Cost of Improvement per unit ($)	Reduced Total Cost over the Design Life of the Appliance ($)
Compact audio 2 Watt max. standby	5	51	5.87 @ 0.115/kWh	1.1 million	56.1 million	1	27.71
Televisions 3 Watt max. standby	7	27	3.11 @ 0.115/kWh	2.5 million	67.5 million	3	17.17
DVD players 3 Watt max. standby	5	8	0.92 @ 0.115/kWh	1.5 million	12 million	1	3.50

Table 21B - Simple Payback for Audio and Video Consumer Electronics (see endnote vii)

Appliance Type	Added First Cost per unit	Annual Unit Energy Savings (kWh)	Annual Unit Energy Cost Savings ($)	Design Life (years)	Simple Payback Period
Compact Audio	$1	51	5.87 @ 0.115/kWh	5	0.2 year
Television	$3	27	3.11 @ 0.115/kWh	7	1 year
DVD Player	$1	8	0.92 @ 0.115/kWh	5	1 year

31. Traffic Signal Petition

The Commission received a petition related to the current standards for traffic signals from Mr. Nathaniel S. Behura, and included it in the Order Instituting Rulemaking adopted on June 25, 2003. On August 25, 2003, Robert Pernell, at that time Commissioner and Presiding Member of the Efficiency Committee, wrote to Mr. Behura indicating the preliminary conclusions of the Efficiency Committee and attaching the August 18, 2003 draft of the *Staff Report on Petition from Nathaniel Behura, representing the Southern California Section of the Institute of Transportation Engineers.* This staff report recommends no change to the standards to respond to Mr. Behura's petition.

The situation has not changed since the August 25 letter to Mr. Behura. Staff recommends that the Commission take formal action to declare that it makes no change to the standards in response to Mr. Behura's petition.

32. Commercial Clothes Washer Petition

In February 2002, the Commission adopted standards for commercial clothes washers. The standards consist of an energy factor standard that takes effect on January 1, 2005, and a water factor standard that takes effect on January 1, 2007.

On February 6, 2004, Governmental Advocates, Inc., on behalf of the Commercial Multi-Housing Laundry Association (CMLA), filed a petition to repeal these regulations.

In the petition, CMLA made the following four assertions:

1. *The standards are not technically feasible.*

2. *The standards will lead to an increase in costs to consumers in master-metered multi-unit dwellings such as apartment houses and dormitories.*

3. *The standards will disadvantage California-based retailers of commercial washers, to the benefit of out-of-state retailers of commercial clothes washers.*

4. *Appliance manufacturers have yet to build an effective commercial top-load washer, or an economically viable front-load washer, that meets the energy factor standard.*

The staff recommends that the Commission make no changes to the standards, for the following reasons:

1. *The standards are technically feasible.* The standards require a minimum "modified energy factor" (MEF) of 1.26 effective January 1, 2005 and a maximum "water factor" (WF) of 9.5 effective January 1, 2007. The Consortium for Energy Efficiency (CEE), which operates a high-efficiency commercial clothes washer incentive program, currently lists 187 different models that all meet both the energy factor and water factor standards.

2. *The standards are cost-effective in master-metered multi-unit dwellings.* In master-metered multi-unit dwellings, there is one electricity (or natural gas) meter for the entire building, and the building owner pays the energy bill. Where the building owner also pays for laundry equipment, the owner will obtain the economic savings that result from the greater efficiency required by the standards. Where laundry equipment is owned and maintained by a third-party laundry service under a contract with the building owner, the increased cost of the laundry equipment will be passed on to the building owner as an increased charge for the "value added" to the laundry service, and the energy bill savings will exceed this incremental cost.

3. *The standards will not disadvantage California retailers to any significant degree.* Because the standards apply to the sale or offering for sale of appliances in California, even an out-of-state retailer is prohibited from selling a non-conforming model to a buyer in California. Although there still remains the theoretical possibility that Californians could go out-of-state to purchase appliances,

there is no evidence that this has happened for any of the many appliances for which the Commission sets standards.

4. *There are effective top-load washers and economically viable front-load washers that meet the energy factor standard.*

As noted above, there are 187 models currently listed by CEE that meet both the energy standard and the factor standard; therefore, there are even more that meet the modified energy factor standard. Some of these are top-loading and some are front-loading. All are "effective" at cleaning clothes. In the 2004 rulemaking, it was demonstrated that these were cost effective. The petitioner submitted no evidence on changed circumstances or evidence that any are not "economically viable."

5. *To change the energy factor standard so close to the effective date would be unfair to the manufacturers that have been preparing to meet the standard.* The energy factor standard take effects on January 1, 2005. To change the standard at this late date would punish the manufacturers that have been preparing to meet the standards by redesigning products and investing in new production equipment, which often involves considerable expense, while rewarding those who have delayed. That result would be bad public policy.

33. Maintaining the Regulations

Upgrading Air-Cooled Air Conditioner and Heat Pump Standards.

- In 2002, the Commission upgraded all of its standards for central air conditioners. Wherever federal standards had been adopted, the Commission adopted standards for California that were identical to the federal standards. The federal standards for single-phase air-cooled air conditioners and single-phase air-source heat pumps with cooling capacities less than 65,000 Btu per hour changed in 2004 as the result of court action. The SEER and HSPF standards in Section 1605.1, Table C-2 are changed accordingly. The HSPF standards in Section 1605.2, Table C-6 are similarly updated.

Correcting Computer Room Air Conditioner Standards.

- In 2002, the Commission upgraded all of its standards for central air-conditioners. Most of the standards for central air conditioners were copied directly from federal standards and were based on a federally mandated test method. Air conditioners designed expressly for cooling computer rooms are tested at different ambient temperatures from the more conventional units and thus the energy efficiency ratio (EER) standards are different. Research has shown that when a computer room air conditioner is tested using the test method expressly intended for such equipment the EER values are from 0.6 to 1.0 lower, depending on the type of system. Staff used this relationship to calculate values for Tables C-9 and C-10. Unfortunately an editorial error was made in the first line of the fifth column of Table C-10 where a standard of 11.1 was incorrectly shown as 11.7. This error is corrected in the current rulemaking.

Appendix A

Discussion Of Cost-Effectiveness Calculations

The law states that the Commission's appliance standards may not "result in any added total costs to the consumer over the design life of the appliance." (Public Resources Code section 25402(c)(1).) This means that over the life of an appliance, consumers must be better off monetarily (or at least no worse off) if the appliance is subject to the applicable standard than they would be if the appliance were not subject to the standard. This concept is also referred to as "cost-effectiveness."

There are two basic ways in which consumers are affected financially by a new appliance standard. First, consumers (usually) must pay more for a more efficient appliance, because what typically makes the appliance more efficient are additional materials, parts, or research and development, all of which tend to cost more money. Second, consumers save money because they pay less in energy costs to run the appliance. (There may be other costs or savings, such as in maintenance costs, but those tend not to be effected by changes in efficiency.) A proposed standard is cost-effective if the cost savings resulting from the standard would equal or exceed the additional costs resulting from the standard, over the "design life" of the appliance. In most cases, the design life of the appliance is not changed by the standard. The formula that follows assumes that this is the case.

The Commission evaluates cost-effectiveness by comparing the present values of costs and benefits. Following is the generalized equation showing how this comparison is made. (see endnote i,ii)

Added (Reduced) Total Costs over the Design Life of the Appliance	= Added First Cost	- Present value of electricity cost savings	- Present value of gas cost savings	+ Present value of added maintenance cost (if any)	- Present value of reduced maintenance cost (if any)

Some appliances use both gas and electricity. Most appliances use one or the other.

There may be circumstances, though not within this proceeding, where higher efficiency appliances have slightly higher maintenance costs. A few appliances within this proceeding have significantly lower maintenance costs; however, maintenance costs for most higher-efficiency appliances are unchanged since the fundamental technologies used to achieve the higher efficiencies are no different than those used in current production products.

If **Added Total Costs** are equal to or less than zero, then the proposed standard is cost-effective.

Added First Cost, expressed in dollars, are all of the added costs that a standard imposes on a typical consumer, including the additional costs to purchase the appliance (first cost) and any other additional costs such as added installation costs. For instance, some very efficient gas water heaters require more expensive venting systems, which are not part of the water heater. Added First Cost, expressed in dollars, is calculated by comparing the estimated purchase price of a "base-case" appliance of the most common size and design sold today[1] with the estimated purchase price of an appliance, of that same size and design, which barely meets the proposed standard. **Added First Cost** includes added sales tax paid by the consumer.

Energy Costs assumed in calculating cost effectiveness are based on the costs of energy paid by consumers. These costs depend on whether the appliance is commonly used by residential or commercial energy customers. A forecast model developed for the Energy Commission's Energy Information and Analysis Division was used to estimate future energy costs. Electricity costs are from recent analysis by the Commission's Energy Information and Analysis Division; natural gas prices are based on the Commission's *Natural Gas Market Outlook 2000 – 2020*, Appendices C and H. These costs are based on aggregated statewide average analysis.

Design Life is the expected life of the appliance. In most cases the expected life does not change with a new standard. There are, however, notable exceptions such as lamps. In these cases, the cost effectiveness calculation becomes more complicated. For instance, if the base case lamp has a two year life and the more efficient lamp has a ten year life, the comparison is made over ten years and assumes, for the base case, that the lamp is replaced four times in the ten years.

Discount Rate is based on the real after-tax cost of capital for building owners or purchasers of commercial equipment on the basis that major purchases can be funded through financing with tax deductible interest. A simple way to estimate the discount rate is shown by the following examples:

[1] For those appliances for which a minimum performance standard already exists, the "base-case" appliance typically is one that just complies with that standard.

Estimated Discount Rate, 30-Year Fixed Rate Home Loan

	6.04%	interest rate for loan
X	63.00%	tax effect (assuming 28% federal tax rate and 7.75% state tax rate)
=	3.81%	after-tax interest rate
-	1.74%	inflation rate (see endnote iii)
=	2.07%	real after-tax discount rate

Estimated Discount Rate, $10,000 Home Equity Loan

	6.83%	interest rate for loan
X	63.00%	tax effect (assuming 28% federal tax rate and 7.75% state tax rate)
=	4.30%	after-tax interest rate
-	1.74%	inflation rate (see endnote iii)
=	2.56%	real after-tax discount rate

Estimated Discount Rate, Credit Union 7-Year Fixed Home Equity Loan

	4.99%	interest rate for loan
X	63.00%	tax effect (assuming 28% federal tax rate and 7.75% state tax rate)
=	3.14%	after-tax interest rate
-	1.74%	inflation rate (see endnote iii)
=	1.40%	real after-tax discount rate

Estimated Discount Rate, Credit Union 20-Year Fixed Home Equity Loan

	6.99%	interest rate for loan
X	63.00%	tax effect (assuming 28% federal tax rate and 7.75% state tax rate)
=	4.40%	after-tax interest rate
-	1.74%	inflation rate (see endnote iii)
=	2.66%	real after-tax discount rate

Estimated Discount Rate, SAFE Credit Union Visa Platinum Credit Card

	6.90%	Annual Percentage Rate
X	0.00%	tax effect (not applicable for non-mortgage or non-equity loan)
=	6.90%	after-tax interest rate
-	1.74%	inflation rate (see endnote iii)
=	5.16%	real after-tax discount rate

The average of the current wide-ranging interest rates shown in the above examples is 2.77%.

Different assumptions for the interest rate, tax rate, and inflation rate could yield different discount rates, but the 3 percent rate is plausible for reasonable combinations of assumptions, since higher interest rates would be correlated with higher inflation rates. (see endnote iv)

The **Present Value** of a dollar of savings (or costs) in each future year is calculated by reducing the savings (or costs) by the **Discount Rate**.

The equation for determining the present value of a dollar in a future year is:

$$PresentValue = \frac{FutureValue}{(1 + DiscountRate)}$$

The present value for one year is then:

$$PresentValue = \frac{1}{(1 + 0.03)} = 0.970874$$

The **Present Value** of a dollar saved (or spent) two years from now is:

$$PresentValue = \frac{1}{(1 + 0.03)^2} = 0.942596$$

and so on. All costs and savings that occur in any year other than the first year of the **Design Life** are reduced to a present value.

Following is a table showing the present worth of one dollar in each of 30 future years.

Table 22 - Present Worth of Dollar for Next 30 Years

Single Payment Present Worth Factors	
Year Number	Present value of one dollar
1	0.970874
2	0.942596
3	0.915142
4	0.888487
5	0.862609
6	0.837484
7	0.813092
8	0.789409
9	0.766417
10	0.744094
11	0.722421
12	0.70138
13	0.680951
14	0.661118
15	0.641862
16	0.623167
17	0.605016
18	0.587395
19	0.570286
20	0.553676
21	0.537549
22	0.521893
23	0.506692
24	0.491934
25	0.477606
26	0.463695
27	0.450189
28	0.437077
29	0.424346
30	0.411987

Since energy costs normally occur monthly, but an annual analysis is used for simplicity, an approximation is made to account for timing of the monthly costs. This approximation assumes the first years cost occur at the beginning of the first period and therefore are not discounted and then assumes that all other future costs occur at the end of each period. For example, if a standard is adopted for an electric appliance with a five-year useful life expectancy, to take effect on January 1, 2006, the present worth of the energy savings (in 2006) is the sum of:

1.000 X electricity cost savings in first year,
0.942596 X electricity cost savings in second year,
0.915142 X electricity cost savings in third year,
0.888487 X electricity cost savings in fourth year, and
0.862609 X electricity cost savings in fifth year.

The table below shows the results of this analysis for specific equipment useful lives and utility customer classes.

Table 23 - Average Statewide Present Value of Electricity and Natural Gas (real 2003 Dollars)

	Electricity ($/kWh)			***Natural Gas ($/therm)***	
Equipment Useful Life	***Residential***	***Small Commercial***	***Medium Commercial***	***Residential***	***Commercial***
2 Year PV	0.243	0.313	0.250	1.693	1.693
3 Year PV	0.357	0.457	0.365	2.350	2.284
4 Year PV	0.466	0.595	0.475	2.998	2.869
5 Year PV	0.563	0.721	0.581	3.631	3.440
6 Year PV	0.657	0.842	0.682	4.251	4.001
7 Year PV	0.747	0.958	0.779	4.854	4.547
8 Year PV	0.833	1.068	0.871	5.442	5.080
9 Year PV	0.915	1.172	0.958	6.020	5.605
10 Year PV	0.994	1.272	1.042	6.588	6.122
11 Year PV	1.068	1.368	1.121	7.144	6.628
12 Year PV	1.141	1.461	1.198	7.689	7.124
13 Year PV	1.211	1.551	1.273	8.221	7.610
14 Year PV	1.279	1.638	1.346	8.739	8.084
15 Year PV	1.346	1.724	1.417	9.250	8.551
16 Year PV	1.410	1.806	1.485	9.751	9.010
17 Year PV	1.473	1.887	1.552	10.240	9.459
18 Year PV	1.534	1.965	1.617	10.719	9.900
19 Year PV	1.593	2.040	1.679	11.189	10.332
20 Year PV	1.650	2.114	1.740	11.650	10.757
21 Year PV	1.706	2.185	1.800	12.104	11.174
22 Year PV	1.760			12.549	11.584
23 Year PV	1.813			12.987	11.988
24 Year PV	1.864			13.417	12.384
25 Year PV	1.913			13.840	12.773
26 Year PV	1.961			14.255	13.155
27 Year PV	2.008			14.663	13.530

[i] E. L. Grant and W. G. Ireson, Principles of Engineering Economy, © 1964, Ch. 7.

[ii] Summary of Cost Effectiveness, Methodology and Assumptions, March 29, 1990, J. Leber

[iii] Website, Inflationdata.com, May 10, 2004, Current Inflation Rate – 1.74%

[iv] Website, Bankrate.com, May 10, 2004; 30 Year Fixed rate home loan – 6.04%, Home equity loan, $10,000 – 6.83%, 5-Year New car loan – 5.61%.

Website, Golden1.com, May 7, 2004; Credit Union 15-Year Fixed home equity loan – 5.49%, Credit Union 7-Year Fixed home equity loan – 4.99%, Credit Union 20-Year Fixed home equity loan – 6.99%.

Website, Safecu.org, May 10, 2004; Visa Platinum no fee credit card interest rate – 5.16%.

[vii] Simple Payback is a simpler, but less precise, method of calculating cost-effectiveness. Simple payback = added first cost divided by the first year energy cost savings; The simple payback period is the number of years required to make up for the added cost through energy cost savings.