Codes and Standards Enhancement Initiative
For PY2004: Title 20 Standards Development

Analysis of Standards Options
for
BR, ER, and R20 Incandescent Lamps

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1 Introduction

The Pacific Gas and Electric Company (PG&E) Codes and Standards Enhancement (CASE) Initiative Project seeks to address energy efficiency opportunities through development of new and updated Title 20 standards. Individual reports document information and data helpful to the California Energy Commission (CEC) and other stakeholders in the development of these new and updated standards. The objective of this project is to develop CASE Reports that provide comprehensive technical, economic, market, and infrastructure information on each of the potential appliance standards. This CASE report covers standards and options for BR, ER, and R20 lamps.

2 Product Description

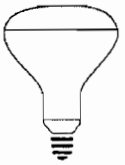
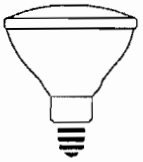
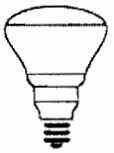
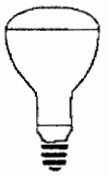
BR and ER lamps are a generally defined by lamp manufacturers as a type of incandescent reflector lamp. Other types of incandescent lamps are R and PAR lamps. All of these lamps are designed to direct light in an arc that measures less than 180 degrees. These lamps are commonly used as downlights in recessed lighting fixtures and in other applications requiring light to be aimed in a particular direction.

R lamps (commonly called *reflector* lamps) were widely used prior to the passage of the federal Energy Policy Act of 1992 (EPAct) (see Table 1). However, this law contained minimum efficiency standards for incandescent reflector lamps, and these standards were restrictive enough that most R lamps cannot meet efficacy requirements (*efficacy* is a lighting term meaning the amount of light provided per unit of energy input; in the U.S. efficacy is typically defined in terms of lumens per Watt). R lamps contain a blown-glass envelope and contain a reflective metallic coating applied directly to part of the bulb surface.

PAR lamps (*parabolic aluminized reflector* lamps) contain an aluminized reflector and a glass or plastic parabolic lens (see Table 1). These lamps are also covered by the EPAct standards. PAR lamps tend to come in three types – conventional PAR lamps (that have been sold for decades), halogen PAR lamps (contain a halogen capsule which increases efficacy; sold since the 1980s), and halogen IR PAR lamps (contain a halogen capsule with a special infrared reflective coating that further increases efficacy and has been sold since the 1990s). Generally, halogen and halogen IR lamps pass the EPAct standards but only a few conventional PAR lamps meet these standards.

BR and ER are lamps are specialized types of lamps that are specifically excluded from the EPAct definition of incandescent reflector lamps. BR lamps (*bulged reflector*) contain a small bulge near the bottom of the lamp neck. ER lamps *(ellipsoidal reflector*) have an ellipsoid reflector that is designed to move the focus of the lamp down several inches in order to minimize trapping of light in recessed fixtures (see Table 1). Prior to passage of EPAct, ER lamp sales were limited and BR lamps were virtually unheard of (e.g. they were not listed in the 1989 lamp catalogs of the three major U.S. lamp manufacturers – Nadel et al. 1989). Since passage of EPAct, sales of BR lamps have skyrocketed, making them the most widely-sold type of incandescent reflector lamps (specific data are provided in section 3). BR lamps have proven to be a large "loophole" in the EPAct lamp efficacy standards. ER sales on the other hand have been very limited.

Table 1: Types of Lamps Used in Reflector Applications

Type of Lamp	Picture	Life	Efficacy (75W)	Description
Reflector Lamp (R-lamp)	 R-40	2000 hours	9 lm/W	Projects (floods) light in one direction. Lamp is a one-piece, glass bulb coated on the inside with a reflective material. Lamp is filled with an inert gas (e.g., argon) to slow evaporation of the tungsten filament. Many wattages previously available were phased out due to standards.
Parabolic Aluminized Reflector Lamp (PAR-lamp)	 PAR-38	2000 hours for non-halogen, 2500-3000 for halogen	12.5 lm/W for halogen	Parabolic reflector shape projects light in a tighter beam than R-lamp. Incandescent and halogen PAR lamps are sold; however only halogen can achieve regulated standards. Lamp design is better for projecting light out of recessed down-lighting ceiling fixtures. Advanced PAR lamps use an infrared (IR) coating applied to the halogen quartz capsule to reflect heat back onto the filament. IR reflection enables the filaments to reach higher temperatures with less input power and improving efficacy (GE's 80W PAR/HIR is 18.75 lm/W).
Bulged Reflector Lamp (BR-lamp)	 BR-30	2000 hours	9.6 lm/W	The BR shaped reflector focuses somewhat more light into the main beam, directing a little more light out of recessed down-lighting fixtures. BR lamps do not incorporate halogen technology, and thus operate at lower efficacies. These lamps have generally been unregulated.
Ellipsoidal Reflector Lamp (ER-lamp)	 ER-30	2000 hours	11.3 lm/W	The ellipsoidal reflector focuses the light beam a few inches in front of the bulb itself – reducing light losses in recessed ceiling fixtures. ER lamps do not incorporate halogen technology, and thus operate at lower efficacies. These lamps have been unregulated, and only operate in a small share of the market.
General Lighting Service GLS lamp (A-type)	 A-19	750 hours	15.8 lm/W	The A-type lamp is not a reflector lamp; however it can be found installed in some reflector lamp fixtures. It is an unregulated lamp, and has a shorter life-span than reflector lamps, but it also offers a lower first cost advantage. Higher efficacy is achieved because the light is non-directional; however in a recessed ceiling fixture, system efficiency would be less than a reflector.
Director Lamp (K-type)	 K-19	1150 hours	13.3 lm/W	The K-type lamp is a modified A lamp, shaped like a directional spot light but without an internal reflector surface. The K lamp diameter is 6.3 cm, exempting it from regulation. Similar to A-type, efficacy is higher because of the lack of light direction - system efficiency would be less than a reflector in an application like a ceiling fixture.

Source: Adapted from ADL 2002.

In addition to the R, PAR, BR and ER distinctions, there are a number of other ways incandescent reflector lamps are classified including lamp diameter, lamp wattage, lumen output, lamp wattage, beam spread (the angle over which most of the light is distributed), and center beam candlepower.

Lamp diameter is generally expressed in eighths of an inch. Common R, BR and ER lamps are 20, 30 and 40 eighths of an inch in diameter as in BR20, BR30, and BR40. PAR lamps are common in diameters of 20, 30 and 38 eighths of an inch as in PAR20, PAR30 and PAR38. The EPAct definition of incandescent reflector lamp applies only to lamps more than 2.75" in diameter and thus include R24 lamps (a very uncommon size) but not to R20 lamps. R20 and BR20 lamps appear to account for about 10% of incandescent reflector lamp retail sales (see section 3.2), but can be replaced with more efficient PAR20 halogen lamps. Thus, it may make sense to include lamps of 2.25-2.75 inch diameter in the California standards.

Most reflector lamps sold are designed for operation at 120 volts. However, 130 volt lamps are also sold and will operate on 120 volt current. A 130 volt lamp operating at 120 volts will have a longer lamp life (nearly double), reduced wattage (about 12% lower), but also lower efficacy. Under EPAct, 130 volt lamps are tested at 130 volts (although for purposes of FTC labeling they are tested at 120 volts) (Howley 2003).

Beam spread is typically denoted with the categorizations *spot* and *flood* where spot lights typically have a beam spread less than about 30 degrees and flood lights typically have a beam spread more than about 30 degrees. The terms "narrow" and "wide" are sometimes used to further define beam spread, as in *narrow spot* or *wide flood* to designate narrower or wider than normal beam spreads.

Center beam candlepower is a measure of the amount of light provided in the center of the lamp beam. This measure is useful for designing display lighting such as for retail stores or museums. The candlepower depends on the lamp lumens and also the type and effectiveness of the reflector. For example, all other things being equal, spot lamps will have a much higher center beam candlepower than flood lamps since spot lamps concentrate the light in a narrower beam.

3 Market Status

3.1 Market Penetration

The 2002 U.S. Lighting Market Characterization (DOE 2002) estimates that there are a total of 346 million incandescent reflector lamps operating in residential, commercial, industrial, and outdoor stationary applications, accounting for 8% of the installed base of incandescent lamps. Incandescent reflector lamps are most common in the residential sector (76% of incandescent reflector lamps) and the commercial sector (23% of incandescent reflector lamps). These lamps are less common in industrial and outdoor stationary applications (combined total of not quite 1% of the incandescent reflector lamp stock. As is discussed in section 4, operating hours are lower in the residential sector than the other sectors, so energy use is not so heavily weighted toward the residential sector.

California accounts for 12% of the U.S. population (Census 2002) and assuming California accounts for the same proportion of incandescent reflector lamp sales, there are approximately 41.5 million incandescent reflector lamps in California, including about 31.6 million such lamps in the residential sector. Approaching this question another way, a study by RLW Analytics (2000) of California households found that the average California residence has 2.7 incandescent reflector lamps. Since California has 11.5 million households (Census 2002), this implies a residential stock of 31 million incandescent reflector lamps. A third way to estimate the stock of incandescent reflector lamps in California, again for the residential sector, is to take annual incandescent reflector lamp sales in California (9.4 million units in 2002 as discussed in section 3.2), and multiply by average lamp life (approximately 2500 hours) divided by the average annual operating hours per year (about 840 hours according to HMG 1999). These data imply a residential stock of 28 million incandescent reflector lamps in California's residential sector.

All three of these estimates are reasonably similar. Averaging the three estimates, the California stock is approximately 30 million incandescent reflector lamps in the residential sector. To this we need to add approximately 10 million lamps for the other sectors.

The market penetration of incandescent reflector lamps in the residential sector is increasing. For example, a 2000 study by RLW Analytics on residential lighting in California found that use of recessed can fixtures is more common in new homes than old homes. In their survey, of the homes build since 1990, 58% had at least one recessed can. For homes build before 1990, only 28% of homes had at least one recessed can (this last figure increases to 40% for older homes that have been remodeled) (RLW Analytics 2000).

3.2 Sales Volume

According to the National Electrical Manufacturers Association (NEMA), annual U.S. shipments of incandescent reflector lamps totaled 188 million units in 2002 (NEMA 2003). Relative to shipments in 1994 (Census 1995), sales have been increasing an average of 4.5% annually over the 1994-2002 period, although the sales increase was more moderate in 2001 and 2002, due at least in part to the recent recession (NEMA 2003).

Another set of lamp sales data comes from Itron Consulting using data they collect and analyze on behalf of California's electric utilities. The Itron data are based on information supplied from bar-codes when retail sales are rung-up. These data cover sales at home, hardware, drug, grocery and mass merchandise stores and thus are a reasonable approximation of sales to residential customers. According to Itron, 115 million incandescent reflector lamps were sold at retail in 2002, including 9.4 million in California (Harcharik 2003).

Combining the NEMA and Itron data, it appears that approximately 115 million lamps are sold nationally to the residential sector (61% of total sales), leaving 73 million lamps for the commercial and other sectors (39% of total sales). As is discussed below, commercial-sector applications have higher operating hours, and thus lamps burn out more frequently on average in the commercial and other sectors than in the residential

sector. Using data on the stock of incandescent reflector lamps nationally and in California (discussed in section 4.1), it appears that about 10.1 million lamps are sold each year for use in the California residential sector, and about 8.8 million for use in the commercial sector.

3.3 Market Penetration of High Efficiency Options

The most efficient types of reflector lamps are compact fluorescent and ceramic metal halide reflector lamps. These lamps typically have efficacies of 30 lumens per Watt or more. However, these lamps are significantly more expensive than other types of reflector lamps (e.g. $8-20 for a compact fluorescent reflector lamp and about $50 for a metal halide lamp, plus the cost of a metal halide ballast and frequently a dedicated metal halide fixture). Due to these present high costs and limited distribution, these lamps probably account for only a few percent of reflector lamp sales. For example, a 2000 field study of California homes by RLW Analytics found that of 380 residential recessed can fixtures surveyed, only 3% contained CFLs (Brost 2004). Additional information on CFL reflector lamps is compiled by PNNL (2003).. Recent California utility programs have brought the day-to-day cost of CFL R lamps down to the $5.00 to $7.50 range, without the benefit of rebates, in big box retail outlets.

Among incandescent reflector lamps, halogen PAR and halogen IR PAR lamps are generally the most efficient types. Halogen R lamps are also sold by a few manufacturers. Halogen lamps typically have efficacies of 11-16 lumens per Watt while halogen IR lamps generally have efficacies of 15-21 lumens per Watt (ADL 2002). Efficacy tends to increase as lamp wattage increases, hence the need for ranges or bins around which to structure standards options. ER lamps, while they have relatively low efficacy (e.g. 9-12 lumens per Watt) can be an energy-saver if they are used to replace higher wattage R or BR lamps. BR, R and conventional (non-halogen) PAR lamps are generally among the least efficient type of incandescent reflector lamp on the market (e.g., 10-13 lumens per Watt). Data on most of the incandescent reflector lamps now on the North American market can be found in Appendix A.

There are several data sources available on the current market share of different types of incandescent reflector lamps, including data from NEMA, Natural Resources Canada, and Itron.

NEMA compiles data from its members on sales of various types of lamps, including reflector incandescent lamps. In addition, they conducted a special analysis for DOE on PAR/R lamps for DOE in 2003 (NEMA 2003). This data, for 2002, is summarized in Table 2. It shows that more than 45% of incandescent reflector shipments are of types not covered by EPAct's efficacy standards (additional uncovered lamps will be in the "other" categories). These data also show that EPAct has been successful in moving significant sales into the halogen category. In 2002, more than one-third of incandescent reflector lamp sales were halogen, up from about 7.6% of commercial and industrial (C&I) sales in 1988, and an even smaller proportion of total sales in 1988 (Nadel et al. 1989).

Natural Resources Canada collected data on reflector lamp sales in Canada as part of a 2002 study (ADL 2002). The study examined sales in 2001 by lamp type and sector. Data are summarized in Table 3. A key finding from this study is that the majority of incandescent reflector lamp sales (52%) are BR lamps, a lamp type exempted from both U.S. and Canadian lamp efficiency standards. In addition, the study provides limited data on the sectoral distribution of sales by wattage within lamp types. For example, a substantial majority of ER lamp sales are to the commercial sector, with 73-97% of ER sales going to the commercial and industrial (C&I) sectors and 3-27% going to the residential sector (varying with lamp wattage). For PAR lamps, a substantial majority also goes to the C&I sectors. On the other hand, the majority of BR lamp sales are to the residential sector including 55% of the category including 65W lamps and 63% of the category including 85W lamps.

Table 2: NEMA 2002 Data on Incandescent Reflector Lamp Shipments.

Lamp type	Units Shipped (1000's)	% of total shipments	Average unit weighted Watts
BR30, 85W and <66W	65,890	35.0	64
BR40, ≤120W	14,915	7.9	90
ER30 or ER40	1,454	0.8	87
Blown glass par (BPAR38), 150W	2,121	1.1	150
Halogen PAR38	49,460	26.3	78
Halogen PAR30	14,516	7.7	67
Other including other halogen PAR, other blown lamps (R, BR, etc.), other non-halogen PAR, etc.	39,913	21.2	Not available
TOTAL	188,269	100%	

Source: NEMA 2003.

Table 3: 2001 Reflector Lamp Sales in Canada by Sector and Lamp Type.

Sector and Lamp Type	Sales (1000s)	% of Total Sales
Residential		
PAR	1,067	11
BR	3,074	31
ER	9	0
Subtotal	4,150	42
Commercial		
PAR	3,672	37
BR	2,114	21
ER	56	1
Subtotal	5,843	58
TOTAL	9,994	100

Note: Totals do not quite add up due to rounding.
Source: ADL 2002.

As discussed above, Itron collects detailed information on residential lamp sales including data on sales for individual types of lamps including lamp type, diameter and wattage. Key findings from an analysis of the Itron data for 2002 are summarized in Table 4. This data goes into more detail than the NEMA and NRCan data and indicates that non-halogen lamps are about three-quarters of residential incandescent lamp sales. Much of the remaining sales are lamps exempted from the EPAct standards including BR lamps and R20 lamps. The majority of opportunities to improve lamp efficiency fall into five categories – BR and R lamps of 60-75 Watts (which account for more than one-third of lamp sales), BR20 and R20 lamps of 45-50 Watts (approximately 8% of sales), blown PAR lamps of around 75 and 150 Watts (about 6% of sales),[1] BR lamps of 85-100 Watts (4-6% of sales), and BR lamps of 120-150 Watts (4-5% of sales). Together these five categories account for about 60% of U.S. and California residential sales of incandescent reflector lamps.

Table 4: 2002 Residential Reflector Lamp Sales in the U.S. and California by Lamp Type and Wattage.

Lamp type and Wattage	Number Sold (1000s)		Percent of Total Sales		Weighted average Wattage
	Calif.	U.S.	Calif.	U.S.	
Halogen	2,255	25,866	27.2	24.3	71
Non-halogen					
BR20, R20					
45-50 watts	676	8,401	8.1	7.9	36
75 watts	141	1,264	1.7	1.2	49
Other	100	899	1.2	0.8	75
BR30, BR40, R30, R40					
45-50 watts	163	2,299	2.0	2.2	46
60-75 watts	2,774	42,295	33.4	39.8	66
85-100 watts	478	3,917	5.8	3.7	89
120-150 watts	395	4,051	4.8	3.8	125
Other	127	1,038	1.5	1.0	126
BR38, PAR38, BPAR38					
65-75 watts	259	2,710	3.1	2.5	75
85-100 watts	137	1,548	1.7	1.5	90
120-150 watts	236	4,003	2.8	3.8	150
ER	6	106	0.1	0.1	73
Other	558	7,990	6.7	7.5	76
Subtotal non-halogen	6,050	80,522	72.8	75.7	74
TOTAL	9377	114620	100.0	100.0	73

[1] Blown PAR lamps are a cross between BR and PAR lamps designed to avoid the EPAct lamp regulations. These lamps are made of blown glass like BR lamps, have a bulge near the bottom (so are a type of BR lamp), but otherwise are in a PAR lamp shape.

Source: Harcharik 2003.

4 Savings Potential

4.1 Baseline Energy Use

Baseline energy consumption varies with lamp wattage and the number of hours a lamp operates each day. Both the NEMA and the Itron data indicate that the average incandescent reflector lamp is approximately 73-74 Watts. In the residential sector, the typical BR lamp is used about 2.3 hours per day (HMG 1999). In the commercial sector, average usage is around 10 hours per day (e.g., ADL [2002] estimated 10 hours per day in office/professional uses, 12 hours per day in retail/mall, 8.9 in education, 13.8 in industrial). As discussed in Section 3.1, on a national basis, there are about 263 million of these lamps in use in the residential sector and about 83 million in the commercial sector. In California the figures are about 30 million in the residential sector and 10 million in the commercial and other sectors. Based on these figures, several measures of base case energy use are provided in Table 5.

Table 5: Base Case Energy Use of Incandescent Reflector Lamps

Variable	Residential Sector	Commercial Sector	Total
Lamp wattage	73	73	
Average daily operating hours	2.3	10	
Annual kWh/lamp	61	266	
Peak coincidence factor (% on at peak)	7%	78%	
Average operating cost:	U.S. (@ $.08/kWh) CA (@ $.12/kWh)		
Installed base (millions): U.S. California	 263 30	 83 10	 346 40
Annual kWh (billions): U.S. California	 16.0 1.83	 22.1 2.66	 38.1 4.49
Peak demand (MW): U.S. California	 1,344 153	 4,726 569	 6,070 722
Annual operating cost ($million) U.S. California	 $1,283 220	 $1,766 319	 $3,049 539

Note: Electric rates from EIA 2003. Residential % on at peak from HMG 1999. Commercial % on at peak from PG&E 2001 (used average of "office" and "all other" categories).

4.2 Proposed Test Method

EPAct references test procedure LM-20-94 published by the Illuminating Engineering Society of North America. This test procedure, which is titled *Photometric Testing of Reflector-Type Lamps*, is periodically revised and was last published in 1994. This test procedure is also referenced in the federal regulations. We recommend that California use this same test procedure for BR and ER lamps.

4.3 Efficiency Measures

To illustrate the range of efficient products available, in this section we concentrate on the most common type of BR lamp -- a 65BR30 product, which means 65 Watts and a diameter of 30 eighths of an inch (i.e., 3.75 inches). This product is produced by all of the major lamp manufacturers and typically provides about 640 lumens and generally has a rated life of 2000 hours. There are number of energy-saving replacements for this lamp which are listed in Table 6. One manufacturer also produces R and BR lamps that just meet the EPAct standards.

Table 6: Energy Saving Alternatives to the 65 Watt BR Lamp

Lamp Type	Watts	Typical Lumens	Typical Life (hours)
BR30 (base case)	65	640	2000
R30 "Halogena"	60	700	3000
Halogen PAR30 long-neck	50	580-660	3000
Halogen IR PAR30	45	770	3000
ER30	50	525 (but less light trapped in recessed fixtures)	2000
CFL	20	750 (mean)	6000
R30 or BR30 high-efficacy	65	725	2000

As discussed previously, while the 65 Watt BR lamp is the most common type of reflector lamp not subject to the EPAct efficacy regulations, there are several other exempted lamps that are also fairly common including BR20 and R20 lamps of 45-50 Watts, blown PAR lamps of around 75 and 150 Watts, BR lamps of around 85 Watts, and BR lamps of around 120 Watts. Table 7 provides information on these lamps and higher-efficiency replacements for these lamps with similar light output.

Table 7: Energy Saving Alternatives to Other Common Exempted Lamps

Lamp Type	Watts	Typical Lumens	Typical Life (hours)
R/BR20 (base case)	50	380	2000
Halogen PAR20	35	360	2500
85BR30 (base case)	85	855	2000
Halogen PAR30	60	800	3000
120BR40 (base case)	120	1120	2000
Halogen PAR30 longneck	75	1100	3000
75BPAR38 (base case)	75	650	2000
Halogen PAR38	60	800	2500
Halogen PAR38	50	600	2500
150BPARR38 (base case)	150	1350	2000
Halogen PAR38	90	1300	2500

4.4 Standards Options

The most obvious standards option is to subject BR and ER lamps to the EPAct standards – the same standards that R and PAR lamps need to meet. These standards are provided in Table 8.

Table 8: U.S. EPAct Standards for Incandescent Reflector Lamps

Rated Lamp Wattage	Minimum Avg. Efficacy (lumens/W)
40-50	10.5
51-66	11.0
67-85	12.5
86-115	14.0
116-155	14.5
156-205	15.0

If BR and ER lamps were subjected to this standard, most current BR and ER lamps would be eliminated from the market, although high-efficacy BR's could still be sold. Consumers would then need to choose between halogen lamps, compact fluorescent lamps, and the high-efficacy 65 Watt BRs and Rs.

A variation on this proposal would be to exempt the 50ER30 lamp from the standards so that these lamps could continue to be sold as an energy-saving alternative to the 65BR30. With the ER lamp, less light is trapped in recessed fixtures than the BR lamp, which makes this an appropriate substitution in some applications. Such an exemption should

only apply to 50 Watt ER lamps, so that ER lamps don't in the future become a widely exploited loophole in the lamp regulations.

4.5 Energy Savings

The energy savings of such a standard depends on what lamps consumers buy after the new standard takes effect. Table 9 includes our estimate of the average savings for different types of lamps, and a calculation of the weighted average savings using the sales data in Table 4 to do the weighting.

Energy savings for California from the proposed standards can be estimated using the data in Table 5 along with the average Watts saved from Table 9. In addition, we only apply these savings to the proportion of lamp sales that are not halogen as, estimated using the data in Tables 2 through 4. Based on these data, savings from the proposed standard, once the stock fully turns over, are summarized in Table 10.

Table 9: Estimated Average Power Savings for Replacement of Different Types of Exempted Lamps

Current Lamp Type	Estimated Avg. Savings (Watts)	Notes
65BR30	7.5	Some will be replaced with 50W halogen, some with 60W Halogena, some w/ higher efficacy 65W R/BR
50R20	7.5	Some will use 35W halogen, some 50W
85BR30	12.5	Some will use 60W halogen, some 75W
120BR40	32.5	Some will use 75W halogen, some 100W
75BPAR38	20.0	Some will use 50W halogen, some 60W
150BPAR38	45.0	Some will use 90W halogen, some 120W
Weighted average	13.1	Based on sales data in Table 4

Table 10: Estimated Savings in California from Extending EPAct Standards to BR, ER and R20 Lamps

Lamp Type	Installed Base (millions)	% Sales not Halogen	Savings/Lamp (Watts)	GWh Saved/yr	MW Saved
Residential	30	73%	13	239	20
Commercial	10	38	13	180	39
Total				419	59

Percent sales not halogen from Table 4 for residential. For commercial, we use the data in Table 3, and assume that all PAR lamps are halogen, which is likely a generous assumption.

Using data from sections 3.2 and 4.1, we estimate that of the savings listed in Table 10, about 34% of the residential savings will occur after one year, and about 88% of the commercial savings will occur after one year, making for total savings after one year of 240 GWh and 41 MW.

5 Economic Analysis

5.1 Incremental Cost

Replacements for inefficient BR lamps and R/BR20 lamps cost more than standard lamps. Table 11provides incremental costs for several possible replacements. We separate out residential and commercial products. For residential, these costs are based on a survey of three of retail stores in California during November 2003. For commercial, these are average costs obtained for multiple products of each type from two web sites (bulbs.com and atlantalightbulbs.com). Pricing varies with quantity – we used quantities of a dozen. These prices tend to be a modest discount (average of 17%) off of the residential prices we obtained. Large commercial customers can obtain much lower prices (e.g., discounts can be more than 80% off of published price schedules -- NYOGS 2003).

Table 11: Incremental Costs for Replacements for BR Lamps

Lamp Type	Typical Retail Cost		Incremental Cost	
	Residential	Commercial	Residential	Commercial
Base – 65BR	4.01	2.63	--	--
60 R Halogena	5.99	4.97*	1.98	2.34
50 halogen PAR	7.81	5.30	3.80	2.67
50ER	4.80	2.84	0.79	0.21
65R hi-efficacy (no spacing change)	4.69	3.13**	0.68	0.50
20 W CFL	9.73	16.38	5.72	13.75
Base – 50R20	5.48	2.43	--	--
35 halogen PAR	7.23	6.74	1.75	4.31
Base – 85BR	4.27	2.77	--	--
60 halogen PAR	7.97	6.71	3.70	3.94
Base – 120BR	5.31	3.05	--	--
75 halogen PAR	7.27	5.43	1.96	2.38
Base – 75BPAR	3.24	3.35	--	--
60 halogen PAR	NA	5.60		2.25
50 halogen PAR	5.98	6.22	2.74	2.87
Base – 150BPAR	3.49	2.94	--	--
90 halogen PAR	6.31	5.44	2.82	2.50

* Prices not available on the web, so we assumed a 17% discount off of the residential price, which is the average discount from residential prices of the products included in this table.

** $0.50 more than a standard 65BR30 per Love (1998).

5.2 Design Life

Based on a review of the catalogs of the major lamp manufacturers, the rated lamp life for standard BR, R and ER lamps is 2000 hours, although some extended life products are sold, most commonly with a 2500 hour life. Halogen lamps are generally rated for 3000 hours, although some halogen products have only a 2500 hour rated life (see Tables 6 and 7). Compact fluorescent reflector lamps are typically rated for 6000 hours. This is shorter than for non-reflector CFLs and reflects the fact that reflector lamps are often used in recessed fixtures where heat builds up, which can shorten ballast life.

5.3 Life Cycle Cost

Tables 12 and 13 provide life-cycle cost savings for several possible replacements for BR and R20 lamps. Table 12 covers the residential sector (using residential lamp prices and operating hours) and Table 13 covers the commercial sector (using commercial lamp prices and operating hours). For this analysis we examine a 6000 hour period, which can be achieved by 3 BR or R lamps, 2 halogen PAR lamps, or one CFL reflector lamp.

Table 12: Residential Life-Cycle Costs for Replacements for BR Lamps

Lamp Type	Watts Saved	Incremental Retail Cost	Lamp Life (hours)	PV of Energy Savings (6000 hrs)	PV of Incremental Lamp Costs (6000 hrs)	NPV Savings (6000 hrs)
Base – 65BR	--	--	2000	--	--	--
60 R Halogena	5	1.98	3000	$3.20	$ 0.15	$ 3.04
50 Halogen PAR	15	3.80	3000	9.59	3.61	5.98
50ER	15	0.79	2000	9.59	2.21	7.38
65R hi-efficacy (no spacing change)	0	0.68	2000	0.00	1.90	- 1.90
65R hi-efficacy (w/ spacing change)*	10	-0.02	2000	6.39	- 5.63	11.99
20 W CFL	45	5.72	6000	28.78	- 1.50	30.27
Base – 50R20	--	--	2000	--	--	--
35 halogen PAR	15	1.75	2500	9.59	0.92	8.67
Base – 85BR	--	--	2000	--	--	--
60 halogen PAR	25	3.70	3000	15.99	3.19	12.80
Base – 120BR	--	--	2000	--	--	--
75 halogen PAR	45	1.96	3000	28.78	- 1.05	29.83
Base – 75BPAR	--	--	2000	--	--	--
50 halogen PAR	25	2.74	2500	15.99	4.38	11.61
Base – 150BPAR	NA	--	2000	--	--	--
90 halogen PAR	60	2.82	2500	38.37	4.42	33.94

* 65R hi-efficiency with spacing change means that the number of fixtures are reduced proportionately to account for the higher light output of the higher-efficiency lamps. This is applicable in only new construction and major retrofit. For this calculation, we assume a typical recessed can fixture costs $50 including installation (McCullough 2003).

Notes: Incremental costs from Table 11. NPV based on operating hours and electric rates in Table 5 and a 3% real discount rate (from CEC 2001). We include a full range of replacements for the 65BR30 lamp but for the other lamp types we include only the most likely replacement.

Table 13: Commercial Life-Cycle Costs for Replacements for BR Lamps

Lamp Type	Watts Saved	Incremental Retail Cost	Lamp Life (hours)	PV of Energy Savings (6000 hrs)	PV of Incremental Lamp Costs (6000 hrs)	NPV Savings (6000 hrs)
Base – 65BR	--	--	2000	--	--	--
60 R Halogena	5	2.34	3000	$ 3.46	$ 2.04	$ 1.42
50 Halogen PAR	15	2.67	3000	10.39	2.68	7.71
50ER	15	0.21	2000	10.39	0.61	9.78
65R hi-efficacy (no spacing change)	0	0.50	2000	0.00	1.46	- 1.46
65R hi-efficacy (w/ spacing change)*	10	0.03	2000	6.92	- 6.05	12.97
20 W CFL	45	13.75	6000	31.16	8.73	22.43
Base – 50R20	--	--	2000	--	--	--
35 halogen PAR	15	4.31	2500	10.39	8.65	1.74
Base – 85BR	--	--	2000	--	--	--
60 halogen PAR	25	3.94	3000	17.31	5.02	12.29
Base – 120BR	--	--	2000	--	--	--
75 halogen PAR	45	2.38	3000	31.16	1.71	29.45
Base – 75BPAR	--	--	2000	--	--	--
60 halogen PAR	15	2.25	2500	10.39	3.31	7.08
50 halogen PAR	25	2.87	2500	17.31	4.76	12.55
Base – 150BPAR	NA	--	2000	--	--	--
90 halogen PAR	60	2.50	2500	41.55	4.13	37.42

* See asterisk explanation below Table 12 above.
Notes: See notes for Table 12 above.

Overall, for nearly all of the residential and commercial substitutions examined, the replacement lamps have lower life-cycle costs than the base case lamps. The net present value savings range from just over $1 per lamp to as high as $37 per lamp (for replacing a 150 Watt BPAR with a 90 Watt halogen PAR. The only case where net present value costs increase are when a 65 Watt BR lamp is replaced with a higher-efficacy 65 Watt R

or BR lamp and the number of fixtures is not reduced. In this case, lumen output increases but no energy is saved. The net present value of this situation is a small extra cost – less than $2 spread over several years. However, when the higher efficacy 65 Watt lamps are used with less fixtures, in order to have the same light output, there are substantial net present value savings. Overall, the situations with higher net present value costs are limited both in the number of sockets affected and the amount of additional cost. In the vast majority of cases, there are substantial benefits, with net present value benefits many times net present value costs (the simple average across all the cases examined is a benefit-cost ratio of 6.9).

6 Acceptance Issues

6.1 Infrastructure Issues

There is a wide-variety of lamps that customers can choose from to replace existing BR lamps. Some manufacturers have expressed concern that if standards are set on BR lamps, many consumers will just use higher wattage general service incandescent lamps, resulting in higher energy use and often lower light levels, since in recessed fixtures, much of the light from general service lamps is trapped in the fixture. To some extent, use of general service lamps in recessed fixtures already happens, primarily in the residential sector. For example, the 2000 field study by RLW Analytics mentioned above examined 380 recessed can fixtures in California homes and found that 17% of these fixtures used either standard or globe incandescent lamps. Data on lamp watts was not collected (Brost 2004). We hear anecdotally about consumers who use general service lamps in recessed fixtures, primarily because when a BR lamp burns out, a general service lamp may be the only one handy (most consumers keep a stock of general service lamps on hand but not as many keep a stock of BR lamps). The question is whether this practice will increase if BR lamps are regulated, since replacement lamps will be somewhat more expensive. We think this practice will not increase significantly, because as discussed in section 5, consumers who want a low-cost lamp will still be able to purchase a higher efficacy non-halogen 65R30 or 65BR30 lamp. 50ER30 lamps can also be produced cheaply in quantity.

In the case of higher wattage BR lamps (e.g. 85BR and 120BR), low-cost replacements will not be available (unless manufacturers find a new loophole in the regulations), but opportunities to use higher-wattage general service lamps are also more limited. Hopefully most homeowners will use the higher-efficacy halogen lamps, because these provide better light and have lower life-cycle costs. But some homeowners may use general service lamps because they are handy and cheaper. Homeowners typically stock 60 Watt, 100 Watt and perhaps 75 Watt general service lamps at home. An 85 Watt BR lamp could be replaced by any of these, depending on what is handy, resulting in reduced light levels but probably not higher watts on average. Also, some 85 Watt BRs would likely be replaced by 65 Watt R or BR lamps that just meet the EPAct standard. For 120 Watt BR lamps that are replaced with general service lamps and not halogen lamps, the most likely replacement would be a 100 Watt general service lamp, since 150 Watt general service lamps are not as widely purchased by homeowners as lamps of 100 Watts and less.

Still, in order to minimize inappropriate use of general service lamps in reflector lamp applications, and instead encourage use of the more efficient halogen or compact fluorescent lamps, we recommend that the State and utilities work with retail stores on a consumer education campaign in the months after the new standards take effect.

6.2 Existing Standards

As noted above, the U.S. Energy Policy Act of 1992 (EPAct) established minimum efficacy standards on R and PAR lamps but not BR and ER lamps. These standards are summarized in Table 8. They went into effect in 1995.

NEMA claims that because BR and ER lamps are mentioned in EPAct, they are "covered products" and state standards are preempted (Pitsor 2003). However, this argument seems untenable to us since the only place BR and ER lamps are mentioned in EPAct is to exclude them from the definition of incandescent reflector lamp and the definition of incandescent lamp (EPCA Section 321(30)(C)). We recommend that the CEC's legal counsel review this section to verify that our interpretation is correct.

Canada also has a standard for incandescent reflector lamps. The original Canadian standard was nearly identical to the U.S. standard but in 2002 Canada adopted revisions to their standard to cover BR and ER lamps, to subject 60-66 Watt lamps to the 12.5 lumen per Watt standard, to exempt BR65, BR85, and BR120 lamps[2] and to have a weaker standard for ER lamps that most existing products can meet. The change took effect in April 2003 (Delves 2003, ADL 2002). A study on the proposed change found that the change would have little impact as the continued exemptions for specific BR lamps would leave 70% of the product unregulated and the other changes would affect only a limited number of products (ADL 2002). However, the Canadian government reasoned that the remaining savings were worthwhile and adopted the amendment (Delves 2003).

The California regulations proposed here avoid the problem identified by the ADL study for Canada because they do not contain any new exemptions except for 50 Watt ER lamps. Our recommendation for California also leaves the required efficacy for 60-66 Watt lamps unchanged from EPAct, allowing high efficacy 65R and 65BR lamps to continue to be sold.

California, in its recently approved Title 24 residential building standard that takes effect in 2005 does encourage use of compact fluorescent lamps in recessed fixtures. Specifically, the new Title 24 lighting requirements requires half the installed wattage in the kitchen to be "high efficacy" and also requires fixtures used in bathrooms, garages, laundry rooms, dining rooms or outdoors to be "high efficacy" (or to have a motion sensor with integral photo control, or in the case of dining rooms, a dimming switch). "High efficacy" is defined as lamps without screw-based sockets and that have an efficacy of at least 40-60 lumens per watt, varying with lamp wattage (these efficacies can be achieved using CFLs but not incandescent lamps) (CEC 2003). The new code is scheduled to go into effect in October 2005 and will decrease the use of incandescent

[2] Specifically, the revised Canadian regulations exempt BR lamps less than 66 Watts with diameters of BR30 or less. They also exempt 85BR30 lamps and BR38 and BR40 lamps with a rated power of less than 121 Watts.

reflector lamps in new homes at least somewhat, although the degree of reduction will depend on whether the market favors the controls option over the high efficacy option.

7 Recommendations

Based on our analysis, extending the EPAct standards to BR, ER, and R20 lamps appears to make sense. Such a standard will prompt many consumers to use more efficient lamps, saving a substantial amount of energy and money. We recommend that a year be provided after the standard is finalized to allow manufacturers to prepare for the new standard. Assuming the standard is finalized in late-2004, a reasonable effective date would be January 1, 2006.

Specifically, we recommend that the following definition for added to Section 1602 of the CEC Appliance Efficiency Regulations:

"State-regulated incandescent reflector lamp" means a lamp which is not colored or designed for rough or vibration service applications, that contains an inner reflective coating on the outer bulb to direct the light, a E26 medium screw base, a rated voltage or voltage range that lies at least partially within 115 to 130 volts, and that falls into one of the following categories:

(1) a BR or ER bulb shape and which has a diameter which equals or exceeds 2.25 inches;

(2) a R, PAR or similar bulb shape and which has a diameter of 2.25-2.75 inches.

Note: This definition is based on the federal definition of incandescent reflector lamps, but only includes lamps that are excluded from the federal definition (the federal definition excludes BR and ER lamps by name and also only includes lamps "with a diameter which exceeds 2.75 inches").

In addition, the following provision should be added to Section 1605.3 of the current CEC Appliance Efficiency Regulations:

(o) ***State-Regulated Incandescent Reflector Lamps.***

Energy Efficiency Standard for State-Regulated Incandescent Reflector Lamps. *Lamps covered by the definition of state-regulated incandescent reflector lamps sold in the state*

on or after January 1, 2006 shall meet the efficacy requirements shown in Table O. However, 50 Watt ER lamps are exempted from these requirements.

Table O

Standards for State-Regulated Incandescent Reflector Lamps

Rated Lamp Wattage	*Minimum Avg. Efficacy (lumens/W)*
40-50	*10.5*
51-66	*11.0*
67-85	*12.5*
86-115	*14.0*
116-155	*14.5*
156-205	*15.0*

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Appendix A. Reflector Lamps in the Catalogs of the Three Major North American Manufacturers

The following are all the reflector lamps identified by Arthur D. Little, Inc. in 2002 from the catalogues of General Electric Lighting, Osram/Sylvania and Philips Lighting. This material was an appendix in a study prepared for Natural Resources Canada (ADL 2002) and is used here with permission from NRCan.

PAR Lamps between 40 – 50 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumen	Life	Effic
				Low values	120	510	2000	10.6
				High values	130	850	6000	17.0
GE	PAR38	45	17470	45PAR/H/SP10°	120	510	2500	11.3
GE	PAR38	45	16229	45PAR/H/SP10°	130	510	2500	11.3
GE	PAR38	45	17471	45PAR/H/FL25°	120	510	2500	11.3
GE	PAR38	45	16231	45PAR/H/FL25°	130	510	2500	11.3
GE	PAR38	45	40793	45PAR/HIR/SP12°/XL	120	600	6000	13.3
GE	PAR38	45	40790	45PAR/HIR/FL40°/XL	120	600	6000	13.3
Philips	PAR38	45	26544-7	45PAR38/HAL/SP12	120	530	2000	11.8
Philips	PAR38	45	26558-7	45PAR38/HAL/FL28	120	530	2000	11.8
Philips	PAR38	45	26595-9	45PAR38/HAL/SP12	130	530	2000	11.8
Philips	PAR38	45	26597-5	45PAR38/HAL/FL28	130	530	2000	11.8
Philips	PAR38	45	26883-9	45PAR38/HAL/FL28	120	530	2000	11.8
Philips	PAR38	45	22946-8	45PAR38/HAL/SP12/LL	120	530	2500	11.8
Philips	PAR38	45	22947-6	45PAR38/HAL/SP12/LL	130	530	2500	11.8
Philips	PAR38	45	22948-4	45PAR38/HAL/FL28/LL	120	530	2500	11.8
Philips	PAR38	45	22949-2	45PAR38/HAL/FL28/LL	130	530	2500	11.8
Philips	PAR38	45	24951-6	45PAR38/HAL/FL28/LL	120	530	2500	11.8
Sylvania/OSRAM	PAR38	45	14588	45PAR/CAP/SPL/FL	120	520	2500	11.6
Sylvania/OSRAM	PAR38	45	15537	45PAR/HAL/SPL/FL/RP	120	520	2500	11.6
Sylvania/OSRAM	PAR38	45	14591	45PAR/CAP/SPL/FL	130	520	2500	11.6
Sylvania/OSRAM	PAR38	45	14589	45PAR/CAP/SPL/SP	120	520	2500	11.6
Sylvania/OSRAM	PAR38	45	15538	45PAR/HAL/SPL/SP/RP	120	520	2500	11.6
Sylvania/OSRAM	PAR38	45	14592	45PAR/CAP/SPL/SP	130	520	2500	11.6
Sylvania/OSRAM	PAR38	45	14590	45PAR/CAP/NSP	120	520	2500	11.6
Sylvania/OSRAM	PAR38	45	14593	45PAR/CAP/NSP	130	520	2500	11.6
Sylvania/OSRAM	PAR38	45	14010	45PAR/CAP/WFL	130	520	2500	11.6
GE	PAR38	50	17980	50PAR/H/SP10°	120	590	2000	11.8
GE	PAR38	50	17979	50PAR/H/FL25°	120	590	2000	11.8
GE	PAR38	50	17926	50PAR/H/FL25°	130	590	2000	11.8
GE	PAR30	50	14023	50PAR30/H/SP10°	120	610	3000	12.2
GE	PAR30	50	17870	50PAR30/H/SP10°	130	610	3000	12.2
GE	PAR30	50	17871	50PAR30/H/FL25°	120	610	3000	12.2
GE	PAR30	50	17872	50PAR30/H/FL25°	130	610	3000	12.2
GE	PAR30	50	14022	50PAR30/H/FL35°	120	610	3000	12.2
GE	PAR30	50	17874	50PAR30/H/FL35°	130	610	3000	12.2
GE	PAR30	50	14940	50PAR30L/H/SP10°	120	580	3000	11.6
GE	PAR30	50	11117	50PAR30L/H/SP10°	130	580	3000	11.6
GE	PAR30	50	11116	50PAR30L/H/FL40°	120	580	3000	11.6
GE	PAR30	50	11123	50PAR30L/H/FL40°	130	580	3000	11.6
GE	PAR30	50	14941	50PAR30L/H/WFL	120	630	3000	12.6
GE	PAR30	50	19902	50PAR30/HIR/SP9°	120	770	3000	15.4
GE	PAR30	50	21534	50PAR30/HIR/SP9°	130	770	3000	15.4
GE	PAR30	50	19901	50PAR30/HIR/FL25°	120	770	3000	15.4
GE	PAR30	50	21533	50PAR30/HIR/FL25°	130	770	3000	15.4
GE	PAR30	50	19900	50PAR30/HIR/FL35°	120	770	3000	15.4
GE	PAR30	50	19903	50PAR30/HIR/FL35°	130	770	3000	15.4
GE	PAR38	50	12396	50PAR/HIR/SP10°	120	850	3000	17.0

GE	PAR38	50	22843	50PAR/HIR/SP10°	130	850	3000	17.0
GE	PAR38	50	12397	50PAR/HIR/FL25°	120	850	3000	17.0
GE	PAR38	50	22850	50PAR/HIR/FL25°	130	850	3000	17.0
Philips	PAR-30L	50	22922-9	50PAR30L/HAL/NSP9	120	530	2000	10.6
Philips	PAR-30L	50	22923-7	50PAR30L/HAL/SP16	120	530	2000	10.6

PAR Lamps between 40 – 50 Watts (continued)

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumen	Life	Effic
Philips	PAR-30L	50	22925-2	50PAR30L/HAL/NFL30	120	530	2000	10.6
Philips	PAR-30L	50	22926-0	50PAR30L/HAL/FL30	130	530	2000	10.6
Philips	PAR-30L	50	22927-8	50PAR30L/HALFL40	120	530	2000	10.6
Philips	PAR-30L	50	22928-6	50PAR30L/HAL/FL40	130	530	2000	10.6
Philips	PAR-30L	50	23645-5	50PAR30L/HAL/WFL60	120	600	2000	12.0
Philips	PAR-30L	50	24955-7	50PAR30L/HAL/WFL60	120	600	2000	12.0
Philips	PAR-30L	50	28472-9	50PAR30L/HAL/WFL60	130	600	2000	12.0
Philips	PAR-30S	50	26349-1	50PAR30S/HAL/NSP10	120	630	2000	12.6
Philips	PAR-30S	50	26357-4	50PAR30S/HAL/NSP10	130	630	2000	12.6
Philips	PAR-30S	50	26358-2	50PAR30S/HAL/NFL30	120	630	2000	12.6
Philips	PAR-30S	50	26362-4	50PAR30S/HAL/NFL30	130	630	2000	12.6
Philips	PAR-30S	50	26364-0	50PAR30S/HAL/FL40	120	630	2000	12.6
Philips	PAR-30S	50	26384-8	50PAR30S/HAL/FL40	130	630	2000	12.6
Sylvania/OSRAM	PAR-30	50	14710	50PAR30/CAP/FL	120	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14533	50PAR30/CAP/FL	130	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14527	50PAR30/CAP/NFL	120	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14531	50PAR30/CAP/NFL	130	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14916	50PAR30/CAP/2NFL	120	580	2500	11.6
Sylvania/OSRAM	PAR-30	50	14526	50PAR30/CAP/NSP	120	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14530	50PAR30/CAP/NSP	130	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14537	50PAR30LN/CAP/WFL "Long Neck"	120	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14536	50PAR30LN/HAL/WFL/RP "Long Neck"	120	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14486	50PAR30LN/CAP/WFL "Long Neck"	130	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14520	50PAR30LN/CAP/NFL "Long Neck"	120	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14478	50PAR30LN/CAP/NFL "Long Neck"	130	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14509	50PAR30LN/CAP/NSP "Long Neck"	120	600	2500	12.0
Sylvania/OSRAM	PAR-30	50	14482	50PAR30LN/CAP/NSP "Long Neck"	130	600	2500	12.0

PAR Lamps between 51 – 59 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumen	Life	Effic
				Low values	120	780	6000	14.2
				High values	120	780	6000	14.2
GE	PAR38	55	40794	55PAR/HIR/SP12°/XL	120	780	6000	14.2
GE	PAR38	55	40792	55PAR/HIR/FL40°/XL	120	780	6000	14.2

PAR Lamps between 60 – 66 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumen	Life	Effic
				Low values	120	715	1750	11.0
				High values	130	1110	3000	18.5
GE	PAR38	60	25266	60PAR/H/SP10°	120	800	3000	13.3
GE	PAR38	60	25270	60PAR/H/SP10°	130	800	3000	13.3
GE	PAR38	60	25269	60PAR/H/FL25°	120	800	3000	13.3
GE	PAR38	60	25271	60PAR/H/FL25°	130	800	3000	13.3
GE	PAR30	60	27212	60PAR30/H/SP10°	120	800	3000	13.3
GE	PAR30	60	40167	60PAR30/H/FL25°	120	800	3000	13.3
GE	PAR30	60	27214	60PAR30/H/FL35°	120	800	3000	13.3
GE	PAR38	60	18627	60PAR/HIR/SP10°	120	1110	3000	18.5
GE	PAR38	60	18629	60PAR/HIR/SP10°	130	1110	3000	18.5
GE	PAR38	60	23227	60PAR/HIR/SP12°	120	1110	3000	18.5
GE	PAR38	60	18626	60PAR/HIR/FL30°	120	1110	3000	18.5

PAR Lamps between 60 – 66 Watts (continued)

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumen	Life	Effic
GE	PAR38	60	18628	60PAR/HIR/FL30°	130	1110	3000	18.5
GE	PAR38	60	10467	60PAR/HIR/FL40°	120	1110	3000	18.5
GE	PAR38	60	20947	60PAR/HIR/WFL	120	1110	3000	18.5
GE	PAR38	60	20948	60PAR/HIR/WFL	130	1110	3000	18.5
Philips	PAR-30S	60	35751-7	60PAR30S/HAL/NSP10	120	800	2500	13.3
Philips	PAR-30S	60	35752-5	60PAR30S/HAL/NSP10	130	800	2500	13.3
Philips	PAR-30S	60	35753-3	60PAR30S/HAL/NFL30	120	800	2500	13.3
Philips	PAR-30S	60	35788-9	60PAR30S/HAL/NFL30	130	800	2500	13.3
Philips	PAR-30S	60	35758-2	60PAR30S/HAL/FL40	120	800	2500	13.3
Philips	PAR-30S	60	35762-4	60PAR30S/HAL/FL40	130	800	2500	13.3
Philips	PAR-38	60	23059-9	60PAR38/HAL/SP10/WLL	120	880	3000	14.7
Philips	PAR-38	60	23309-8	60PAR38/HAL/SP10/WLL	130	880	3000	14.7
Philips	PAR-38	60	23062-3	60PAR38/HAL/WSP12/WLL	120	880	3000	14.7
Philips	PAR-38	60	23330-4	60PAR38/HAL/WSP12/WLL	130	880	3000	14.7
Philips	PAR-38	60	23065-6	60PAR38/HAL/FL28/WLL	120	880	3000	14.7
Philips	PAR-38	60	23356-9	60PAR38/HAL/FL28/WLL	130	880	3000	14.7
Philips	PAR-38	60	26385-5	60PAR38/HAL/WFL60/WLL	120	880	3000	14.7
Philips	PAR-38	60	28471-1	60PAR38/HAL/WFL60/WLL	130	880	3000	14.7
Sylvania/OSRAM	PAR-30	60	14333	60PAR30/CAP/NFL	120	830	3000	13.8
Sylvania/OSRAM	PAR-38	60	14468	60PAR/CAP/SPL/FL	120	880	3000	14.7
Sylvania/OSRAM	PAR-38	60	14448	60PAR/CAP/SPL/FL	130	880	3000	14.7
Sylvania/OSRAM	PAR-38	60	14469	60PAR/CAP/SPL/SP	120	880	3000	14.7
Sylvania/OSRAM	PAR-38	60	14449	60PAR/CAP/SPL/SP	130	880	3000	14.7
Sylvania/OSRAM	PAR-38	60	14423	60PAR/CAP/WSP	120	880	3000	14.7
Sylvania/OSRAM	PAR-38	65	13802	65PAR/FL	120	715	1750	11.0
Sylvania/OSRAM	PAR-38	65	13805	65PAR/FL	130	715	1750	11.0
Sylvania/OSRAM	PAR-38	65	13804	65PAR/SP	120	715	1750	11.0
Sylvania/OSRAM	PAR-38	65	13808	65PAR/SP	130	715	1750	11.0

PAR Lamps between 67 –85 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumen	Life	Effic
				Low values	120	750	2000	10.0
				High values	130	1500	3000	18.8
GE	PAR30	75	14802	75PAR30/H/SP10°	120	1030	3000	13.7
GE	PAR30	75	18056	75PAR30/H/SP10°	130	1030	3000	13.7
GE	PAR30	75	18057	75PAR30/H/FL25°	120	1030	3000	13.7
GE	PAR30	75	14779	75PAR30/H/FL35°	120	1030	3000	13.7
GE	PAR30	75	18060	75PAR30/H/FL35°	130	1030	3000	13.7
GE	PAR30	75	11124	75PAR30L/H/SP10°	120	940	3000	12.5
GE	PAR30	75	11129	75PAR30L/H/SP10°	130	940	3000	12.5
GE	PAR30	75	14943	75PAR30L/H/FL25°	120	940	3000	12.5
GE	PAR30	75	11131	75PAR30L/H/FL25°	130	940	3000	12.5
GE	PAR30	75	16393	75PAR30L/H/WFL	120	1050	3000	14.0
GE	PAR38	75	14751	75PAR/H/SP9°	120	1030	2500	13.7
GE	PAR38	75	14748	75PAR/H/FL25°	120	1030	2500	13.7
GE	PAR38	75	21389	75PAR/H/FL25°	130	1030	2500	13.7
Philips	PAR-38	75	37408-2	75PAR38/2FL	120	750	2000	10.0
Philips	PAR-30S	75	28479-4	75PAR30S/HAL/NSP10	120	965	2000	12.9
Philips	PAR-30S	75	28488-5	75PAR30S/HAL/NFL30	120	965	2000	12.9
Philips	PAR-30S	75	28491-9	75PAR30S/HAL/FL40	120	965	2000	12.9
Philips	PAR-30S	75	28492-7	75PAR30S/HAL/FL40	130	965	2000	12.9
Philips	PAR-30L	75	22930-2	75PAR30L/HAL/NSP9	120	940	2000	12.5
Philips	PAR-30L	75	22934-4	75PAR30L/HAL/SP16	120	940	2000	12.5
Philips	PAR-30L	75	22941-9	75PAR30L/HAL/NFL30	120	940	2000	12.5
Philips	PAR-30L	75	22943-5	75PAR30L/HAL/NFL30	130	940	2000	12.5
Philips	PAR-30L	75	22944-3	75PAR30L/HAL/FL40	120	940	2000	12.5
Philips	PAR-30L	75	22945-0	75PAR30L/HAL/FL40	130	940	2000	12.5

PAR Lamps between 67 –85 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumen	Life	Effic
Philips	PAR-38	75	28782-1	75PAR38/HAL/SP10WLL	120	1050	2500	14.0
Philips	PAR-38	75	28783-9	75PAR38/HAL/SP10/WLL	130	1050	2500	14.0
Philips	PAR-38	75	28784-7	75PAR38/HAL/FL28/WLL	120	1050	2500	14.0
Philips	PAR-38	75	28785-4	75PAR38/HAL/FL28/WLL	130	1050	2500	14.0
Sylvania/OSRAM	PAR-30	75	14603	75PAR30/CAP/NFL	120	1100	2500	14.7
Sylvania/OSRAM	PAR-30	75	14627	75PAR30/CAP/NFL	130	1100	2500	14.7
Sylvania/OSRAM	PAR-30	75	14604	75PAR30/CAP/NSP	120	1100	2500	14.7
Sylvania/OSRAM	PAR-30	75	14628	75PAR30/CAP/NSP	130	1100	2500	14.7
Sylvania/OSRAM	PAR-30	75	14606	75PAR30/CAP/FL	120	1100	2500	14.7
Sylvania/OSRAM	PAR-30	75	14629	75PAR30/CAP/FL	130	1100	2500	14.7
Sylvania/OSRAM	PAR-30	75	14786	75PAR30LN/CAP/NSP "Long Neck"	120	1100	2500	14.7
Sylvania/OSRAM	PAR-30	75	14777	75PAR30LN/CAP/NSP "Long Neck"	130	1100	2500	14.7
Sylvania/OSRAM	PAR-30	75	14769	75PAR30LN/CAP/NFL "Long Neck"	120	1100	2500	14.7
Sylvania/OSRAM	PAR-30	75	14778	75PAR30LN/CAP/NFL "Long Neck"	130	1100	2500	14.7
Sylvania/OSRAM	PAR-30	75	14768	75PAR30LN/CAP/WFL "Long Neck"	120	1100	2500	14.7
Sylvania/OSRAM	PAR-30	75	14785	75PAR30LN/CAP/WFL "Long Neck"	130	1100	2500	14.7
Sylvania/OSRAM	PAR-38	75	14513	75PAR/CAP/SPL/FL	120	1040	2500	13.9
Sylvania/OSRAM	PAR-38	75	14515	75PAR/CAP/SPL/FL	130	1040	2500	13.9
Sylvania/OSRAM	PAR-38	75	14514	75PAR/CAP/SPL/SP	120	1040	2500	13.9
Sylvania/OSRAM	PAR-38	75	14516	75PAR/CAP/SPL/SP	130	1040	2500	13.9
Sylvania/OSRAM	PAR-38	75	14510	75PAR/CAP/WSP	120	1040	2500	13.9
Sylvania/OSRAM	PAR-38	75	14517	75PAR/CAP/VWFL	130	1040	2500	13.9
GE	PAR38	80	27216	80PAR/HIR/SP10°	120	1500	3000	18.8
GE	PAR38	80	27217	80PAR/HIR/SP12°	120	1500	3000	18.8
GE	PAR38	80	27218	80PAR/HIR/FL25°	120	1500	3000	18.8

PAR Lamps between 86 –115 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumen	Life	Effic
				Low values	120	1260	2000	14.0
				High values	130	2070	6000	20.7
GE	PAR38	90	17450	90PAR/H/SP10°	120	1260	2500	14.0
GE	PAR38	90	13311	90PAR/H/SP10°	130	1260	2000	14.0
GE	PAR38	90	17451	90PAR/H/FL25°	120	1260	2500	14.0
GE	PAR38	90	13308	90PAR/H/FL25°	130	1260	2500	14.0
GE	PAR38	90	25727	90PAR/H/WFL	120	1260	2500	14.0
GE	PAR38	90	40795	90PAR/HIR/SP12°/XL	120	1470	6000	16.3
GE	PAR38	90	40791	90PAR/HIR/FL40°/XL	120	1470	6000	16.3
GE	PAR38	90	17691	90PAR/CB/H/FL25°	120	1260	2500	14.0
Philips	PAR-38	90	26559-5	90PAR38/HAL/SP12	120	1280	2000	14.2
Philips	PAR-38	90	26562-9	90PAR38/HAL/FL28	120	1280	2000	14.2
Philips	PAR-38	90	26599-1	90PAR38/HAL/SP12	130	1280	2000	14.2
Philips	PAR-38	90	26600-7	90PAR38/HAL/FL28	130	1280	2000	14.2
Philips	PAR-38	90	26877-1	90PAR38/HAL/FL28	120	1280	2000	14.2
Philips	PAR-38	90	23069-8	90PAR38/HAL/SP12/LL	120	1280	2500	14.2
Philips	PAR-38	90	23650-5	90PAR38/HAL/SP12LL	130	1280	2500	14.2
Philips	PAR-38	90	23070-6	90PAR38/HAL/FL28/LL	120	1280	2500	14.2
Philips	PAR-38	90	23651-3	90PAR38/HAL/FL28/LL	130	1280	2500	14.2
Philips	PAR-38	90	23646-3	90PAR38/HAL/WFL60/LL	120	1280	2500	14.2
Philips	PAR-38	90	24953-2	90PAR38/HAL/FL28/LL	120	1280	2500	14.2
Philips	PAR-38	90	28392-9	90PAR38/HAL/WFL60	130	1280	2500	14.2
Sylvania/OSRAM	PAR-38	90	14579	90PAR/CAP/SPL/FL	120	1300	2500	14.4
Sylvania/OSRAM	PAR-38	90	15545	90PAR/HAL/SPL/FL/RP	120	1300	2500	14.4
Sylvania/OSRAM	PAR-38	90	14577	90PAR/CAP/SPL/FL	130	1300	2500	14.4
Sylvania/OSRAM	PAR-38	90	14601	90PAR/CAP/NFL	130	1300	2500	14.4
Sylvania/OSRAM	PAR-38	90	14602	90PAR/CAP/WFL	130	1300	2500	14.4
Sylvania/OSRAM	PAR-38	90	14580	90PAR/CAP/SPL/SP	120	1300	2500	14.4

PAR Lamps between 86 –115 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumen	Life	Effic
Sylvania/OSRAM	PAR-38	90	15539	90PAR/HAL/SPL/SP/RP	120	1300	2500	14.4
Sylvania/OSRAM	PAR-38	90	14578	90PAR/CAP/SPL/SP	130	1300	2500	14.4
Sylvania/OSRAM	PAR-38	90	14586	90PAR/CAP/NSP	120	1300	2500	14.4
Sylvania/OSRAM	PAR-38	90	14587	90PAR/CAP/NSP	130	1300	2500	14.4
Sylvania/OSRAM	PAR-38	90	14971	90PAR/CAP/2FL	120	1260	2500	14.0
Sylvania/OSRAM	PAR-38	90	14973	90PAR/CAP/2FL	130	1260	2500	14.0
Sylvania/OSRAM	PAR-38	90	14972	90PAR/CAP/2SP	120	1260	2500	14.0
GE	PAR38	100	17992	100PAR/H/SP10°	120	1400	2000	14.0
GE	PAR38	100	17986	100PAR/H/FL25°	120	1400	2000	14.0
GE	PAR38	100	17947	100PAR/H/FL25°	130	1400	2000	14.0
GE	PAR38	100	18635	100PAR/HIR/SP10°	120	2070	3000	20.7
GE	PAR38	100	18636	100PAR/HIR/SP10°	130	2070	3000	20.7
GE	PAR38	100	18631	100PAR/HIR/FL25°	120	2070	3000	20.7
GE	PAR38	100	18633	100PAR/HIR/FL25°	130	2070	3000	20.7
GE	PAR38	100	10473	100PAR/HIR/FL40°	120	2070	3000	20.7

PAR Lamps between 116 –155 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumen	Life	Effic
				Low values	120	1700	750	11.3
				High values	130	2175	3000	15.8
Sylvania/OSRAM	PAR-38	120	14855	120PAR/CAP/SPL/FL	120	1900	3000	15.8
Sylvania/OSRAM	PAR-38	120	14861	120PAR/CAP/SPL/FL	130	1900	3000	15.8
Sylvania/OSRAM	PAR-38	120	14856	120PAR/CAP/SPL/SP	120	1900	3000	15.8
Sylvania/OSRAM	PAR-38	120	14874	120PAR/CAP/SPL/SP	130	1900	3000	15.8
Sylvania/OSRAM	PAR-38	120	14594	120PAR/CAP/WFL	120	1900	3000	15.8
GE	PAR38	150	26370	150PAR/FL/CVG	120	1700	2000	11.3
GE	PAR38	150	26371	150PAR/SP/CVG	120	1700	2000	11.3
Philips	PAR-38	150	37423-1	150PAR38/2FL	120-130		2000	
Sylvania/OSRAM	PAR-38	150	15608	150/OPAR/FL	120		2000	
Sylvania/OSRAM	PAR-38	150	13921	150PAR/SP	130	2175	800	14.5
Sylvania/OSRAM	PAR-38	150	13922	150PAR/FL	130	2175	750	14.5

PAR Lamps between 156 – 205Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumen	Life	Effic
(none)								

BR Lamps between 40 – 50 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumens	Life	Efficacy
				Low values	120	450	2000	10.0
				High values	120	485	2500	10.8
GE	BR30	45	20330	45R/FL/MI/1 6PK	120	485	2000	10.8
GE	BR30	45	26804	45R30/FL/LL	120	450	2500	10.0

BR Lamps between 51 – 59 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumens	Life	Efficacy
(none)								

BR Lamps between 60 – 66 Watts

Manufacturer	Lamp	Wattage	Product	Lamp Description	Volts	Lumens	Life	Efficacy

	Type		Code					
				Low values	120	700	2000	10.8
				High values	130	770	5000	11.8
GE	BR30	65	15711	75R30/SP/65WM	120	755	2000	11.6
GE	BR30	65	14264	75R30/SP/65WM	130	725	2000	11.2
GE	BR30	65	15709	75R30/FL/65WM	120	755	2000	11.6
GE	BR30	65	14263	75R30/FL/65WM	130	725	2000	11.2
GE	BR30	65	26639	75R30/FL/65WM/CVG	120		2000	
GE	BR30	65	20332	65R/SP/MI/16PK	120	755	2000	11.6
GE	BR30	65	20331	65R/FL/MI/16PK	120	755	2000	11.6
GE	BR30	65	18011	65R/FL/MI/TWIN	120	755	2000	11.6
GE	BR30	65	23520	65R30/SW 6PK	120	740	2000	11.4
GE	BR30	65	22978	65R30/PRO 6PK	130	725	2000	11.2
GE	BR30	65	22714	65R30/FL/COMM 12PK	120	770	2000	11.8
GE	BR40	65	14265	75R/FL/65WM	120	730	2000	11.2
GE	BR40	65	14266	75R/FL/65WM	130	700	2000	10.8
GE	BR40	65	14016	65R40/FL/MI 6PK	120	730	2000	11.2
GE	BR30	65	26805	65R30/FL/LL	120	725	2500	11.2
GE	BR30	65	26806	65R30/SP/LL	120	725	2500	11.2
Philips	BR-30	65	24876-5	65BR30FL/FL55 12/1	120		2000	
Philips	BR-30	65	24884-9	65BR30FL/FL55	130		2000	
Philips	BR-30	65	24882-3	65BR30/FL/LL55 12/1	120		2500	
Philips	BR-30	65	24877-3	65BR30/SP20 12/1	120		2000	
Philips	BR-30	65	24880-7	65BR30/SP20	130		2000	
Philips	BR-30	65	22546-6	65BR/SP20	120-130		2000	
Philips	BR-30	65	24885-6	65BR30/SP/LL20 12/1	120		2500	
Philips	BR-30	65	24452-5	65BR/SFL	120		5000	
Philips	BR-40	65	22536-7	65BR/FL60	120		2000	
Philips	BR-40	65	22535-9	65BR/FL60	120		2000	
Philips	BR-40	65	22537-5	65BR/FL60	130		2000	
Sylvania/OSRAM	BR-30	65	15165	65R30/FL	120		2000	
Sylvania/OSRAM	BR-30	65	13129	65BR30/FL	130		2000	
Sylvania/OSRAM	BR-30	65	15160	65BR30/FL/RP	120		2000	
Sylvania/OSRAM	BR-30	65	15149	65BR30/SP/RP	120		2000	

BR Lamps between 67 – 85 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumens	Life	Efficacy
				Low values	120	680	2000	9.1
				High values	130	720	2000	9.6
GE	BR38	75	18045	75PAR/FL/1/COMM 6PK	120	720	2000	9.6
Philips	BR-30	75	24903-7	75BR30/FL/TF	120		2000	
Sylvania/OSRAM	BR-40	75	15126	75BR/FL	120	680	2000	9.1
Sylvania/OSRAM	BR-40	75	15128	75BR/FL/RP	120	680	2000	9.1
Sylvania/OSRAM	BR-40	75	15125	75BR/FL	130	680	2000	9.1
Philips	BR-30	85	24897-1	85BR30/FL55 12/1	120		2000	
Philips	BR-30	85	24898-9	85BR30/SP20 12/1	120		2000	
Philips	BR-40	85	22527-6	85BR/FL60	120		2000	
Philips	BR-40	85	22528-4	85BR/FL60	130		2000	
Philips	BR-40	85	22539-1	85BR/SP20	130		2000	
Philips	BR-40	85	22542-5	85BR/FL60 8/1	120		2000	
Philips	BR-40	85	22694-4	85BR/SP20 8/1	120		2000	

BR Lamps between 86 – 115 Watts

Manufacturer	Lamp	Wattage	Product	Lamp Description	Volts	Lumens	Life	Efficacy

	Type		Code					
				Low values	120	935	2000	9.4
				High values	130	1100	2000	12.2
GE	BR40	90	14267	100R/FL/90WM	120	1100	2000	12.2
GE	BR40	90	14268	100/FL/90WM	130	1050	2000	11.7
GE	BR40	90	14017	90R40/FL/MI 6PK	120	1100	2000	12.2
Philips	BR-25	100	31572-1	100BR25/25	120		2000	
Sylvania/OSRAM	BR-40	100	14851	100BR/FL	120	935	2000	9.4
Sylvania/OSRAM	BR-40	100	14871	100BR/FL/RP	120	935	2000	9.4
Sylvania/OSRAM	BR-40	100	14847	100BR/FL	130	935	2000	9.4

BR Lamps between 116 – 155 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumens	Life	Efficacy
				Low values	120	1150	2000	9.6
				High values	130	1650	2000	13.3
GE	BR40	120	15048	150R/FL/120WM	120	1600	2000	13.3
GE	BR40	120	15746	150R/FL/120WM	130	1600	2000	13.3
GE	BR40	120	27428	150R/FL/120WM/CVG	130	1550	2000	12.9
GE	BR40	120	15047	150R/SP/120/WM	120	1600	2000	13.3
GE	BR40	120	22715	120R/FL/COMM 6PK	120	1600	2000	13.3
GE	BR40	120	20333	120R/FL/MI/1 6PK	120	1600	2000	13.3
GE	BR40	120	20824	120R/FLMI/TWIN	120	1600	2000	13.3
GE	BR40	120	22987	120R40/RPO 6PK	130	1600	2000	13.3
GE	BR40	120	20334	120R/SP/MI/1 6PK	120	1600	2000	13.3
Philips	BR-40	120	22533-4	120BR/FL60	120	1150	2000	9.6
Philips	BR-40	120	22541-7	120BR/FL60	120	1150	2000	9.6
Philips	BR-40	120	22532-6	120BRFL60	130	1150	2000	9.6
Philips	BR-40	120	22534-2	120BR/SP20 8/1	120-130	1250	2000	10.4
Philips	BR-40	120	22544-1	120BR/SP20	120-130	1250	2000	10.4
Sylvania/OSRAM	BR-40	120	14093	120BR/FL	120		2000	
Sylvania/OSRAM	BR-40	120	14899	120BR/FL	130		2000	
Sylvania/OSRAM	BR-40	120	14896	120BR/FL/RP	120		2000	
Sylvania/OSRAM	BR-40	120	14911	120BR/SP	120		2000	
Sylvania/OSRAM	BR-40	120	14909	120BR/SP	130		2000	
Sylvania/OSRAM	BR-40	120	14897	120BR/SP/RP	120		2000	
GE	BR38	150	18052	150PAR/FL/1/COMM 6PK	120	1650	2000	11.0

BR Lamps between 156 – 205 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumens	Life	Efficacy
Philips	BR-40	200	22654-8	200BR/FL	120		2000	0.0

BR Lamps between 156 – 205 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Lamp Description	Volts	Lumens	Life	Efficacy
				Low values	120		2000	
				High values	130		4000	
Sylvania/OSRAM	BR-38	250	14661	250K/BR38/FL	125		4000	0.0
Philips	BR-40	300	37441-3	300BR/FL	120-130		2000	0.0

Philips	BR-40	300	37442-1	300R/FL/1	120-130		2000	

ER Lamps between 40 – 50 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Description	Volts	Lumens	Life	Efficacy
				Low values	120	450	2000	9.0
				High values	130	525	2000	10.5
GE	ER30	50	44429	50ER30	120	525	2000	10.5
GE	ER30	50	11823	50ER30	130	525	2000	10.5
Sylvania/OSRAM	ER-30	50	15102	50ER30	120	450	2000	9.0
Sylvania/OSRAM	ER-30	50	15110	50ER30/RP	120	450	2000	9.0
Sylvania/OSRAM	ER-30	50	15107	50ER30	130	450	2000	9.0

ER Lamps between 51 – 59 Watts

8.1.1.1

Manufacturer	Lamp Type	Wattage	Product Code	Description	Volts	Lumens	Life	Efficacy
(none)								

ER Lamps between 60 – 66 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Description	Volts	Lumens	Life	Efficacy
(none)								

ER Lamps between 67 – 85 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Description	Volts	Lumens	Life	Efficacy
				Low Values	120	750	2000	10.0
				High Values	130	850	2000	11.3
GE	ER30	75	37044	75ER30	120	850	2000	11.3
GE	ER30	75	42850	75ER30	130	850	2000	11.3
Philips	ER-30	75	20572-4	75ER30	120		2000	
Philips	ER-30	75	29636-8	75ER30	130		2000	
Sylvania/OSRAM	ER-30	75	15100	75ER30	120	750	2000	10.0
Sylvania/OSRAM	ER-30	75	15109	75ER30/RP	120	750	2000	10.0
Sylvania/OSRAM	ER-30	75	15101	75ER30	130	750	2000	10.0

ER Lamps between 86 – 115 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Description	Volts	Lumens	Life	Efficacy
(none)								

ER Lamps between 116 – 155 Watts

Manufacturer	Lamp	Wattage	Product	Description	Volts	Lumens	Life	Efficacy

	Type		Code					
				Low Values	120	1370	2000	11.4
				High Values	130	1425	2000	11.9
GE	ER40	120	41607	120ER40	120	1425	2000	11.9
GE	ER40	120	43231	120ER40	130	1425	2000	11.9
Philips	ER-40	120	21562-4	120ER40	120		2000	
Philips	ER-40	120	21565-7	120ER40	130		2000	
Sylvania/OSRAM	ER-40	120	15166	120ER40	120	1370	2000	11.4
Sylvania/OSRAM	ER-40	120	15168	120ER40	130	1370	2000	11.4

ER Lamps between 156 – 205 Watts

Manufacturer	Lamp Type	Wattage	Product Code	Description	Volts	Lumens	Life	Efficacy
(none)								