

WHITE PAPER ON RETAIL LIGHTING ENERGY CODES

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Introduction

The beginning of the next code development cycle for the national energy codes, ASHRAE/IESNA 90.1 and IECC has started, and with it have been proposed highly restrictive provisions for retail lighting, hereinafter referred to as "90.1-P". These follow the imposition of highly restrictive retail lighting provisions in two state codes in the Pacific Northwest, Oregon and Washington in 2003-2004.

In my opinion, the proposals go much too far and there are severe ramifications. If enacted, they will

- force the use of ceramic metal halide display lighting even where it is not cost effective
- increase the cost of track and other display lighting systems in accent intensive designs by 300-500%
- unreasonably limit or prevent good lighting practice
- increase compliance documentation costs and complexity

These issues were carefully studied in developing the California Title 24 2005 Standards and while significant changes in Title 24 were introduced, the 90.1, IECC, and state code proposals are significantly more severe. I contend that these other proposals are wrong because the provisions require advanced technology that is not cost effective and in many cases will serve to prevent lighting design practices consistent with IESNA RP-2-01. In the interest of reasonable and fair energy codes, I believe that 90.1, IECC and the State developed codes should revert to 90.1-1999 or a proposed compromise presented below, until the cost effectiveness of ceramic metal halide (or alternative high efficacy display lighting) is proven at all applicable US energy rates.

Comparing Standards

The following tables compare the various current standards, proposals and specific historical standards

TABLE 1 - CURRENT, PROPOSED AND RELEVANT HISTORIC ENERGY CODES FOR LIGHTING IN THE US

Code	Base Allowance	General display Allowance	Wall Display Allowance	Floor Display Allowance	Allowance for ornamental lighting	Allowance for very valuable merchandise
Title 24 2005 Track 45 w/lf allows current limiting devices to reduce to 15 w/lf	0.9 w/sf RCR<3.5 1.2 w/sf RCR 3.5-7 1.4 w/sf RCR>7	NA	21 w/lf of sales area perimeter Height adjustment above 12' up to 2x at 20'	1.5 w/sf of sales area Height adjustment above 12' up to 2x at 20'	0.7 w/sf includes special effects lighting	1.3 w/sf of entire space or 20 w/sf of case area Height adjustment above 12' up to 2x at 20'
90.1-1999 Track 50 w/lf	2.1 w/sf	1.6 w/sf for general merchandise OR 3.9 w/sf for fine merchandise including fine apparel Entire sales area	NA	NA	1.0 w/sf	NA
90.1-2001 IECC-2000 Track 50 w/lf	2.1 w/sf	1.6 w/sf for general merchandise Entire sales area OR 3.9 w/sf for fine merchandise including fine apparel Limited to shelf or case area of actual display	NA	NA	1.0 w/sf	NA
90.1-2004 IECC-2004 Track 50 w/lf	1.7 w/sf	1.6 w/sf for general merchandise Entire sales area OR 3.9 w/sf for fine merchandise including fine apparel Limited to shelf or case area of actual display	NA	NA	1.0 w/sf	NA
90.1-PROP IECC-PROP Track 50 w/lf	1.5 w/sf	1.6 w/sf for general merchandise limited to 50% of the sales area OR 3.9 w/sf for fine merchandise including fine apparel Limited to shelf or case area of actual display	NA	NA	1.0 w/sf	NA
90.1-1989 Track 50 w/lf	Type A jewelry 5.6 w/sf x AF Type B fine merchandising 3.2 w/sf x AF Type C Mass merchandising 3.3 w/sf x AF Type D General merchandising 3.1 w/sf x AF Type E Food and miscellaneous 2.8 w/sf x AF Type F service establishments 2.7 x AF		NA	NA	NA	NA
Oregon 2003 Track 37.5 w/lf	2.0 w/sf all except 4.0 w/sf jewelry	NA	NA	NA	NA	NA
Washington Track 50 w/lf	1.5 w/sf	1.5 w/sf Height adjustment of 2% per ft above 12'	NA	NA	NA	NA

TABLE 2a - EXAMPLES *with* Decorative Lighting and Height Adjustments

<p>JEWELRY STORE 2400 sf (60 x 40) Three rooms with at least three walls (800 sf each) 12' ceiling 360 sf of display cases 320 lf of full height walls with 4 shelves 16" deep - 1706 sf of display shelves</p> <p>California 2005 General 2400 x 1.2 w/sf = 2880w Wall allowance 320 lf *21 = 6720 w Floor display allowance 1.5 * 2400 = 3600w Display case all 360*20 = 7200 Display case whole 2400*1.3 = 3120w Decorative 2400 * .7 = 1680w TOTAL ALLOWED 18,000 w 7.5 w/sf</p> <p>90.1-1999 General 2.1 x 2400 = 5040 Fine Allowance 3.9 x 2400 = 9360 Chandelier allowance 1.0 x 2400 = 2400 TOTAL ALLOWED 16,800 w 7.0 w/sf</p> <p>90.1-2004 General 1.7 x 2400 = 4080 Fine Allowance cabinets 3.9 x 360 = 1404 w Fine allowance shelves 3.9 x 1706 = 6653 w Chandelier allowance 1.0 x 2400 = 2400 TOTAL ALLOWED 14,537 w 6.1w/sf</p> <p>Oregon 2003 2400*4 w/sf = 9600 w 4.0 w/sf</p> <p>Washington 2004 2400 * 3.0 w/sf = 7200 w 3.0 w/sf</p> <p>Proposed 90.1/IECC 2400*1.5 w/sf 3600 w Cases 3.9 w/sf * 360 = 1404 Shelves 3.9 w/sf * 1706 = 6653 w Chandelier allowance 1.0 *2400 = 2400 TOTAL ALLOWED 14,057 w 5.9 w/sf</p> <p>90.1-1989 2400*5.6*1.3 = 17472 w 7.3 w/sf</p>	<p>HIGH END RETAIL BIG BOX (CRATE AND BARREL) 24,000 sf (150 x 160) 25% of space with ceiling at 20' open area RCR =3.5 50% of space with ceiling at 12' small areas <800 sf 25% of space with ceiling at 10' small areas <800 sf 1240 lf of full height walls with average 3 shelves 18" deep = 5580 sf of display shelves - 720 sf of cases</p> <p>California 2005 General 24000 x 1.2 w/sf = 28800w Wall allowance 1240 lf *21 = 26040 w Floor display allowance 1.5 * 24000 = 36000w Display case all 720*20 = 14400 Display case whole 24000*1.3 = 31200w Decorative 24000 * .7 = 16800w Height allowance 25,200w TOTAL ALLOWED 147,240 w 6.1 w/sf</p> <p>90.1-1999 General 2.1 x 24000 = 50400 Fine Allowance 3.9 x 24000 = 93600 Chandelier allowance 1.0 x 24000 = 24000 TOTAL ALLOWED 168,000 w 7.0 w/sf</p> <p>90.1-2004 General 1.7 x 24000 = 40800 Fine Allowance cabinets 3.9 x 720 = 2,808 w Fine allowance shelves 3.9 x 5580 = 21,762 w Chandelier allowance 1.0 x 24000 = 24,000 TOTAL ALLOWED 89,370 w 3.7w/sf</p> <p>Oregon 2003 24000*2 w/sf = 48,000 w 2.0 w/sf</p> <p>Washington 2004 24000 * 3.0 w/sf = 72000 w Height Allowance 1152 w TOTAL ALLOWED 73152 w 3.1 w/sf</p> <p>Proposed 90.1/IECC 24000*1.5 w/sf 36000 w Fine Allowance cabinets 3.9 x 720 = 2,808 w Fine allowance shelves 3.9 x 5580 = 21,762 w Chandelier allowance 1.0 *24000 = 24000 w TOTAL ALLOWED 84,570 w 3.5 w/sf</p> <p>90.1-1989 24000*3.2*1.4 = 107,520 w 4.5 w/sf</p>	<p>GENERAL MERCHANDISE (AIRPORT STORE) 1200 sf (40 x 30) One room with 10' ceiling RCR<2 60 sf of display cases 140 lf full height walls with 2 shelves 18" deep = 420 sf of display shelves</p> <p>California 2005 General 1200 x 0.9 w/sf = 1080w Wall allowance 140 lf *21 = 2940 w Floor display allowance 1.5 * 1200 = 1800w Display case all 60*20 = 1200 Display case whole 1200*1.3 = 1560w Decorative 1200 * .7 = 840 w TOTAL ALLOWED 7,860 w 6.5 w/sf</p> <p>90.1-1999 General 2.1 x 1200 = 2520 w General Allowance 1.6 x 1200= 1920 w Chandelier allowance 1.0 x 1200 = 1200 w TOTAL ALLOWED 5,640 w 4.7 w/sf</p> <p>90.1-2004 General 1.7 x 1200 = 2040 w General allowance display 1.6 x 1200 = 1920 w Chandelier allowance 1.0 x 1200= 1200 w TOTAL ALLOWED 5,160 w 4.3 w/sf</p> <p>Oregon 2003 1200*2 w/sf = 2400 w 2.0 w/sf</p> <p>Washington 2004 1200 * 3.0 w/sf = 3600 w 3.0 w/sf</p> <p>Proposed 90.1/IECC 1200*1.5 w/sf 1800 w General allowance display 1.6 x 1200 x .5 = 960 w Chandelier allowance 1.0 x 1200= 1200 w TOTAL ALLOWED 3960 w 3.3 w/sf</p> <p>90.1-1989 1200*3.3*1.2 = 4572 w 4.0 w/sf</p>
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TABLE 2b - EXAMPLES *without* Decorative Lighting and Height Adjustments

<p>MALL JEWELRY STORE 2400 sf (60 x 40) Three rooms with at least three walls (800 sf each) 12' ceiling 360 sf of display cases 320 lf of full height walls with 4 shelves 16" deep - 1706 sf of display shelves</p> <p>California 2005 General 2400 x 1.2 w/sf = 2880w Wall allowance 320 lf *21 = 6720 w Floor display allowance 1.5 * 2400 = 3600w Display case all 360*20 = 7200 Display case whole 2400*1.3 = 3120w TOTAL ALLOWED 16,320 w 6.8 w/sf</p> <p>90.1-1999 General 2.1 x 2400 = 5040 Fine Allowance 3.9 x 2400 = 9360 TOTAL ALLOWED 14400 w 6.0 w/sf</p> <p>90.1-2004 General 1.7 x 2400 = 4080 Fine Allowance cabinets 3.9 x 360 = 1404 w Fine allowance shelves 3.9 x 1706 = 6653 w TOTAL ALLOWED 12137 w 5.1w/sf</p> <p>Oregon 2003 2400*4 w/sf = 9600 w 4.0 w/sf</p> <p>Washington 2004 2400 * 3.0 w/sf = 7200 w 3.0 w/sf</p> <p>Proposed 90.1/IECC 2400*1.5 w/sf 3600 w Cases 3.9 w/sf * 360 = 1404 Shelves 3.9 w/sf * 1706 = 6653 w TOTAL ALLOWED 11657 w 4.9 w/sf</p> <p>90.1-1989 2400*5.6*1.3 = 17472 w 7.3 w/sf</p>	<p>HIGH END RETAIL BIG BOX (CRATE AND BARREL) 24,000 sf (150 x 160) 25% of space with ceiling at 20' open area RCR =3.5 50% of space with ceiling at 12' small areas <800 sf 25% of space with ceiling at 10' small areas <800 sf 1240 lf of full height walls with average 3 shelves 18" deep = 5580 sf of display shelves - 720 sf of cases</p> <p>California 2005 General 24000 x 1.2 w/sf = 28800w Wall allowance 1240 lf *21 = 26040 w Floor display allowance 1.5 * 24000 = 36000w Display case all 720*20 = 14400 Display case whole 24000*1.3 = 31200w TOTAL ALLOWED 105,240 w 4.4 w/sf</p> <p>90.1-1999 General 2.1 x 24000 = 50400 Fine Allowance 3.9 x 24000 = 93600 TOTAL ALLOWED 144,000 w 6.0 w/sf</p> <p>90.1-2004 General 1.7 x 24000 = 40800 Fine Allowance cabinets 3.9 x 720 = 2,808 w Fine allowance shelves 3.9 x 5580 = 21,762 w TOTAL ALLOWED 65,370 w 2.7w/sf</p> <p>Oregon 2003 24000*2 w/sf = 48,000 w 2.0 w/sf</p> <p>Washington 2004 24000 * 3.0 w/sf = 72000 w 3.0 w/sf</p> <p>Proposed 90.1/IECC 24000*1.5 w/sf 36000 w Fine Allowance cabinets 3.9 x 720 = 2,808 w Fine allowance shelves 3.9 x 5580 = 21,762 w TOTAL ALLOWED 60,570 w 2.5 w/sf</p> <p>90.1-1989 24000*3.2*1.4 = 107,520 w 4.5 w/sf</p>	<p>GENERAL MERCHANDISE (AIRPORT STORE) 1200 sf (40 x 30) One room with 10' ceiling RCR<2 60 sf of display cases 140 lf full height walls with 2 shelves 18" deep = 420 sf of display shelves</p> <p>California 2005 General 1200 x 0.9 w/sf = 1080w Wall allowance 140 lf *21 = 2940 w Floor display allowance 1.5 * 1200 = 1800w Display case all 60*20 = 1200 Display case whole 1200*1.3 = 1560w TOTAL ALLOWED 7020 w 5.9 w/sf</p> <p>90.1-1999 General 2.1 x 1200 = 2520 w General Allowance 1.6 x 1200 = 1920 w TOTAL ALLOWED 4,400 w 3.7 w/sf</p> <p>90.1-2004 General 1.7 x 1200 = 2040 w General allowance display 1.6 x 1200 = 1920 w TOTAL ALLOWED 3,960 w 3.3 w/sf</p> <p>Oregon 2003 1200*2 w/sf = 2400 w 2.0 w/sf</p> <p>Washington 2004 1200 * 3.0 w/sf = 3600 w 3.0 w/sf</p> <p>Proposed 90.1/IECC 1200*1.5 w/sf 1800 w General allowance display 1.6 x 1200 x .5 = 960 w TOTAL ALLOWED 2760 w 2.3 w/sf</p> <p>90.1-1989 1200*3.3*1.2 = 4572 w 4.0 w/sf</p>
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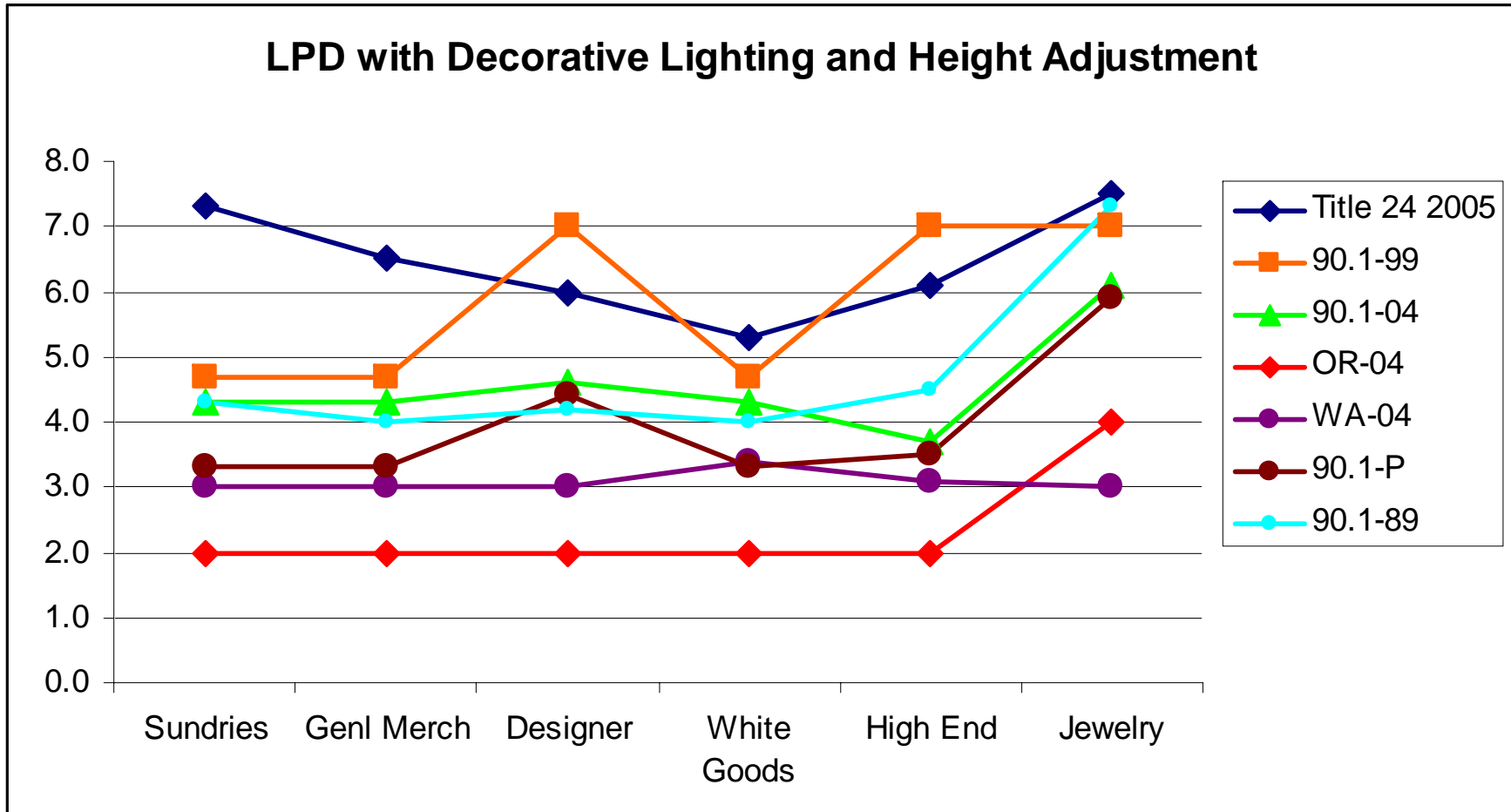
TABLE 3a – EXAMPLES *with* Decorative Lighting and Height Adjustments

<p>BIG BOX WHITE GOODS STORE 12,000 sf (100x120) One big room with 18' ceiling RCR<2 No display cases No fine merchandise Free standing displays</p> <p>California 2005 General 12000 x 0.9 w/sf = 10,800w Wall allowance 440 lf *21 = 9,240 w Floor display allowance 1.5 * 12000 = 18,000 w Height Allowance .65*27240 = 17706 w Decorative Allowance .7 x 12000 = 8400 w TOTAL ALLOWED 64,146 w 5.3 w/sf</p> <p>90.1-1999 General 2.1 x 12000 = 25,200 General Allowance 1.6 x12000 = 19,200w Decorative Allowance 12000 w TOTAL ALLOWED 56,400 w 4.7 w/sf</p> <p>90.1-2004 General 1.7 x 12000= 20,400 General allowance 1.6 x 12000 = 19,200 Decorative Allowance 12000 w TOTAL ALLOWED 51,600 w 4.3 w/sf</p> <p>Oregon 2003 12000*2 w/sf = 24000 w 2.0 w/sf</p> <p>Washington 2004 12000* 3.0 w/sf = 36000 w Height Adjustment 4320 w TOTAL ALLOWED 40320 w 3.4 w/sf</p> <p>Proposed 90.1/IECC General 12000*1.5 w/sf 18000 w General allowance 12000 x 1.6 x .5 = 9600w Decorative Allowance 12000 w TOTAL ALLOWED 39600 w 3.3 w/sf</p> <p>90.1-1989 12000*3.3*1.2 = 47520 w 4.0 w/sf</p>	<p>DESIGNER CLOTHING RETAIL 4,800 sf (80 x 60) 12' high ceiling spaces divided into 600 sf areas 480 lf of full height walls with average 3 shelves 18" deep = 2160sf of display shelves - 120 sf of cases</p> <p>California 2005 General 4800 x 1.2 w/sf = 5760w Wall allowance 480 lf *21 = 10080 w Floor display allowance 1.5 * 4800 = 7200w Display case all 120*20 = 2400 Display case whole 4800*1.3 = 62400w Decorative lighting .7 x 4800 TOTAL ALLOWED 28,880 w 6.0 w/sf</p> <p>90.1-1999 General 2.1 x 4800 = 10080 w Fine Allowance 3.9 x 4800 = 18,720 w Decorative Allowance 4800 w TOTAL ALLOWED 33,600 w 7.0 w/sf</p> <p>90.1-2004 General 1.7 x 4800 = 8160 w Fine Allowance cabinets 3.9 x 120 = 468 w Fine allowance shelves 3.9 x 2160 = 8,424 w Decorative Allowance 4800 w TOTAL ALLOWED 21,852w 4.6 w/sf</p> <p>Oregon 2003 4800*2 w/sf = 9,600 w 2.0 w/sf</p> <p>Washington 2004 4800 * 3.0 w/sf = 14,400 w 3.0 w/sf</p> <p>Proposed 90.1/IECC 4800*1.5 w/sf 7200 w Fine Allowance cabinets 3.9 x 120 = 468 w Fine allowance shelves 3.9 x 2160 = 8,424 w Decoative Allowance 4800 TOTAL ALLOWED 20,892 w 4.4 w/sf</p> <p>90.1-1989 4800*3.2*1.3 = 19,968 w 4.2 w/sf</p>	<p>SUNDRIES STORE 600 sf (20 x 30) One room with 10' ceiling RCR<3 20 sf of display cases 70 lf full height walls with 4 shelves 18" deep = 560sf of display shelves</p> <p>California 2005 General 600 x 0.9 w/sf = 540w Wall allowance 100 lf *21 = 2100w Floor display allowance 1.5 * 600 = 900w Display case all 20*20 = 400 Display case whole 600*1.3 = 780w Decorative lighting .7 x 600 TOTAL ALLOWED 4360 w 7.3 w/sf</p> <p>90.1-1999 General 2.1 x 600 = 1260 w General Allowance 1.6 x 1200= 960 w Decorative lighting 600 w TOTAL ALLOWED 2800 w 4.7 w/sf</p> <p>90.1-2004 General 1.7 x 600 = 1020 w General allowance display 1.6 x 600 = 960w Decorative lighting 600 w TOTAL ALLOWED 2580 w 4.3 w/sf</p> <p>Oregon 2003 600*2 w/sf = 1200 w 2.0 w/sf</p> <p>Washington 2004 600 * 3.0 w/sf = 1800 w 3.0 w/sf</p> <p>Proposed 90.1/IECC 600*1.5 w/sf 900 w General allowance display 1.6 x 600 x .5 = 480w Decorative lighting 600 w TOTAL ALLOWED 1980 w 3.3 w/sf</p> <p>90.1-1989 600*3.3*1.3 = 2574 w 4.3 w/sf</p>
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TABLE 3b – Examples *without* Decorative Lighting or Height Adjustments

<p>BIG BOX WHITE GOODS STORE 12,000 sf (100x120) One big room with 18' ceiling RCR<2 No display cases No fine merchandise Free standing displays</p> <p>California 2005 General 12000 x 0.9 w/sf = 10,800w Wall allowance 440 lf *21 = 9,240 w Floor display allowance 1.5 * 12000 = 18,000 w TOTAL ALLOWED 38,040 w 3.2 w/sf</p> <p>90.1-1999 General 2.1 x 12000 = 25,200 General Allowance 1.6 x12000 = 19,200w TOTAL ALLOWED 44,400 w 3.7 w/sf</p> <p>90.1-2004 General 1.7 x 12000= 20,400 General allowance 1.6 x 12000 = 19,200 TOTAL ALLOWED 39,600 w 3.3 w/sf</p> <p>Oregon 2003 12000*2 w/sf = 24000 w 2.0 w/sf</p> <p>Washington 2004 12000* 3.0 w/sf = 36000 w 3.0 w/sf</p> <p>Proposed 90.1/IECC General 12000*1.5 w/sf 18000 w General allowance 12000 x 1.6 x .5 = 9600w TOTAL ALLOWED 27600 w 2.3 w/sf</p> <p>90.1-1989 12000*3.3*1.2 = 47520 w 4.0 w/sf</p>	<p>DESIGNER CLOTHING RETAIL 4,800 sf (80 x 60) 12' high ceiling spaces divided into 600 sf areas 480 lf of full height walls with average 3 shelves 18" deep = 2160sf of display shelves - 120 sf of cases</p> <p>California 2005 General 4800 x 1.2 w/sf = 5760w Wall allowance 480 lf *21 = 10080 w Floor display allowance 1.5 * 4800 = 7200w Display case all 120*20 = 2400 Display case whole 4800*1.3 = 62400w TOTAL ALLOWED 25,440 w 5.3 w/sf</p> <p>90.1-1999 General 2.1 x 4800 = 10080 w Fine Allowance 3.9 x 4800 = 18,720 w TOTAL ALLOWED 28,800 w 6.0 w/sf</p> <p>90.1-2004 General 1.7 x 4800 = 8160 w Fine Allowance cabinets 3.9 x 120 = 468 w Fine allowance shelves 3.9 x 2160 = 8,424 w TOTAL ALLOWED 17,052 w 3.6 w/sf</p> <p>Oregon 2003 4800*2 w/sf = 9,600 w 2.0 w/sf</p> <p>Washington 2004 4800 * 3.0 w/sf = 14,400 w 3.0 w/sf</p> <p>Proposed 90.1/IECC 4800*1.5 w/sf 7200 w Fine Allowance cabinets 3.9 x 120 = 468 w Fine allowance shelves 3.9 x 2160 = 8,424 w TOTAL ALLOWED 16,092 w 3.4 w/sf</p> <p>90.1-1989 4800*3.2*1.3 = 19,968 w 4.2 w/sf</p>	<p>SUNDRIES STORE 600 sf (20 x 30) One room with 10' ceiling RCR<3 20 sf of display cases 70 lf full height walls with 4 shelves 18" deep = 560sf of display shelves</p> <p>California 2005 General 600 x 0.9 w/sf = 540w Wall allowance 100 lf *21 = 2100w Floor display allowance 1.5 * 600 = 900w Display case all 20*20 = 400 Display case whole 600*1.3 = 780w TOTAL ALLOWED 3940 w 6.5 w/sf</p> <p>90.1-1999 General 2.1 x 600 = 1260 w General Allowance 1.6 x 1200= 960 w TOTAL ALLOWED 2200 w 3.7 w/sf</p> <p>90.1-2004 General 1.7 x 600 = 1020 w General allowance display 1.6 x 600 = 960w TOTAL ALLOWED 1980 w 3.3 w/sf</p> <p>Oregon 2003 600*2 w/sf = 1200 w 2.0 w/sf</p> <p>Washington 2004 600 * 3.0 w/sf = 1800 w 3.0 w/sf</p> <p>Proposed 90.1/IECC 600*1.5 w/sf 900 w General allowance display 1.6 x 600 x .5 = 480w TOTAL ALLOWED 1380 w 2.3 w/sf</p> <p>90.1-1989 600*3.3*1.3 = 2574 w 4.3 w/sf</p>
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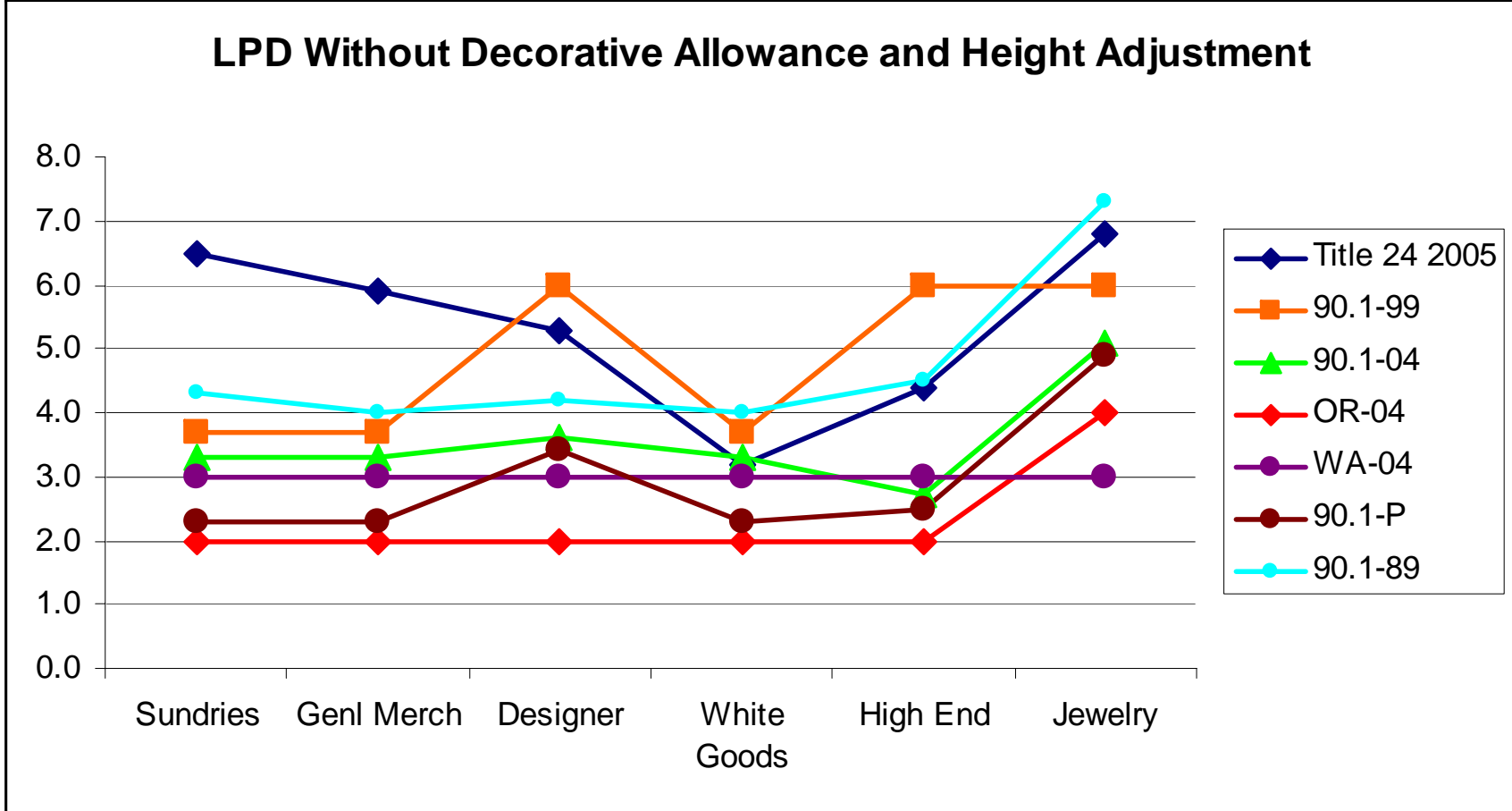
LPD with Decorative Lighting and Height Adjustment



This chart shows the various energy codes and how they apply to real life lighting applications. In general, there is a reasonable correlation between California Title 24 and ASHRAE/IESNA 90.1-1999, and both are much more than most other codes.

Standards 90.1-89, 90.1-2004 and 90.1-P (including IECC) are clumped in the middle.

Washington almost always the second lowest allowance, with Oregon significantly lower than any other standard except for jewelry, where Oregon and Washington, being much lower than the others, swap places at the bottom.



Only two standards – California Title 24 and ASHRAE/IESNA 90.1-89 – provide significant additional power when mounting heights are greater than normal. Washington provides a modest increase. However, California Title 24, 90.1-99, 90.1-2004, and 90.1P all provide decorative lighting allowances. When these additional allowances, which are not intended to increase light levels, are removed, the correlation among codes improves. Without decorative lighting, 90.1-P becomes as stringent as the Oregon and Washington codes, except for jewelry stores, where the Washington and Oregon codes are uniquely lower than the others.

Implications

California Title 24

The rationale behind California Title 24 standards can be found at

http://www.energy.ca.gov/title24/2005standards/archive/documents/2002-07-18_workshop/presentations/2002-07-23_LIGHTING.PDF

In developing its 2005 Standards, California determined several key things:

- In the opinion of lighting designers in California, the proposed standards permit reasonable lighting design practice in California as long as retailers refrain from unnecessary wasteful practices like incandescent downlighting. Bernie Bauer, IALD and Brian Liebel, PE, testified in support.
- The basis of display lighting in California is halogen IR lamps. A challenge by PG&E to effectively require ceramic metal halide was dismissed when it was demonstrated that ceramic metal halide lighting did not meet the statutory cost effectiveness criteria
- The standard needed to be simpler, resulting in the new Tailored Method

In general, Title 24 is the most generous energy code in the nation among those meeting the Federal Energy Policy Act of 1992.

ASHRAE/IESNA 90.1 and IECC

Standard 90.1-1999 fairly closely matches Title 24. However, with 90.1-2001, a critical change in the retail display lighting allowance was made. It changed the intent of the 90.1 standard from an overall allowance throughout the sales area, to a specific allocation for the higher power allowance restricted to the actual display area. The net effect is to make the design of designer and high end stores much more restrictive and/or expensive (see later). The 2004 revisions continued this and reduced the general lighting allowance 20%. I remain very concerned that these changes are NOT with the blessing of the IESNA Retail Committee.

The big problem is the proposed changes to 90.1 ("90.1-P"). These changes will reduce lighting power allowances in almost all store types to ½ of the allowed power in California. The biggest impact is on small stores where there is little or no ability to juggle power. The net effect will be to make the cost of lighting for the smallest stores up to 500% more expensive than current codes.

Oregon and Washington

Compared to the other codes (except for 90.1P) these two energy codes are completely disconnected. A group of lighting designers in Oregon has approached the Office of Energy with an emergency proposed change. This leaves Washington alone as a state in which for whatever reason, there seems to be no recognition of the depth of the problem.

Opinion

Based on my work in developing California Title 24 and my service on the 90.1-99 committee, I do not believe that at this time the 90.1 and IECC committees are properly addressing retail lighting. **I strongly recommend rejecting any further changes in 90.1 and IECC specifically the current proposal by Jeff Johnson posted on the IECC website.**

In the long run, I think 90.1 should be repaired. The current allowance for “fine merchandise” requires calculating the display area including every shelf. This is a considerable implication with respect to documentation complexity, and probably unnecessary. Recognizing that it is hard to go backwards, as a compromise, I suggest improving 90.1 (and IECC) by changing the retail lighting allowances as follows:

Retail Base Allowance: 1.5 w/sf

Display Allowance (except for very valuable merchandise) 2.5 w/sf for up to 100% of the sales area

Display Allowance for very valuable merchandise*: 3.9 w/sf for up to 100% of the sales area.

Decorative Lighting Allowance: 1.0 w/sf

For stores with both very valuable merchandise and other merchandise, only the portion of the store in which very valuable merchandise is located may use the higher allowance.

**Very valuable merchandise should be limited to include jewelry, silver, china and very valuable collectables.*

This would make 90.1 and IECC middle of the road – less than California but a compromise of all other standards.

I strongly recommend that Oregon and Washington drop their current codes and consider using the above recommendation. This recommendation is LESS than 90.1-1989 and 90.1-1999.

The Threat of Added Costs

Store design generally involves a layered design in which certain light sources are better than others.

1. General lighting, for which fluorescent, compact fluorescent, and HID lamps are suitable.
2. Linear display lighting, such as valances, for which fluorescent is also suitable.
3. Decorative lighting, for which tungsten lighting is still preferred in order to create the proper ambience.
4. Wash lighting, for which fluorescent, HID and tungsten sources can be used.
5. Display lighting, for which tungsten and low wattage HID sources can be used

The last two will be most directly affected by these on-going changes. In the Title 24 process, it was determined that the opportunity to reduce retail lighting power density hinged on the cost effectiveness of ceramic metal halide.

The math is relatively simple: a PAR38 halogen IR 90 watt display lamp, suitable for typical 10-12' mounting height, produces about the same mean beam candlepower as a 39 watt PAR30 ceramic metal halide. Including ballast loss, the ceramic metal halide operates at 45 watts. Assuming 12/7 operation plus maintenance periods, the annual use is about 5000 hours.

- A halogen display luminaire costing about \$40 including lamp will consume 450 kWh and add about 150 kWh of air conditioning costs in a southern climate. At 10 cents per kWh, this costs about \$60 per year. In addition, there will be 1.67 burnouts costing about \$15 each (lamp and labor) to fix, resulting in total annual operating costs of about \$85.00.
- A ceramic metal halide display luminaire costing about \$200 including lamp will consume about 225 kWh and add about 75 kWh of air conditioning costs in a southern climate. At 10 cents per kWh, this costs about \$30 per year. In addition, there will be about .55 burnouts costing about \$50 each (lamp and labor) to fix, and about .05 ballast failures per year costs about \$100 to fix, resulting in annual operating costs of about \$62.50.
- The difference in annual cost is \$22.50 per luminaire. The difference in luminaire cost is \$160, so the simple payback period is about 7.1 years.

In California, it was successfully argued that in order to be cost effective as a retail lighting system, the ceramic metal halide luminaire needed to pay back within a five year lease.

Using metal halide will increase the cost of display lighting by about 400%. However, within a 5 year lease, this investment *will probably be repaid* under the following conditions:

- Very high utility rates averaging over 15 cents per kWh
- High rates (over 10 cents) and a year round cooling climate
- Unusually high operating hours (24/7) and high rates

Conversely, under the following conditions the original investment *will not be repaid* at a reasonable rate, if at all:

- Unusually low electric rates (7 cents or less average)
- Low electric rates and a northern climate (10 cents or less, average)
- Low rates and short operating hours

If stores lack the ability to offset capital expenses with operating savings, it may not be possible to justify using ceramic metal halide at all, given the high cost of the initial installation.

Track

Lighting track was turned from retail lighting's greatest invention to a major problem by energy codes. This is as much the fault of the National Electric Code as anything.

However, few contractors, engineers and inspectors know that the code changed 9 years ago. In the 1996 NEC, a fine print note (FPN) was added to Article 410-103 explaining that the watts-per-foot rating of track was intended only for feeder and service calculations, and as many feet of track as desired could be connected to a 20 amp branch circuit. This was a dramatic change from the 90 VA per foot effectively requiring a new 20 amp circuit for every 21', 4" of track. Starting in 1999, there is no longer an article 410-103 - the watts per foot of track has been moved to the section on feeders and services.

In addition, a new inline current limiting device is available that determines the VA rating of all downstream track. Also, a low voltage transformer can be used to limit track load.

California Title 24 is writing new rules that permit the designer to choose one of three ratings: (1) the VA of track determined by branch circuit breakers; or (2) 45 VA/foot or the actual load whichever is greater; or (3) the sum VA of transformer or inline limiter ratings. If inline limiters are used, track must be counted at least 15 VA per foot. **All codes should be updated to use these evolving values.**

What Does This Mean to Store Developers?

In California

- Use the tailored method
- Use full height interior partitions- maximize lf of walls
- High ceilings are not a problem
- Use decorative lighting

In 90.1 States

- Always claim “fine merchandise”
- Count every inch of display shelves and countertops
- Use decorative lighting
- Don’t build stores with high ceilings

In IECC states

- Always claim “fine merchandise”
- Count every inch of display shelves and countertops
- Don’t use decorative lighting
- Don’t build stores with high ceilings

In Oregon and Washington

- Think twice about building.