

# LIGHTING RETROFITS

T8 vs. T5 Technology  
Best Practices

(an abbreviated perspective)

**Rich Fair, LC**  
**Philips Lighting**

**Made Possible by-**

**Colorado Green Building Guild**

**Boulder County *energySMART***

**Denver Energy Challenge**

# Replacing HID High-Bays

- 458 Watts vs 360 or less alternative
- 20K Hr Lamp Life vs 30K Hrs or Greater
- 3 minute warm-up time
- 15 Minute re-strike time
- Cannot use motion sensors
- Requires back-up Halogen or other for instant on
- Lamp Color Variation—CCT Variances
- Volatile Lamp Source
- Glare---a Harsh point-source
- Hard to achieve uniformity
- Poor lumen maintenance
- Low CRI



# Fluorescent Advantages vs HID

- Use of Sensors
- Better Uniformity
- Energy Savings
- Better Color rendering
- Instant-on
- Longer lamp life
- Eliminates point source glare
- Wide variety of Color temperature options

## Highbay retrofit options

400 W MH	6-L T8	8-L T8	6-L T5HO
458 watts	220 watts	294 watts	360 watts
24,500 lumens	21,240 lumens	28,320 lumens	28,500 lumens
54 LPW (79 initial)	97 LPW (101 initial)	97 LPW (101 initial)	79 LPW (83 initial)

# Gymnasiums- *Do the Right Thing!*

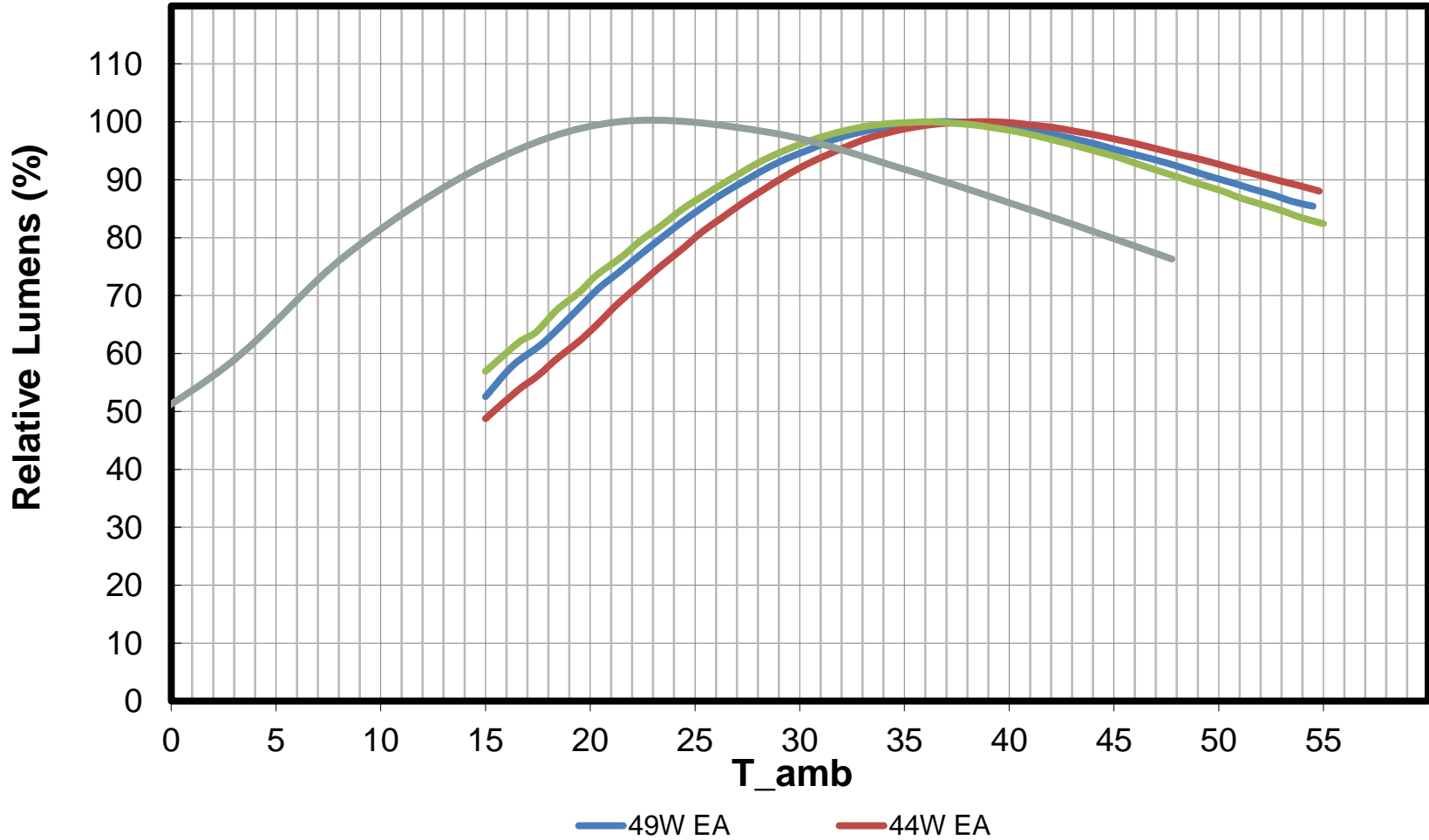
- Wire Guards
- Locking Sockets
- DR Rubberized Acrylic Lenses
- Don't Under-light the space
- Optional-Inboard/Outboard Ballast Switching

# T8 vs. T5H0

	T5	T8
Lamp Replacement Cost		X
Highest Efficiency/LPW		X
CRI	X	X
Ambient Temperature Performance		X
High Ceiling Applications	X	
Low Ceiling Applications (<15 feet)		X
Retro-Fitting T12 Systems		X
BF Choices for Lumen Output Requirements		X
Lower Lamp Wattage Alternatives	X	X
Compact Luminaire Design	X	
Emergency Circuit Cost		X

# Relative Lumens vs. Ambient Temperature

T5HO and F32T8/800

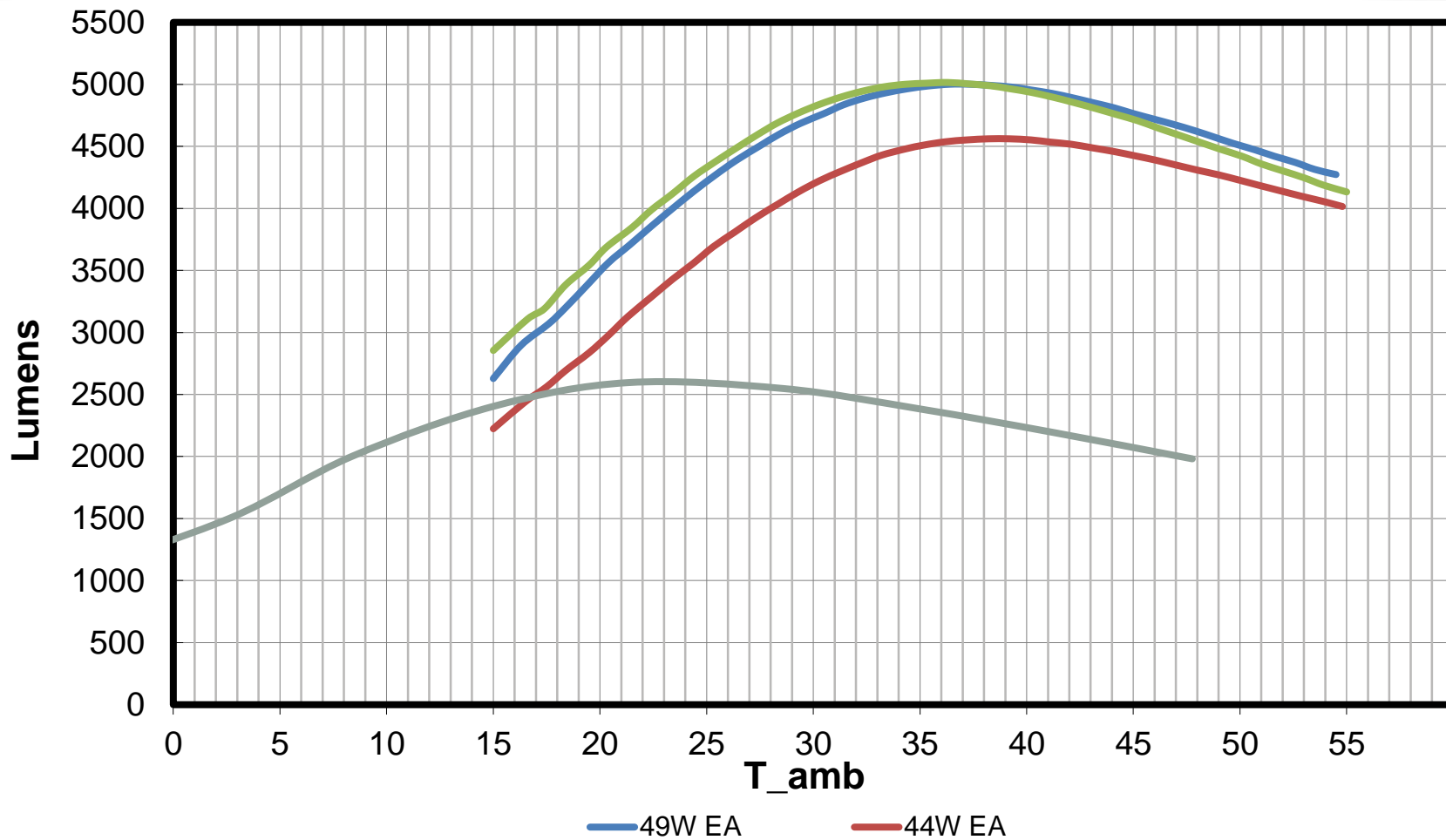


T5HO – Ballast Factor = 1.0

F32T8 – Ballast Factor = 0.88

# Lumens vs. Ambient Temperature

T5HO and F32T8/800



T5HO – Ballast Factor = 1.0

F32T8 – Ballast Factor = 0.88



# Tools of the Trade!

- Light Meter
- Ballast Checker
- Notepad
- Criteria List/Existing Situation/Goals of the End-user

# Note the Existing Lighting Criteria

- Get accurate fixture count
- Determine KWHR Rate
- Fixture types (Are they still in good shape?)-  
lenses bad? Sockets?
- Ballast types – mfg & part # (need to open  
fixtures and look inside)
- Lamp types /Lamps per fixture
- Take light readings (foot candles measurements)
- Note other conditions – dual switching,  
emergency ballasts, dimming, etc.
- Name of each Area and Burn Time--  
Hours/Day/Days/Week

# Formulas

- Energy savings
  - $\text{watts saved} \div 1000 = (\text{KW}) \times \text{annual hours} \times \text{energy cost } (\$/\text{KWH}) = \text{annual } \$ \text{ energy savings}$
- Simple payback
  - $\$ \text{ project investment} \div \$ \text{ annual savings} = \text{simple payback in years}$
- ROI
  - $\$ \text{ annual savings} \div \$ \text{ project investment} = \text{ROI}$  (change decimal to percentage)

# Annual cost per watt

HOURS PER DAY  
DAYS PER WEEK

\$ Rate/ KWH	8 hours			10 hours			12 hours			14 hours			18 hours			24 hours		
	5 days	6 days	7 days	5 days	6 days	7 days	5 days	6 days	7 days	5 days	6 days	7 days	5 days	6 days	7 days	5 days	6 days	7 days
.01	.02	.02	.03	.03	.03	.04	.03	.04	.04	.04	.04	.05	.05	.06	.07	.06	.07	.09
.02	.04	.05	.06	.05	.06	.07	.06	.07	.09	.07	.09	.10	.09	.11	.13	.12	.15	.17
.03	.06	.07	.09	.08	.09	.11	.09	.11	.13	.11	.13	.15	.14	.17	.20	.19	.22	.26
.04	.08	.10	.12	.10	.12	.15	.12	.15	.17	.15	.17	.20	.19	.22	.26	.25	.30	.35
.05	.10	.12	.15	.13	.16	.18	.16	.19	.22	.18	.22	.25	.23	.28	.33	.31	.37	.44
.06	.12	.15	.17	.16	.19	.22	.19	.22	.26	.22	.26	.31	.28	.34	.39	.37	.45	.52
.07	.15	.17	.20	.18	.22	.25	.22	.26	.31	.25	.31	.36	.33	.39	.46	.44	.52	.61
.08	.17	.20	.23	.21	.25	.29	.25	.30	.35	.29	.35	.41	.37	.45	.52	.50	.60	.70
.09	.19	.22	.26	.23	.28	.33	.28	.34	.39	.33	.39	.46	.42	.51	.59	.56	.67	.79
.10	.21	.25	.29	.26	.31	.36	.31	.37	.44	.36	.44	.51	.47	.56	.66	.62	.75	.87
.11	.23	.27	.32	.29	.34	.40	.34	.41	.48	.40	.48	.56	.51	.62	.72	.69	.82	.96
.12	.25	.30	.35	.31	.37	.44	.37	.45	.52	.44	.52	.61	.56	.67	.79	.75	.90	1.05
.13	.27	.32	.38	.34	.41	.47	.41	.49	.57	.47	.57	.66	.61	.73	.85	.81	.97	1.14
.14	.29	.35	.41	.36	.44	.51	.44	.52	.61	.51	.61	.71	.66	.79	.92	.87	1.05	1.22
.15	.31	.37	.44	.39	.47	.55	.47	.56	.66	.55	.66	.76	.70	.84	.98	.94	1.12	1.31
.16	.33	.40	.47	.42	.50	.58	.50	.60	.70	.58	.70	.82	.75	.90	1.05	1.00	1.20	1.40
.17	.35	.42	.50	.44	.53	.62	.53	.64	.74	.62	.74	.87	.80	.95	1.11	1.06	1.27	1.49
.18	.37	.45	.52	.47	.56	.66	.56	.67	.79	.66	.79	.92	.84	1.01	1.18	1.12	1.35	1.57
.19	.40	.47	.55	.49	.59	.69	.59	.71	.83	.69	.83	.97	.89	1.07	1.24	1.19	1.42	1.66
.20	.42	.50	.58	.52	.62	.73	.62	.75	.87	.73	.87	1.02	.94	1.12	1.31	1.25	1.50	1.75
.21	.44	.52	.61	.55	.66	.76	.66	.79	.92	.76	.92	1.07	.98	1.18	1.38	1.31	1.57	1.83
.22	.46	.55	.64	.57	.69	.80	.69	.82	.96	.80	.96	1.12	1.03	1.24	1.44	1.37	1.65	1.92
.23	.48	.57	.67	.60	.72	.84	.72	.86	1.00	.84	1.00	1.17	1.08	1.29	1.51	1.44	1.72	2.01
.24	.50	.60	.70	.62	.75	.87	.75	.90	1.05	.87	1.05	1.22	1.12	1.35	1.57	1.50	1.80	2.10
.25	.52	.62	.73	.65	.78	.91	.78	.94	1.09	.91	1.09	1.27	1.17	1.40	1.64	1.56	1.87	2.18

# 2 x 2 Luminaire Retro-Fit

<b>Lamp</b>	<b>Mean Lumens</b>	<b>Input Watts</b>	<b>BF</b>	<b>LUMENS</b>	<b>Life hours</b>	<b>CRI</b>
<b>2-FB34T12/CW</b>	<b>2050x2=4100</b>	<b>72</b>	<b>.88</b>	<b>3600</b>	<b>18 K</b>	<b>59</b>
<b>3-F17 T8/TL841</b>	<b>1280x3=3840</b>	<b>45</b>	<b>.90</b>	<b>3840 NLO</b>	<b>24/30K</b>	<b>85</b>
		<b>40</b>	<b>.81</b>	<b>3456 LW</b>	<b>24/30K</b>	<b>85</b>
<b>2-FB32T8/25 W</b>	<b>2330x2=4660</b>	<b>38</b>	<b>.77</b>	<b>3588 LW</b>	<b>24/30K</b>	<b>85</b>

# 2 x 4 Luminaire Retro-Fit

<u>Lamp</u>	<u>Mean Lumens</u>	<u>Input Watts</u>	<u>BF</u>	<u>LUMENS</u>	<u>Life hours</u>	<u>CRI</u>
4-F34T12/CW	2300x4=9200	144	.88	8096	20 K	59
2-F32T8/ADV841	3000x2=6000	73	1.18	7080-HL	24/30K	85
4-FB32T8/25 W	2330x4=9320	76	.77	7176-LW	24/30K	85

# Best Practices – A few more

- Clean Lenses
- Mock-ups
- Utilize IES fc recommendations

# Questions ???