Gap Between Marketing Hype and Best Practice for Lighting

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ABSTRACT

With so many new technologies, products, and strategies, it can be difficult even for lighting experts to understand all of the differences between marketing hype and best practice. Marketing literature can make many products look like the best thing since sliced bread. Do manufacturers sometimes promote a new product because it is really better, or just because it is different and has little competition?

A first-class best-practice report can optimize and standardize retrofits, remodels, and new construction within an organization.

No specific manufacturers or models are listed.

MARKETING HYPE

Following are some examples of what I consider marketing hype or over-marketed products.

- Energy saving 25-30W F32T8s
- Lamp life of some F32T8s
- Dimming ballasts for daylight harvesting and peak load shedding
- New T5 troffers
- Hibays
- Focus on inexpensive fixtures and short payback
- Performance contracts by ESCOs on lighting projects

Energy Saving 25-30W F32T8s

Yes, these lamps do use less wattage than full wattage 32W F32T8s, but be aware of the big picture.

The savings are often only half of what is expected. For example, 28 watters may only save 2-2.5 watts, not 4 watts, compared to full wattage F32T8s, when both types are driven by extra efficient .87 ballast factor (BF) ballasts.

These lamps should not be driven with many rapid start and program start ballasts.

These lamps do not work with dimming ballasts.

These lamps striate for up to 10 minutes after being turned on when not driven by striation control ballasts.

These lamps can take a long time to reach full brightness.

These lamps are often not recommended for occupancy sensor applications.

These lamps are not recommended for use below 60°F.

These lamps are expensive, especially the 25 watters, which can cost end customers over $3 per lamp.

Often, more of these lamps have to be purchased, stocked, installed, and recycled than high-lumen full-wattage lamps.

Light levels with some of these lamps may be too low.

Long-term savings cannot be guaranteed.

Every time that I asked a facility manager if his or her staff will be able to keep straight where the energy saving 25-30W F32T8s and where the full wattage F32T8s should go down the road, when the only difference is in the label, they said NO and decided to go with all 32W F32T8s, which can be used in the full range of T8 applications.

What I really do not like about the facilities that have switched to these energy-saving lamps, especially when keeping existing generic electronic ballasts (GEBs) and fixtures, is that it often creates "no man's land." This no man's land is where the wattage reduction with these lamps makes it very difficult to make optimal solutions, such as high lumen full wattage F32T8s, extra efficient ballasts, upgrade kits, and suspended indirect fixtures, cost effective.

If you worked for a lamp manufacturer, would you prefer selling the same number of higher margin energy saving 25-30W F32T8s compared to the same number of lower margin basic grade 32W F32T8s or a lower number of good margin high lumen 32W F32T8s? Again wearing the shoes of a lamp manufacturer, would you prefer making the quick sale of energy saving 25-30W F32T8s, which may not require the end customer to hire a contractor and fund a comprehensive retrofit?

T8 Lamp Life

I do not understand why lamp manufacturers typically rate T8 lamp life with rapid start ballasts, when about 90 percent of the ballasts used with T8s are instant start. Actual lamp life can be significantly less than what is shown in lamp catalogs.

It can be very important to read the footnotes in lamp catalogs. One manufacturer lists one F32T8 model at a 30,000 hour rating in the main section of its 2004 lamp catalog. After you find the obscure pages where the footnote descriptions are and read all eight footnotes, the last ones state that the 30,000 hours are only with one of their program start ballast models, and lamp life is only 15,000 hours with instant start ballasts.

Dimming Ballasts

Although it seems logical that dimming ballasts should save wattage and kWh in daylight harvesting and peak load shedding applications, most, if not all dimming ballasts, are "energy hogs." With T8s, at full light output, dimming ballasts consume about 20 percent more wattage than extra efficient fixed BF ballasts. And as dimming ballasts dim, their ballast efficacy factor (BEF) gets worse, because a higher percentage of wattage is used for lamp cathode heating. BEF = BF x 100/system wattage. More information is available in Table 1—BEF.

Let's examine a daylight harvesting application comparing dimming ballasts with turning on and off extra efficient fixed BF ballasts. There are 100 12′ x 12′ offices, and each office has one 8′ fixture with 6 F32T8 lamps. The offices are used 6 AM to 12 midnight, five days per week. Windows provide significant daylight. The approximate amount of electric light required is 100 percent for six hours per day, 67 percent for four hours per day, and 33 percent for eight hours per day. The kWh rate is $0.10 with no demand charges. Table 2 shows how much more electricity can be saved with the fixed BF ballasts. Even if all of the fixed BF ballasts were on all 4680 hours per year, they would not use that much more kWh than the dimming ballast set up. That extra electrical consumption is peanuts compared to the cost of dimming ballasts, control systems, installation, commissioning, and recommissioning.

At least in California there is a big push to curtail peak load for those critical ten or so days a year, when reserves are very low and electrical prices are very high, like $.50/kWh. But is it really the best strategy to get fancy and expensive peak shaving systems when there

Table 1.

BALLAST EFFICACY FACTOR TABLE - 2F32T8				
general type	*further description*	*ballast factor*	*system watts*	*BEF*
IS	extra efficient	0.87	53	1.64
	basic grade	0.87	58	1.50
	extra efficient	0.77	48	1.60
	basic grade	0.77	51	1.51
	extra efficient	1.15	72	1.60
	basic grade	1.15	77	1.49
PS	extra efficient	0.88	55	1.60
	basic grade	0.88	62	1.42
	extra efficient	0.71	46	1.54
RS/PS dimming	continous photocell system	0.99	66	1.50
		0.49	41	1.20
		0.18	18	1.00
	continuous 0-10V	0.88	64	1.38
		0.05	14	0.36
	continuous powerline	1.00	68	1.47
		0.05	15	0.33
	continous DALI	1.00	70	1.43
		0.54	45	1.20
		0.05	17	0.29
	three stages	0.88	62	1.42
		0.58	45	1.29
		0.27	28	0.96
notes: Wattages based mainly on 277V.				
Values will vary among specific ballasts.				
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are still so many more cost-effective opportunities that save wattage all the time?

Usually when I talk with facility or maintenance people that have dimming ballasts and controls for them, they tell me that they do not like their systems for various reasons, including the cost of replacement parts, trying to get replacement parts, and trying to get the system to work properly.

After being involved with one digital addressable lighting interface (DALI) project in northern California, it will be a long time before I even consider DALI again. I recently learned about a southern California city that used DALI ballasts and control system to help qualify for LEED Silver rating on a new building. After fruitlessly trying to get

Table 2.

DIMMING BALLASTS vs. STAGED FIXED BF EXTRA EFFICIENT IS BALLASTS										
ballast type	*number of 2F32T8 ballasts per fixture*	*BF*	*number of F32T8s on per fixture*	*wattage per fixture*	*annual hours*	*KWH rate*	*itemized annual KWH*	*total annual electrical cost per fixture*	*total annual electrical cost per 100 fixtures*	*advantage with fixed BF EE IS ballasts*
dimming	**3**	**0.88**	**6**	**189**	**1560**	**$0.10**	**$29.48**	**$62.56**	**$6,255.60**	**24%**
	3	**0.59**	**6**	**138**	**1040**	**$0.10**	**$14.35**			
	3	**0.29**	**6**	**90**	**2080**	**$0.10**	**$18.72**			
fixed BF EE IS	**3**	**0.88**	**6**	**162**	**1560**	**$0.10**	**$25.27**	**$47.74**	**$4,773.60**	
	3	**0.88**	**4**	**108**	**1040**	**$0.10**	**$11.23**			
	3	**0.88**	**2**	**54**	**2080**	**$0.10**	**$11.23**			
notes:										
Dimming ballasts can either be continous or stage dimming.										
Fixed BF EE IS is fixed ballast factor extra efficient instant start.										
Each fixture could also have 3 2-lamp dimming ballasts or 1 4-lamp ballast and 1 2-lamp EE IS ballast.										
Numbers will vary dependent on specific ballasts considered. Please do your own comparisons.										
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the DALI system to work, they disconnected the control system. Now they have very expensive and energy hogging on-and-off ballasts.

If you were a ballast manufacturer, would you try to sell high-priced specialized dimming ballasts, which probably have few equivalents, or low-margin fixed output ballasts?

At least two manufacturers are working on more efficient and lower-cost dimming ballasts, which may be introduced in 2006. The upcoming wireless controlled dimming ballasts may also be of interest.

New T5 Troffers

One large fixture manufacturer recently introduced a new T5 troffer line, which may be the best direct troffer available, but…

The marketing literature states that the 2x4 version with two high performance T5 lamps and extra efficient ballast consumes 58W, which is 33 percent less wattage than 2x4 18-cell parabolic troffer that has 3 F32T8s that consume 88W. That is true basing the comparison on the T8 fixture using generic .87-.90 BF ballasting. I wonder why this fixture manufacturer compares the best T5 technology only with basic grade T8 technology. In an apples-to-apples comparison, three high lumen 32W F32T8s with extra-efficient .77 BF ballasting consume about 73W. There are also some upgrade kits for 2x4 18-cell parabolic troffers that allow good lighting with 2 high lumen 32W F32T8s and extra-efficient .87-.88 BF ballast, which consume 53W.

Even if these T5 troffers are great troffers, they are still troffers, which make the ceiling look like a checkerboard. I much prefer suspended indirects, which provide a better quality of lighting and usually allow for a lower watts per square foot power density. Plus there is at least one new suspended indirect fixture that can be used in 8′ ceilings.

Hibays

I am so sick and tired of the marketing hype from T8 hibay manufacturers, reps, and contractors who put down everything else, T5HO folks who put down everything else, fluorescent folks who put down everything else, and HID folks who put everything else down.

One manufacturer that makes T5HO and T8 hibays wanted me to specify their product. I told them that I would consider it if they would make their comparison table more fair, including listing a col-

umn for better than just a basic grade-spun aluminum dome for HID. Guess what—I never heard from them after that.

Recently I was informed about a salesman trying to sell T8 hibays in a Fresno, California, metal foundry. First of all, Fresno gets very hot in the summer. Secondly, there is a lot of heat from melting metal. Even after the facility person told the salesman that the air temperature often exceeds 140°F at fixture height, the salesman still promoted T8 hibays, evidently not being aware that the heat would be a killer to electronic ballast life and lamp light output.

After numerous hibay projects and writing eight articles on hibays, I firmly believe that it is a fairly even playing field among the best T8, T5HO, and electronically ballasted pulse-start MH hibays. The optimal solution depends on specific application requirements. My latest hibay article "MH vs. FLUORESCENT—10 Rounds in the Hibay Arena" is set up for people to pick a specific project and judge each round. The winning technology scores the most points or knocks out the opponent. This article is available at *www.lightsearch.com* or by contacting me. A slightly earlier article "Hibays—It's All about the Details" is available for free, like other articles, in the article page at *www.lightingwizards.com*.

The bottom line is that it is easier to feel confident that hibay fixture manufacturers are promoting the best product for specific applications when they are more than a one-trick pony. So I prefer dealing with hibay manufacturers that offer T8, T5HO, electronically ballasted HID, and induction hibays.

Focus on Inexpensive Fixtures and Short Payback

Often the least expensive lighting fixtures result in the most expensive lighting system, because higher wattage fixtures or more fixtures are required. Way too often, fixture manufacturers, rep agencies, contractors, ESCOs and end-customers focus on short payback. But since payback does not include any benefits after payback period, often options with longer payback periods provide substantially more long-term benefits, which can be calculated with life cycle costing, cost of ownership, and other factors.

More detailed information on economics is available in "Retrofit/Upgrade Quarterly—December 2003" and "Penny Wise and Dollar Foolish," available in the article page at *www.lightingwizards.com*.

ESCO Performance Contracts for Lighting Projects

ESCOs can provide comprehensive and guaranteed energy-saving projects with positive cash flow financing, which can be a very good solution for many end customers.

But way too often when others and I try to specify energy efficient lighting that would also improve lighting quality significantly, ESCOs often deem them too expensive. Lighting quality improvements are commonly sacrificed, so lighting can be the cash cow to subsidize other energy measures.

K-12 school districts are a common example. Frequently, their lighting systems are outdated for today's needs, which include substantial AV presentations and computer use. The new generation of suspended indirect fixtures designed for schools are very good and very energy efficient, although they cost significantly more to buy and install than just doing lamp and ballast retrofits. With low annual hours of operation in schools, it is difficult for these suspended indirect lighting systems to be cost effective with the ESCO's mark-up on top of the lighting contractor's price.

Maybe if more ESCOs, and even lighting professionals, would try to educate customers on soft savings, such as improved student performance and increased worker productivity, which can often dwarf hard savings, such as electrical costs, there would be more quality lighting projects.

Is a performance contract really necessary with most lighting projects that the before and after wattages can easily be agreed upon?

It is recommended for end customers to compare proposals from energy-efficient lighting consultants and/or lighting retrofit contractors that focus on improved quality lighting with lighting proposals from ESCOs. An ESCO is not necessary for positive cash flow financing.

BEST PRACTICE

A well conceived best practice report can optimize and standardize retrofits, remodels, and new construction within an organization.

A best practice report aims at the optimal balance of the following. It is not easy juggling ten divergent items.

- Architectural appearance
- Lighting quality

- Control flexibility
- Ease of use
- Initial cost
- Energy efficiency
- Utility or other incentives
- Parts maintenance costs
- Labor maintenance costs
- Sustainability

To make the juggling easier, some specific best practices that I have found to work very well for many applications follow.

Since most of my work is with existing buildings, the following is biased toward those applications, but the information is also applicable for new construction and gut rehabs.

Work Horse Lamps

High-lumen long-life high-Kelvin 32W F32T8s are my main lamp type. These lamps provide the best opportunity for delamping, lower BF ballasts, and fewer fixtures. Plus they can be used with any T8 ballasts and can be operated down to 0°F.

Initial catalog lumens

- 3100+ for up to 4100K
- 3000+ for 5000K

Lamp life at industry standard three-hour cycles

- 24,000+ hours with instant start ballasts
- 30,000+ hours with program start ballasts

Kelvin

- 5000K preferred for most applications
- 4100K if I cannot convince customer to use 5000K

Table 3 shows that these high lumen F32T8s are the most efficacious when ballasts are included. (The new proprietary high performance T5 lamp and ballast is not included in this table, based on manufacturer request.)

Why high Kelvin? Because increased blue content provides what is called spectrally enhanced lighting or scotopically enhanced lighting.

Table 3.

4' LINEAR FLUORESCENT EFFICACY TABLE												
4' lamp type	*lamp lumens*	*lamp watts*	*lamp lumens per lamp watts*	*lamp quant*	*ballast type*	*ballast factor*	*system watts*	*initial system lumens*	*initial system lumens per watt*	*end of life lumen maint-enance*	*end of life system lumens*	*end of life system lumens per watt*
high perform. F32T8	3100	32	96.9	2	EE IS	0.87	53	5394	101.8	92%	4962	93.6
28W F32T8	2750	28	98.2	2	EE IS	0.87	48	4785	99.7	92%	4402	91.7
25W F32T8	2400	25	96.0	2	EE IS	0.86	43	4128	96.0	92%	3798	88.3
30W F32T8	2850	30	95.0	2	EE IS	0.87	52	4959	95.4	92%	4562	87.7
F28T5	2900	28	103.6	2	PS	1.00	64	5800	90.6	94%	5452	85.2
basic grade F32T8	2800	32	87.5	2	EE IS	0.87	53	4872	91.9	90%	4385	82.7
F54T5HO	5000	54	92.6	2	PS	1.00	117	10000	85.5	93%	9300	79.5
F34T12 CW	2650	34	77.9	2	RS M	0.88	72	4664	64.8	78%	3638	50.5
notes: Lumens, lumen maintenance, ballast factors and wattages may vary among various manufacturers.												
Although efficacy can be improved with IS and RS ballasts with T5s and T5HOs, lamp life can be greatly reduced and												
lamp manufacturers may not warranty the lamps.												
93% is used as an average EOL lumen maintenance for T5HOs. 90% - 94% range among manufacturers.												
All wattages based on 277V. EE IS is extra efficient instant start. PS is program start. RS M is rapid start magnetic.												
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The human eye perceives light with more blue content as brighter, and visual acuity is improved. More detailed information is available in the SEL page and article page of *www.lightingwizards.com*.

Table 4 shows how much wattage can be saved with these lamps by using fewer lamps, lower BF ballasts, and/or fewer fixtures. For example, using paper task modified lumens, third generation F32T8 850 lamps provide 49 percent more usable light than basic grade F32T8 735 lamps. But be aware that the IESNA does not fully accept benefits of spectrally or scotopically enhanced lighting.

Extra Efficient Ballasts For T8s

Help eliminate generic electronic ballasts (GEBs).

Extra efficient ballasts consume 3-6 fewer watts than equivalent

Table 4.

S/P Benefits of 5000K 3100-Lumen F32T8s

lamp	initial photopic (catalog) lumens	S/P ratio	brightness $P(S/P)^{.5}$	paper $P(S/P)^{.78}$	computer $P(S/P)^{1.0}$
F34T12 CW	2650	1.50	3246	3636	3975
F34T12 WW	2700	1.00	2700	2700	2700
F32T8 730	2800	1.19	3054	3207	3332
F32T8 735	2800	1.30	3192	3436	3640
F32T8 741	2800	1.56	3497	3961	4368
F32T8 830 2nd	2950	1.29	3351	3598	3806
F32T8 835 2nd	2950	1.41	3503	3857	4160
F32T8 841 2nd	2950	1.62	3755	4298	4779
F32T8 830 3rd	3100	1.29	3521	3781	3999
F32T8 835 3rd	3100	1.41	3681	4053	4371
F32T8 841 3rd	3100	1.62	3946	4516	5022
F32T8 850 3rd	3100	1.90	4273	5114	5890
Increase of energy efficiency of 3100-initial-photopic-lumen 850 3rd generation F32T8s when considering full field of view compared to		CW	**32%**	**41%**	**48%**
		WW	**58%**	**89%**	**118%**
		730	**40%**	**59%**	**77%**
		735	**34%**	**49%**	**62%**
		741	**22%**	**29%**	**35%**
		830 2nd	**28%**	**42%**	**55%**
		835 2nd	**22%**	**33%**	**42%**
		841 2nd	**14%**	**19%**	**23%**
		830 3rd	**21%**	**35%**	**47%**
		835 3rd	**16%**	**26%**	**35%**
		841 3rd	**8%**	**13%**	**17%**

notes : Lumens and S/P ratios can vary among lamps and manufacturers.

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GEBs that have the same BF. For example, with lamps a 2F32T8 .87 BF instant start GEB consumes 58-59W, compared to 52-54W with equivalent extra efficient ballast. Although extra efficient ballasts typically cost $1-$2 more than GEBs from distribution, extra-efficient ballasts can save 270 kWh over their 60,000 hour rated life, which typically spans 15 years. Depending on electric rates, that comes out to $20 to $40 savings.

All major ballast manufacturers have extra-efficient instant start ballasts, and most have program start versions.

One major problem is that most all T8 fixtures come with .87-.90 BF GEBs. Most fixture manufacturers do not even have a published option coding for extra-efficient ballasts in their catalogs or websites. Many fixture manufacturers, especially some of the large ones, charge an arm and a leg for extra-efficient instant start ballasts. I have been quoted over an $8 adder from a fixture manufacturer on a relatively small project. At that type of cost adder, plus contractor and other mark-ups, extra-efficient ballasts can become not that great of a deal. But if fixture manufacturers did good negotiations with ballast manufacturers, fixture manufacturers' costs for extra-efficient instant-start ballast should be a buck or so. Some of the very large fixture manufacturers are used to large production runs with GEBs, and if they have to use anything else for a small project, the price can get jacked up. If more customers requested more fixtures with extra efficient ballasts, complained if the cost adder was over $4, and got competitive bids from small, medium, and large manufacturers, hopefully pricing and lead times would come down. New stricter energy codes, like the 2005 California Title 24, will promote the need to lower wattage fixtures.

There is some good news. Responding to Efficiency Vermont's request, two fixture manufacturers recently began stocking T8 fixtures with extra-efficient ballasts and only charging about a dollar extra. Hopefully that will expand across the country with additional manufacturers.

Extra-efficient ballasts, combined with high lumen T8s, allow for extra savings. For example, two high lumen 32W F32T8s with extra efficient .77 BF instant-start ballast consumes 48W, while providing about the same amount of light as two basic grade 32W F32T8s with a .87-.90 BF GEB, which consumes 58-59W. That is about an 18 percent savings, which is about the same savings as going from two F34T12CWs with magnetic ballasts to two basic grade F32T8s and .87-.90 BF GEBs.

Minimize Lamp Types

Reducing lamp types can save substantial money and time in ordering, stocking, and replacement.

Regarding linear fluorescents, in addition to T12s, try to avoid lamps that are expensive, uncommon, and/or bulky, such as:

- 3' and 8' T8s
- U-bend T8s
- Biax

And think twice if you really need:

- T5s
- T5HOs

Minimize the number of compact fluorescents, HID and incandescents.

And, very importantly, avoid single-source lamps where plausible.

It has been my experience that many lighting designers, architects, and engineering firms do not give due consideration regarding lamp types or single source lamps. This all-too-common example shows the ramification of that. The facility staff really liked the lighting quality and energy efficiency in their new medical office building. But attitude changed after two years, which is when many of the lamps started to burn out. The facility staff found out that this one building had more lamp types than the other seven buildings on this campus combined. The staff could not fit all of the lamp types on their carts, so they had to waste a lot of time going down to the basement to get certain lamp types. Plus, many of the lamps were expensive and did not have that great of rated life.

Long Life Lamps

Long life F32T8s have already been discussed.

When space allows, consider 24,000-hour rated F17T8s instead of 6,000-12,000-hour rated compact fluorescents. If 2' is too long, consider 25,000-hour rated cold cathode compact fluorescents or some of the new 20,000-hour rated high output compact fluorescents.

Consider 20,000-hour 300-350W pulse start MH with dimmed, dimming electronic ballast instead of 10,000-15,000 175 or 250W MH. This system can be factory or site set to the same output levels of lower HID, while reducing inventory to a single lamp type.

If you need to use incandescents, 130V versions typically have 2.5 times longer lamp life than 120V versions when driven at 120V.

Suspended Indirect Fixtures

Suspended indirect fixtures are defined to include fixtures with all up light to 50 percent uplight and 50 percent downlight in this report.

When I am brought into an office or school classroom type of retrofit project, I think first of replacing existing troffers and wrap-arounds with suspended indirect fixtures. Plan B is to use upscale kits. An example of an upscale kit that I like to use in retrofitting 2x4 18-cell and 2x2 9-cell parabolic troffers is shown in Figure 1. The last option is doing a lamp and ballast retrofit.

Since 75 percent of my retrofit projects are T8s to better T8s, basic grade T8s with GEBs are the base case in Table 5, which is my version of Paul Simon's song "50 Ways to Leave Your Lover." This table shows 18 options for a typical private office that has two 2x4 18-cell parabolic troffers, each with three basic grade F32T8s. Although the paybacks do not look very good for new suspended indirect fixtures, they provide the best long-term benefits.

Figure 1.

Table 5.

RETROFIT, RELAMP, RELIGHT & REDESIGN OPTIONS FOR TYPICAL INDIVIDUAL OFFICE WITH 2X4 18 CELL PARABOLIC 3F32T8-700 TROFFERS

$0.15	blended KWH rate			3600	annual hours		$0.05	utility or 3rd party incentive for first year KWH reduction			15	number of years for cumulative long term benefit				
existing					18 options to consider (shorter paybacks do not always provide better long term benefits)											
fixture type	quan - tity	total watts	annual elect'l cost	lamp life @ 3 hour cycles	#	4R	quan - tity	products	total watts	annual elect'l savings	incen- tive	appr. installed cost	simple payback in years	lamp life @ 3 hour cycles	long term benefit
2x4 18 cell parabolic troffers each with 3 F32T8 735s or 741 lamps and 3-lamp .88 BF generic instant start electronic ballast (originally inboard/ outboard switching)	2	172	$92.88	18,000 average (15,000 to 20,000 range)	1A	retrofit	2	3 32W F32T8 850s & .6 BF EE PS ballast	114	$34.45	$10.44	$120.00	3.2	24,000	$429.72
					1B	retrofit	2	3 32W F32T8 850s & TW .6 BF PS ballasting	91	$48.11	$14.58	$140.00	2.6	24,000	$618.79
					2A	retrofit	2	3 32W F32T8s & .77 BF EE IS ballast	144	$16.63	$5.04	$100.00	5.7	24,000	$177.02
					2B	retrofit	2	3 32W F32T8s & TW .77 BF EE IS ballasting	115	$33.86	$10.26	$120.00	3.2	24,000	$420.63
					3A	retrofit	2	3 28W F32T8s & .87 EE IS ballast	142	$17.82	$5.40	$100.00	5.3	18,000	$172.70
					3B	retrofit	2	3 28W F32T8s & TW .87 BF EE IS ballasting	114	$34.45	$10.44	$120.00	3.2	18,000	$407.22
					4A	retrofit	2	3 25W F32T8 850s & .87 EE IS ballast	126	$27.32	$8.28	$110.00	3.7	18,000	$308.14
					4B	retrofit	2	3 25W F32T8 850s & TW .87 EE IS ballasting	101	$42.17	$12.78	$130.00	2.8	18,000	$515.39
					5A	retrofit	2	3 25W F32T8 835/841s & 1.0 BF EE IS ballast	144	$16.63	$5.04	$110.00	6.3	18,000	$144.52
					5B	retrofit	2	3 25W F32T8 835/841s & TW 1.0 BF EE IS	115	$33.86	$10.26	$130.00	3.5	18,000	$388.13
					6A	relamp	2	3 28W F32T8s & use existing ballast	155	$10.10	$3.06	$25.00	2.2	18,000	$109.53
					6B	relamp	2	3 25W F32T8 850s & use existing ballast	140	$19.01	$5.76	$30.00	1.3	18,000	$230.88
					7A	retrofit/ relight	2	upscale kit or new basket fixture with 2 32W F32T8 850s & .77 BF EE IS ballast	96	$45.14	$13.68	$250.00	5.2	24,000	$1,235.84
					7B	retrofit/ relight	2	upscale kit or new basket fixture with 2 32W F32T8 841s & .87 BF EE IS ballast	106	$39.20	$11.88	$250.00	6.1	24,000	$1,144.94
					7C	retrofit/ relight	2	upscale kit or new basket fixture with 2 32W F32T8 835s & 1.0 BF EE IS ballast	130	$24.95	$7.56	$250.00	9.7	24,000	$926.78
					8A	redesign	1	new 8' suspended indirect fixture with good batwing distribution, 2 32W F32T8 850s & 1.15 BF IS ballast	73	$58.81	$17.82	$480.00	7.9	24,000	$4,237.41
					8B	redesign	1	new 8' suspended indirect fixture with good batwing distribution, 2 32W F32T8 841s & 1.32 BF EE IS	85	$51.68	$15.66	$480.00	9.0	24,000	$4,128.33
					8C	redesign	1	new 8' suspended indirect fixture with good batwing distribution, 4 32W F32T8 835s & .77 BF IS ballast	96	$45.14	$13.68	$480.00	10.3	24,000	$4,028.34

notes: (Prepared by Stan Walerczyk, LC, Principal of Lighitng Wizards. 6/16/05 version)

Delamping these parabolic troffers is not an option, because it ruins proper cut-off angles, which can greatly increase direct, indirect and overhead glare.

Listed 32W F32T8s are high performance ones that are rated for 3100 catalog lumens, 82 - 86 CRI and 24,000 hour rating with IS ballasts at 3 hour cycles

25W F32T8s may not be recommended with occupancy sensors or other short cycle applications, especially with existing ballasts.

EE = extra efficient. BF = ballast factor. IS = instant start. PS = program start. TW = tandem wiring using 1 2-lamp & 1 4-lamp per fixture pair to allow for board/outboard switching.

Wattages are based on 277V line voltage and may be higher with 120V. Lower wattages with higher Kelvin lamps are based on scotopically enhanced lighting.

With some states' prevailing wages and union rates, can be considerably less labor costs to retrofit than replace fixtures.

In options, total watts is reduced 20% in options that inboard/outboard switching is re-introduced, because not all lamps will be on all of the time.

Annual electrical savings include 10% for reduced air conditioning load. In some areas this would be higher, and in other areas this would be lower.

Although this table includes an incentive for 25W and 28W F32T8s with new EE ballasts, some programs do not include them, because long term savings cannot be guarranteed.

long term benefit = (annual elect. savings x number of years) + incentive - initial installed cost. Small adder for 24,000 hour rated lamps and using fewer lamps. Because of increased pro

$50/year for baskets and $150 - $250/year added for suspended indirects. $250 is 1/2 of 1% improvement on $50,000 salary. 0.05% is not wasting 2.5 minutes/day.

Regarding long term benefits, cost of money is considered to be offset by increases in electricity, majority of maintenance savings and increases in worker salaries.

KWH rate, annual hours, incentive rate, and length of long term benefit can all be easily changed in colored/shaded boxes. Ballasts are typically rated for 15 years, fixtures much longer.

Not only do good suspended indirect fixtures usually provide the best quality of light. They also:

- Eliminate cave and checkerboard ceiling effects.
- Make space seem larger and more appealing.
- Reduce glare—direct, indirect, and overhead.
- Provide a good balance of horizontal and vertical footcandles.
- Improve uniformity.

It is more than just lighting quality. There are usually fewer lamps and ballasts, so fewer to buy, replace, and recycle down the road. Good suspended indirects with high lumen F32T8s and extra-efficient ballasts often allow for 0.6-0.8W per square foot, which is usually significantly lower power density than retrofitting existing troffers or installing new direct troffers.

With such a low power density, it does not seem cost effective to use expensive dimming ballasts and control systems.

For new construction and remodels, it is usually less expensive to install rows of suspended indirect fixtures than individual troffers. Although suspended indirect fixtures typically cost more than troffers, the labor is usually much less with suspended indirects. Many suspended indirect fixtures are available in 12′ sections and one power feed can be used for an entire row.

Not all suspended indirect fixtures are created equally. It is usually best to get ones with good batwing distribution so the ceiling does not look like zebra stripes—bright above fixtures and dark ceiling between fixtures.

Control Flexibility

Many retrofitters eliminate inboard/outboard switching in troffers in an effort to reduce numbers of lamps and/or ballasts.

An example is a private office with a 2x4 troffer that has three F34T12 lamps and two energy-saving magnetic ballasts. This fixture is retrofitted with a white reflector, two F32T8s, and a .87 BF GEB. The office worker is upset, because he or she used to be able to have one lamp on when doing just computer work, two lamps on when doing a combination of computer and paper tasks, and all three lamps on when doing just paper tasks, especially with fine print. After the retrofit, the office worker can either have all lamps on or off.

Plus the two F32T8s and electronic ballast consume more wattage than when the one F34T12 lamp and magnetic ballast was on. This is one reason why many retrofit projects do not save as much as expected. Energy usage actually went up in one recent San Diego office retrofit project because of this.

Dual level lighting does not seem to be that important with suspended indirect fixtures.

One good strategy is to have a relatively low ambient light level and provide good task lights that office workers can turn on and off and maybe aim to suit their needs. In addition to saving substantial kWh, this can improve worker satisfaction and productivity. Especially in office cubicles, workers usually do not have much control in their workspace. Providing tasks lights gives them some control.

Idiot-proof Cost Effective Controls

I have seen way too many complex centralized control systems that either do not work properly or have been bypassed.

Here is a common example. A lawyer comes into his office in a large upscale office building on a Sunday. The lawyer gets frustrated wasting time trying to get the lights to come on. He or she finally finds the telephone number and calls the centralized control system so the lights come on for two hours per call. On Monday morning he or she complains to the property management company. By Monday afternoon the centralized control system is turned off.

I find that many maintenance people prefer simple localized controls like occupancy sensors.

DISCUSSION

Since this is not a politically correct article, it is understandable that some readers may not agree with me. I would appreciate your feedback. My email address is listed below.

Do not get me wrong. I think in general that lamp, ballast, control, and fixture manufacturers do a very good job providing good products that fit real needs. I also think that many ESCOs provide a very good service.

It is of interest that some governmental policies impede innovation by not allowing the purchase of an optimal solution if only one

manufacturer provides it.

Although this article is about lighting, the same general message can apply to other energy efficient practices.

ABOUT THE AUTHOR

Stan Walerczyk, principal of Lighting Wizards, has 16 years of lighting experience, including maintenance, distribution, retrofit contracting, design, third-party review, consulting, and research. He has presented over 200 seminars across North America, including several Lightfairs, and has written over 30 articles. He is a member of the IESNA's Energy Management Committee and past chair of its Retrofit/Upgrade Committee. He is lighting certified by the National Council on Qualifications for the Lighting Professions, and he is a Certified Lighting Efficiency Professional by AEE. Stan has won several IIDA awards and is a past Lighting Efficiency Advocate of the Year for the San Francisco Chapter of the AEE. *stan@lightingwizards.com, www.lightingwizards.com.*