PENNY WISE AND DOLLAR FOOLISH

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It is frustrating when customers use shortest payback or lowest initial cost as their main criteria for retrofits, remodels or new construction.

This frustration, teaching the economics section for a local IESNA ED150 class, and recently seeing a showcase remodel/expansion project with generic electronic ballasts and basic grade T8 lamps -- motivated me to write this.

Basing decisions mainly on the shortest payback is very short sighted. It is a challenge getting people to realize that the logic behind policies, like a maximum 2 year simple payback requirement, is flawed.

Often the shortest payback leaves substantial savings on the table.

I put myself in the customer's shoes and ask myself if it was my money, would I want the shortest payback? Or would I want to spend extra initial money to provide higher savings and better long term benefits, resulting in more money in my pocket in 5, 10 or 15 years.

First of all let's look at generic low-power electronic ballasts for T8s compared to the new-generation extra-efficient low-power ballasts.

For example, project X has 4000 hour annual burn time and blended $0.15 KWH rate.

The payback retrofitting the existing fixtures that have F40T12 lamps and magnetic ballasts with generic low-power ballasts and F32T8 lamps is 1.7 years.

Each extra-efficient low power ballast may cost the end customer $2 to $6 more than the generic ballasts, so $4 is an average. Each extra-efficient ballast saves 3 to 6 watts, to be conservative 3 watts is used. That is an additional annual savings of $1.80, which provides a 2.2 year payback compared to the generic ballast. Electronic ballasts can easily last 15 years. Using first level analysis methods, over that span, each extra-efficient ballast will save $27 more than a generic low-power ballast.

But there is a cost of money. A dollar today is not equal to dollar a year from now, when interest rates are considered. The following equation from Chapter 25 in the 9th Edition of the IESNA Handbook is very helpful in revealing present worth with regard to annual energy savings. It is my understanding that this equation is fairly accepted in the financial community.

P = present worth, or amount of at present dollars
A = annual savings
y = number of years
i = opportunity or interest rate (for this case we will use 6%)

$P = A \times [(1+i)^y-1]/[i(1+i)^y]$
$P = 1.80 \times [(1+.06)^{15}-1]/[.06(1+.06)^{15}]$
P = $17.48

Based on this equation, the annual savings of $1.80 each year over the next 15 years, based on an interest rate of 6%, is worth $17.48 in present dollars.

So spending an extra $4 now provides a 437% ROI (return on investment) over 15 years ($17.48/$4 x 100). Often an asset will not be held that long. The 10 year ROI would be 331%. For 5 years it would be a 190% ROI, and for 3 years, it would be 120%.

The extra $4 now is a very good investment if the asset will be held at least 3 years or even if it will be sold before then, because of the increased value of the asset. It may not be a good investment for a tenant with a lease expiring in less than 3 years and the owner unwilling to help to subsidize the lighting project.

You can do ballast ROIs on your own projects based on your appropriate burn time, KWH rate, annual savings, number of years, opportunity or interest rate and cost. The calcs can compare existing to base retrofit and options to existing or base proposed. Outside California most KWH rates are probably lower than $.15. You could compare generic and extra-efficient low-power ballasts or generic and extra-efficient standard-power ballasts.

Shortest payback vs. long term benefit analysis can also be done with T8 lamps. Typically the benefits of the more expensive extended-life lamps are not included in payback, because the payback time occurs even before standard-life lamps burn out. Standard T8 lamps are rated for 20,000 hours. Extended-life lamps are rated for 24,000 hours, which is 20% longer. Each extended-life lamp costs about $.40 more than equivalent type standard-life lamp, which is about 20% more. So the cost/life pricing is about the same. The benefits of the longer life lamps follow. Maintenance labor is reduced, because lamps will not have to be replaced as often. In California and other states, all fluorescent lamps may have to be recycled which costs about $.40 for a 4' lamp. With longer life lamps, fewer lamps have to be recycled over time. Adding all of the benefits of the extended life lamps, they are typically a 30% better total value than equivalent type standard life lamps.

As I stated in "Why Should The Customer Have To Pay Twice?" in LD+A, 9/01, high-lumen extended-life lamps save additional electricity because fewer lamps or lower ballast factor ballasts are required. Following is an example of how these lamps and extra-efficient ballasts can work together.

Instead of simply recommending T8 group relamping we also provide an option with extra-efficient ballasts and high-lumen universal-type (24,000-hour-rated-life even based on instant start ballasts at 3 hour starts) T8s. For example, consider an office building with 2x4 troffers that have 2 basic-grade 15,000-hour-rated-life (based on 3 hour starts with instant start ballasts) T8s and generic standard-output instant start ballast. Each fixture consumes 58W. Each fixture can be retrofitted with 2 premium T8s and extra-efficient low-power ballast. Not only would there be a 10W reduction, but the group relamping schedule would be increased from 4 to 6 years, and there would also be a brand new 5 to 7 year parts and labor ballast warranty. The retrofit option is often very cost effective when the parts and labor cost of the existing group relamping is 'deducted' from the retrofit parts and labor cost.

Pardon me, but it would not be one of my articles, if I did not state that additional savings may also be achieved by using scotopically enhanced lamps, especially high-lumen extended-life F32T8 850s. So far the before and after feedback from workers at PG&E facilities has been good with dimming down further with 850 lamps. It will be interesting to see the results of the ongoing and upcoming DOE research projects with scotopically enhanced lamps.

Sometimes lighting retrofitters and end customers go too far trying to get a short payback or a high ROI. An example is retrofitting 3 lamp 18 cell parabolic 2x4s with a reflector and 2 lamps. The electrical savings can be substantial with a relatively low installation cost. But the repositioned lamps ruin proper cut-off angles, resulting in excess direct and indirect glare. Quantifying glare problems and other bad lighting problems to worker productivity is very difficult. But check if office workers are wearing baseball hats, covering their modules with cardboard or turning off the ceiling fixtures and bringing in their own floor or table fixtures. Two extra breaks per week, one extra sick day per year or frequent headaches or eyestrain may equate to reducing worker productivity just ½ of 1%. That could total an annual loss of $250 for each worker making $50,000 per year. The comprehensive payback or ROI would be very bad with this type of retrofit. On the other hand a new suspended indirect lighting system may increase worker productivity by .05%. Again this is difficult to quantity, but check number of sick days, talk with the workers, etc. This $250 annual benefit plus electrical savings can provide a very good payback and ROI even if the installed price in each office is $400. The 'people factor', which includes worker productivity in offices and retail sales volume, should be factored into the financial analysis of lighting projects.

These same life cycle and people factor issues also apply for new construction.

Often in lighting, the products and systems that can save the most electricity tend to cost more initially. So the payback is often not the lowest. But after the payback period, the substantial yearly savings, year after year, allow the extra initial cost option to provide the best total solution.

Often a customer would like to have a very effective and efficient lighting system, but cannot afford it. There are several firms that provide positive cash flow financing. The interest rates are usually very reasonable. With no out-of-pocket money the customer's monthly savings are greater than the monthly finance charge.

Afterword

I highly recommend reading 'Energy Efficiency Boosts Property Values' by Mark Jewell in the April 2002 edition of Energy User News. I read it right after I wrote my article and Mark Jewell discusses a much more sophisticated level of economics. If you do not get Energy User News, this article is available on their website, www.energyusernews.com.

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