

A KILLER APPLICATION

Controllable Lighting Systems As A Load Management Strategy

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What exactly is a “Killer Application?” Simply put, it is any technological advance that changes the rules of an industry in a positive way, and by extension the lives of that industry’s customers. Under this heading, the use of controlled lighting as a load management strategy quite precisely fills the job description of a “Killer APP.”

Load management is defined as the modification of energy usage patterns in response to external conditions. Historically, it was focused on interruptible loads, e.g., air conditioners, hot water heaters. As such, it was seen by building managers and occupants as inconvenient or uncomfortable. Lighting was never considered.

That was then. With the marginal cost of electricity today reaching more than 20 times the cost of electricity at off-peak hours, load management, re-framed as the building-wide application of controlled lighting, has emerged as a dynamic, proven energy strategy. It comprehensively addresses changes in energy costs. By employing leading-edge technologies to reduce lighting energy costs, it reduces, under certain rate structures, the average cost of energy for *every* kilowatt-hour used throughout the entire facility. It is the first application to make utility deregulation pay off big for businesses.

A TECHNICAL REVIEW

Before we explore the ways the Controllable Lighting System “Killer APP” will help end-users put another Load Management Strategy into action, a brief review of the new developments in lighting controller technologies is needed.

TAKE CONTROL—WITH LIMITLESS FLEXIBILITY

In many ways, the dimmable ballast and enabling control technologies have delivered us to a world as far beyond the compact fluorescents of the 1980s as electric light was from gas light. However, they can only work if implemented. How can you best take advantage of these advancements? By understanding where we've come from... and where we're going.

The Evolution of Lighting Control Systems

Historically, lighting control systems have been held hostage somewhat by their centralized orientation. With all control devices hard-wired to a single point, their cost-effectiveness, flexibility and even their physical range have been limited.

Today, new control technologies have given rise to a more open, decentralized model. Working seamlessly within a facility, distributed control systems organize hardware and software as a network over standard PCs and can control everything from HVAC to elevators. In addition, they offer you a wealth of information, including real-time reporting on energy usage and occupancy. This instantaneous reporting capability gives facilities managers the ability to make faster decisions and more well-informed choices.

Recent advancements in lighting technology have been no less spectacular. A standard lighting retrofit, utilizing existing T8 lamps and fixed-output electronic ballasts, reduces lighting energy costs an average of 25% compared to existing systems. Using technology developed, designed, engineered and commercialized by companies such as Electronic Lighting, Inc., as part of a larger load-management strategy, you can expect savings of 50-60% over existing systems.

The Components of Control

A building automation system owes much of its ability to produce savings to a process known as scheduling, a technique made possible by programmable lighting controls. Scheduling refers to the customer-directed setting of priorities in the operation of electrical loads, which makes your lighting truly parameter-based. By definition, parameter-based scheduling allows you to adjust schedules any way you want, according to virtually any variable. Lighting schemes can be "tuned" to occupancy patterns, time of year or amount of available daylight, the latter by a process known as daylight harvesting.

Specialized Control Devices

To an extent never before attainable, dimming photosensors make natural light a “no-cost” ally. Here’s the way it works: A dimming photosensor sends a signal to the control network indicating how much light it is detecting. The controllable lighting system acts upon this information, dimming lamps in response to increasing available light, while maintaining desired light levels.

Occupancy sensors interface with other building automation systems to optimize the internal environment, sending a signal when an office is unoccupied to turn off the lights.

Where should you place such devices or initiate such strategies? Anywhere they make sense. Schedules can be programmed on the level of a single fixture or a group of fixtures, commonly called a zone. Deploying the proper lighting products in a zoned configuration puts you on the threshold of lasting savings.

Control Strategies and Productivity

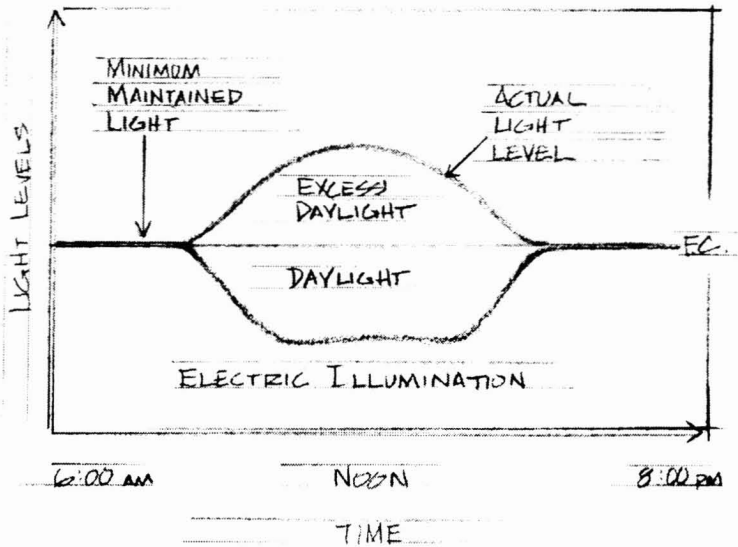
A controllable system enables you to take advantage of the cumulative impact of multiple control strategies. Intelligent use of scheduling, occupancy sensors, daylight harvesting, task dimming and lumen maintenance allows you to realize a myriad of qualitative employee-related benefits. Load management lessens the strain on HVAC systems. Proper light levels—at the proper times—have been linked to increased worker output. With better light comes improved outlooks, and a meaningful boost in overall productivity.

To Control Your Building, Control Yourself

Perhaps you’re a facilities manager charged with optimizing project value. Without question, you’re facing the temptation—powerful in its own right—to opt for the lowest initial cost. After all, “lights are lights.” While such a statement is impossible to refute, keep in mind that the lowest cost today may cost more in the final analysis, particularly when you attempt to sell a given property.

Establish non-negotiable criteria up front, and make sure that the control and lighting system in question hits every spec. Make sure that it works in its intended environment and with all existing control systems. Insist that it’s easy to maintain, reliable and capable of being programmed to do exactly what you want it to do.

No matter which lighting system you choose, due diligence is the order of the day. Prudent investing will yield the highest returns.

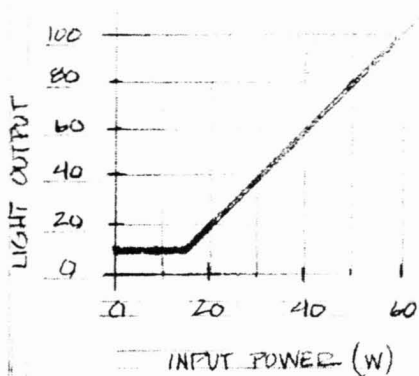


Daylight Harvesting

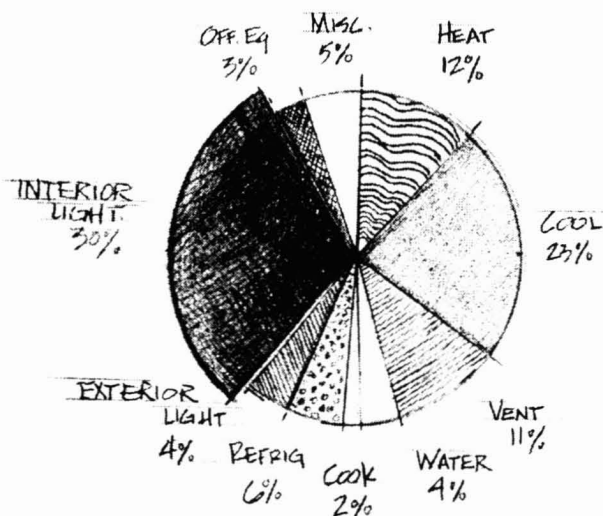
Effective Annual Lighting Hours by Building Type

Small office	3,624
Large office	3,624
Restaurant	4,957
Retail	4,064
Grocery	6,019
Warehouse	3,739
School	2,462
College	3,249
Health	7,955
Lodging	8,572
Miscellaneous	4,005

Average hours that a fluorescent lamp is on in a building that uses this type of lamp.



Power Input vs. Light Output



Commercial Electricity Shares by End Use

CONTROL STRATEGY	RANGE OF SAVINGS	
Load Management (Demand Control)	20-50%	Depending on utility rate schedule
Daylight Harvesting	40-60%	Averaged over an entire year
Occupancy Recognition	10-50%	Depending upon space type and usage
Scheduling (Timing)	10-40%	Depending on occupancy patterns
On/Off	10-50%	Compared to no switching
Task Dimming	10-50%	Depending on occupant preference
Adaptation Compensation (Balancing light levels)	10-40%	Depending on facility nighttime lighting requirements
Lumen Maintenance	10-20%	Depending on lamp lumen depreciation

CONTROLLED LIGHTING BENEFITS

Energy Savings (kWh, kW)	Improved Aesthetics & Image
Electric Cost Savings (\$)	Better Space Marketability
Increased Worker Productivity	Space Savings
Pollution Prevention	Heightened Security
Error Reduction	More Effective Facility Management
Expanded Space Flexibility	Improved Worker Morale

CONTROLLABLE LIGHTING SYSTEMS AND LOAD MANAGEMENT: HELPING END-USERS WIN

In a typical building, lighting represents 30-40% of the total electric load. As such, it offers the greatest single opportunity to affect savings, profitability and rate of return.

With the proper controllable ballast technology in place, a load management strategy yields even greater savings during peak load periods. In its "active mode," it enables you to work preemptively to secure the most attractive pricing. More quietly, it will convince you of the benefits of daylight harvesting—day after day after day.

Whole-building dimming takes into account such hot-button issues as cost-containment, flexibility, deregulation and control. It yields savings far beyond what can be expected from traditional efficiency improvement efforts. It puts you in a better position to negotiate with brokers of power, to realize the benefits of real-time pricing, and to effect better control and management of the building.

"Somebody Get the Lights!"

(With controllable-ballast technology, somebody already has.)

From the darkest to the brightest conditions, the human eye can operate over roughly a ten-trillion fold (10^5) range of illuminance.

Not only is this a remarkable feat of adaptability, it also carries with it significant implications for energy efficiency. Here's how:

- Change in pupil size. In response to varying light levels, the muscles of the iris expand or contract to change the exposed diameter of the pupil by a maximum ratio of 8:1, varying the area of the pupil by a factor of 64.

- Photochemical adaptation. The eye's rods and cones contain pigments which, when absorbing light energy, change composition and release ions that are then translated into an electrical signal sent to the brain.
- Logarithmic perception. When a typical three-way 50-100-150 watt incandescent lamp is turned on its 50-watt setting, the perceived change from a dark room to the 50-watt light is dramatic. Switching to the 100-watt setting adds an equal amount of additional light, but the change in brightness is not perceived to be as great. Moving to 150-watts creates even less of a perceptible light-level change.

How much can you lower light levels before occupants recognize it? Research indicates that levels can be gradually dimmed 30% over 5-15 minutes without occupants perceiving any change.

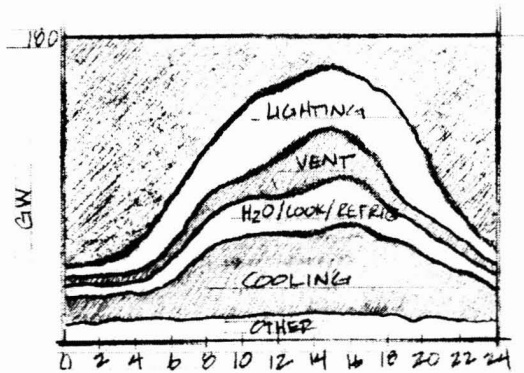
A "KILLER APP" SAVINGS BONUS: HVAC

The net effect of the Killer App on a facility's HVAC depends primarily upon such variables as building type, local climate, size of systems and size of loads. In several meaningful instances, however, the savings are dramatic indeed.

Large buildings dominated by internal loads, using more air conditioning than heating, typically experience site energy bonuses of 40% or more. Translation: Every kWh of reduction in annual lighting energy use yields an additional 0.4 kWh of annual reduction in HVAC energy.

In the United States, lighting accounts directly for nearly 12% of summer peak demand and 10% of winter peak. The reduction in summer peak cooling demand made possible by efficient lighting is often even greater than the net HVAC energy bonus. With daylight dimming as part of your system, many lights will use less energy for much of the morning and early afternoon, reducing heat build-up in the hours approaching the peak.

A collateral benefit of efficient lighting is often the reduced reliance on air conditioning. Another is the potential for the entire cooling system to be downsized, which yields capital as well as energy savings.



Summer Peak Avg. of all U.S. Commercial Buildings

HOW THE KILLER APP AFFECTS YOUR BILL

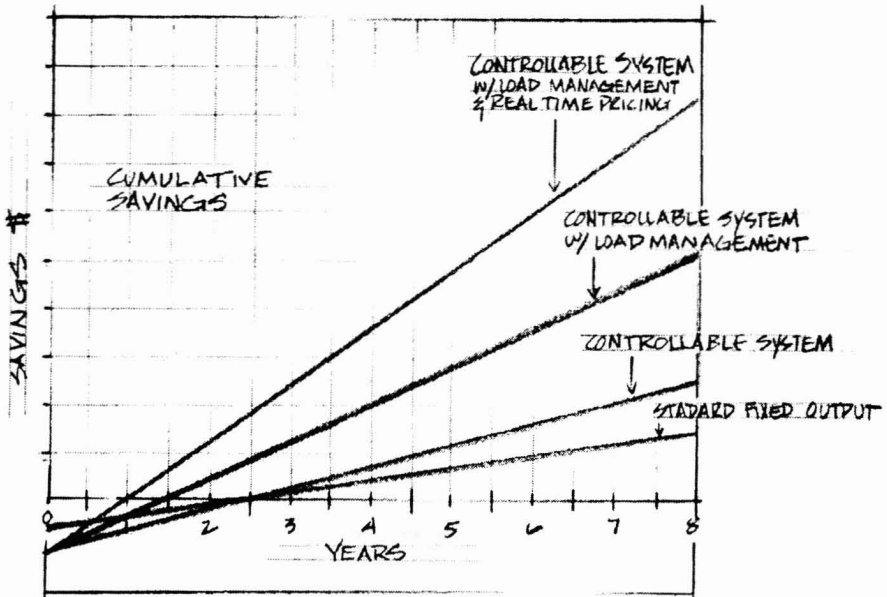
Expect savings far in excess of those you could realize by simply implementing traditional efficiency strategies. Load management, combined with real-time pricing, can result in paybacks approaching one year on an ELI controllable lighting system. The ramifications of full implementation, however, run much deeper. Combined with the latest in facilities information technology, an ELI system becomes what is in essence a preemptive risk management tool, enabling a manager both to modify usage and take advantage of more attractive rate tariffs as they become available.

Looking for rules of thumb? Savings can average \$.75 per square foot per year. In terms of load shedding, expect a reduction of 10 watts per 4' fluorescent lamp.

THE KILLER APP AT WORK IN REAL ESTATE

Consider what the killer app brings to the table in terms of downstream benefits for commercial real estate properties.

Controllable lighting technology can improve operating income, resulting in an increase in asset valuation. For example, take a 200,000 square foot office building. By reducing the operating expenses by \$.75 per square foot, net operating income would increase annually by



Cumulative Savings

\$150,000. Assuming a capitalization rate of 10%, the building's value would increase an amazing \$1,500,000. (The math: $\$.75/10\% = \750 per square foot \times 200,000 square feet.)

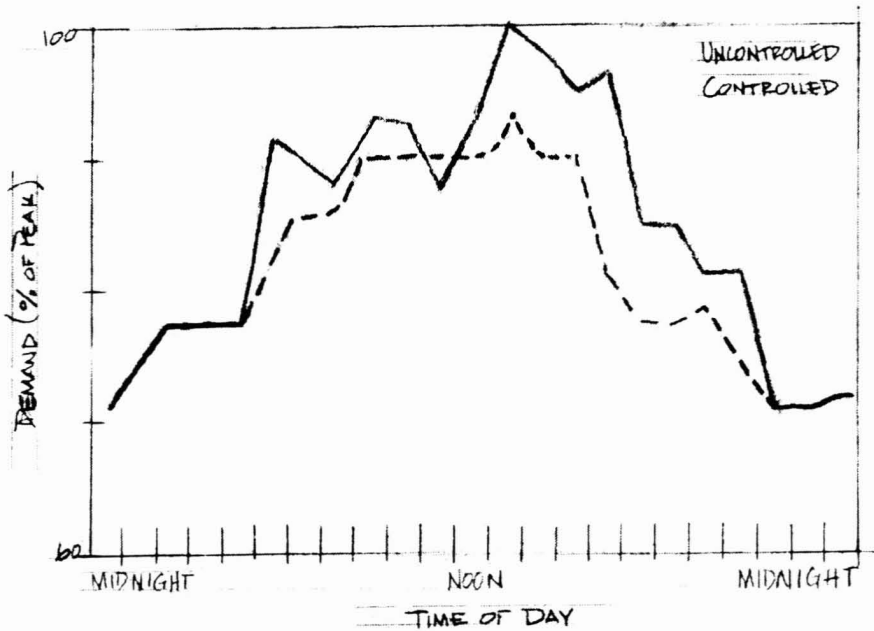
With a 75% loan-to-value ratio, asset managers and building owners could apply the available funds in any manner deemed fit—whether to fund capital improvements, hire additional personnel or bankroll business expansion.

Keep in mind that when the killer app is analyzed as an investment relative to an increase in building value, its payback can be expressed in months rather than years.

WHO ELSE CAN BENEFIT FROM THE CONTROLLABLE LIGHTING "KILLER APP?"

ESCOs... Brokers... Contractors... Utility and Distribution Companies (& Others)

As a breakthrough strategy, building-wide load management is a concept that satisfies every constituency with the energy marketplace, fitting in virtually everywhere and working to the advantage of every shareholder.



Controlled/Uncontrolled Load

ESCOs Win

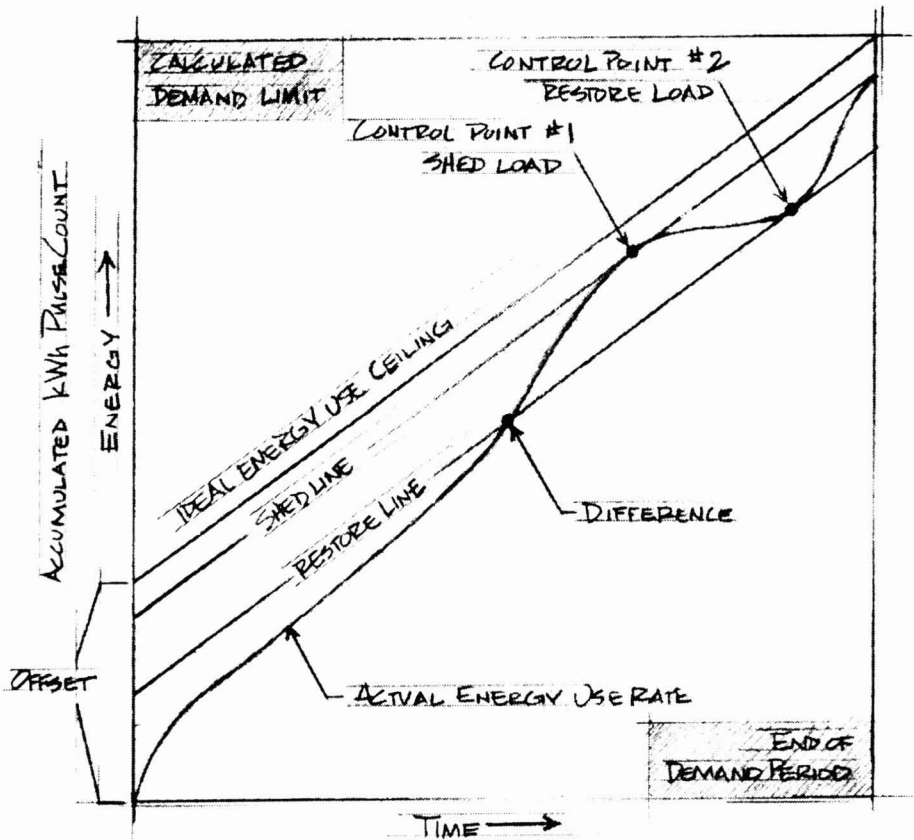
For energy service companies, a load management strategy is a *bona fide* competitive weapon, one that is already differentiating ESCOs as competition heats up.

Lighting system load control is easily integrated with all other building system improvements, which reduces costs and improves overall project economics. Furthermore, it delivers higher kilowatt-hour savings throughout the length of the performance contract—which creates more savings for the customer. In effect, the breakthrough strategy makes longer-term contracts more desirable and works hard to increase an ESCO's standing in the eyes of its customers.

Aggregators & Brokers Win

A breakthrough load management strategy enables brokers to work more closely than ever with customers, creating an energy partnership that strengthens over time.

In concert with the ability to remotely control usage on a real-time basis, load management affords retail energy providers the ability to offer customers competitive prices in a commodity market. Monitored



Load Shedding Logic Savings

by means of a new generation of information technology, a building's lighting system can function as a dispatchable load, freeing up valuable capacity while allowing the customer substantially more flexibility to choose lower-cost rate structures.

Property Management Companies and Contractors Win

With every innovative concept comes dynamic new products that make it possible. Replacing standard electronic ballasts with new dimming technology will help both property management companies and contractors deliver enhanced value to their respective clients.

For management companies, the appeal lies in the ability to offer tenants a more productive, attractive and ultimately more desirable place to work.

For contractors, the ability to market a new and demonstrably better, “full-featured” technology will relieve downward pressures on margins and simultaneously discourage less sophisticated competitors from entering the business.

Transmission and Distribution Companies Win

For a metropolitan distribution network straining at the very edge of its capacity, load management can be employed to reduce peak demand and thereby allow a utility to defer substantial capital outlays.

From a marketing perspective, transmission and distribution companies can leverage the technology by offering incentives to managers of older buildings to effect significant demand reduction.

Other Audiences, Other Upsides

Data unexamined is not worth collecting. It stands to reason, then, that data collated, weighed and investigated must be exploited to the fullest.

For information technology companies, building-wide load management represents further cost justification for customers to invest in their systems. For architects and engineers, it’s a cost-effective, value-added component to present to new and existing accounts. And for anyone to whom environmental conservation is a critical issue, the strategy’s emphasis on reduced peak demand puts forth a winning argument.

At its core, controllable lighting as a load management strategy is a fundamental breakthrough—with nothing but upside.

ABOUT THE AUTHOR

Joseph F. Desmond is president & CEO of Electronic Lighting, Inc., which designs, manufactures and markets controllable lighting systems. Mr. Desmond has worked in the energy/lighting industry for the past 14 years. Prior to ELI, he served as vice president of sales & marketing for Parke Industries, a national energy services provider. In addition, Mr. Desmond held positions with an east coast utility where he was responsible for demand side management programs. He has developed several nationally recognized and award-winning energy management programs during the past decade. Mr. Desmond graduated *magna cum laude* from Northeastern University with a BSBA in marketing and finance.

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