EYE LIGHTING INTERNATIONAL

THE BENEFITS OF TOTAL COST OF OWNERSHIP CALCULATIONS

HOW, WHEN & WHERE

TO USE TCO CALCS

E-LEARNING GUIDE

THE BENEFITS OF TOTAL COST OF OWNERSHIP CALCULATIONS

HOW, WHEN & WHERE **TO USE TCO CALCS**

Total Cost of Ownership

Total Cost of Ownership (TCO), aka; life cycle cost analysis, is an analysis meant to show the lifetime costs that come from certain large scale assets. Ownership brings much more than purchase costs. It includes costs for installing, deploying, operating, upgrading, building and maintaining the assets. For most operations, TCO analysis proves a major difference between purchase price and total life time asset cost.

TCO analysis is used to determine the best methods of acquisition and planning for a wide range of assets, including construction projects, equipment purchases and large scale lighting applications. With lighting, like other assets that consume energy, it can have significant maintenance or operating costs during the service life. Total cost of ownership analysis is, and should be, the primary focus of management when making decisions for major purchases and infrastructures. TCO is the focal point of:

- asset life cycle management
- budgeting and planning
- prioritizing capital acquisition proposals
- vendor selection

There is a wide variety of tools available to calculate TCO; from Edmunds for calculating the TCO of an automobile to recommendations from the EPA on purchasing ENERGY STAR qualified equipment versus conventional equipment.

When it comes to TCO for construction related projects, as defined by Construction Management Association of America, TCO in the real estate and construction industry means the total cost of designing, constructing, operating, and maintaining a project throughout its useful life.

The construction industry has been slow to adopt integrated design and sustainability because it is so fragmented. Owners typically establish minimum design specifications which can be determined by local governmental bodies. Often these local codes do not integrate the most sustainable practices. In addition, the numerous consultants, sub consultants, contractors, and vendors all work with competing interests.

As reported by the "Construction Industry Cost Effectiveness Project" of the Business Roundtable as far back as 1983:

> By common consensus and every available measure, the United States does not get its money's worth in construction, the nation's largest industry. The creeping erosion of construction efficiency and productivity is bad news for the entire U.S. economy. Construction is a particularly seminal industry. The price of every factory, office building, hotel or power plant that is built affects the price that must be charged for the goods or services produced in it or by it. And that effect generally persists for decades. Too much of the industry remains tethered to the past, partly by inertia and partly by historic divisions.

This includes the cycle of an asset, including acquisition, deployment, operation, support and even retirement.

How Is TCO Calculated?

The typical TCO model (Gartner) utilizes two major categories to organize costs. Let us look at construction related projects:

1.) <u>Direct costs:</u> These costs generally cover the visible and support related investments and expenses, which typically include materials.

We then divide those costs by the expected life of the asset to get an annual figure. This includes the costs of:

- All associated materials; everything from paint, to flooring to lighting
- Annual maintenance costs
- Annual costs of all supplies and materials
- Operations; which includes all labor costs and the fully loaded facilities costs for the appropriate share of the floor space used for equipment and furniture
- Administration; which includes an appropriate allocation of finance, HR, administration and procurement department costs, plus the consideration of training costs that may be required

2.) <u>Indirect costs:</u> These costs are less visible and usually are dispersed across the business operations organizations and are comprised of:

- End user operations, such as any ongoing end user support within the organization
    - These costs are identified as part of the project or investment and are easily tracked and computed

- Then there is a more subtle category of end user costs. These are the costs incurred when individuals gradually evolve to become part of the support structure, such as facility maintenance personnel
- Finally, one must consider downtime, when the process is interrupted from the regular work when equipment breaks or human error comes into play

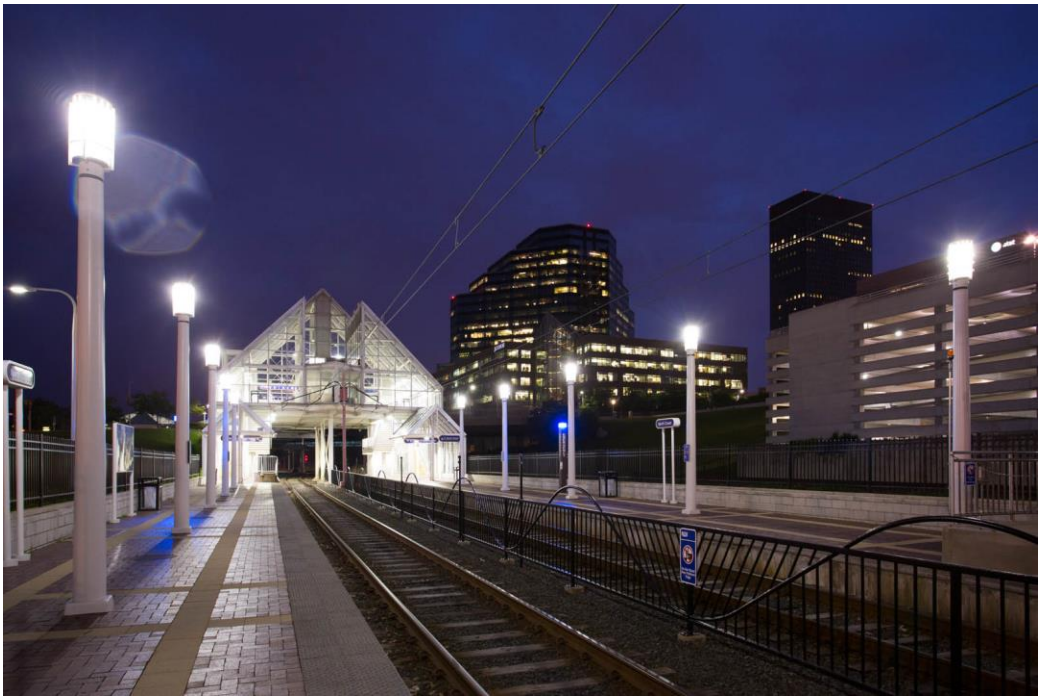
All of the direct and indirect costs are compiled, computed on an annual basis and then totaled to provide the total cost of ownership. Without taking the time for these upfront calculations, a project stands to run far over budget and time.

Scrap or Abandonment Value

The scrap or residual value of something is how much the fixed asset is worth at the end of its lease, or useful life. If you lease equipment for 10 years, its residual value is how much it is worth after 10 years. The residual value is determined by the financial institution that issues the lease before the lease begins. It is based on past value of similar equipment and future predictions. It is an important factor in determining the equipment's lease payments (the other factors may be the interest rate and tax). In capital budgeting projects, residual values reflect how much you can sell the asset for after the organization has finished using it or once the asset-generated cash flows can no longer be accurately forecasted or accrued.

If you have purchased equipment that for instance has a 20 year useful life, the fair market value must be determined by agreement or appraisal after 20 years. Often this figure is determined before the end-life period by comparison to similar equipment. The result is then the

residual, or abandonment value of the equipment. To manage asset-value risk, companies that have lots of expensive fixed assets (e.g., machine tools, vehicles, medical equipment) may purchase residual value insurance to guarantee the value of properly maintained assets at the end of their useful lives.



Taxes in TCO

Most equipment owners must pay property taxes or some type of usage tax on equipment. Taxes, like interest, can be calculated by either using the estimated tax rate multiplied by the actual value of the equipment or by multiplying the tax rate by the average annual investment.

What Tools are available for measuring TCO?

There are a variety of sources for TCO tools. Many are strictly software companies, such as:

- SourceForge

Others provide TCO calculators geared directly to their own products or service offerings, such as:

- Microsoft and Cisco

Still other specific industries provide TCO calculators and instructions for their category of business, such as the lighting industry, with organizations including:

- EPA
- Border States
- Solution Matrix Limited

TCO in the Lighting Industry

In recent years, safety and economics in the design of lighting systems has become a concern in new and existing facilities. Lighting designers consider what light source gives the quality of light required for safe operation and reliability in a particular facility, while considering the economic impact (TCO). With traditional light sources and designs used in

today's hazardous locations, there can be limitations due to factors such as:

- ambient temperatures
- physical size of lamps and luminaires
- lamp efficiency
- lumen depreciation
- availability of the proper optics for hazardous locations
- cost of fixtures
- maintenance
- safety of design
- and more

Around the world lighting designs differ. In North America, Fluorescent tends to be the dominant leader indoors, while High Intensity Discharge (HID) currently dominates outdoors based on the availability of products suited for the application, effect of ambient temperatures (operating at minus 40 °C to plus 40 °C) and grandfathering of designs. Indoor lighting currently covers 22 billion square feet of building envelopes (commercial office, manufacturers, retailers, etc.) in North America.

With the introduction of new lighting technology such as LED there has been increased considerations of other options available for lighting systems in both greenfield and brownfield facilities. Decisions on what type of lighting system to use are too often based on up front capital cost, and not on the long term maintainability, efficiency of light and safety in the work environment. All of this disregards the true TCO.

ESCOs

In today's construction environment, a major portion of large scale project planning and implementation is outsourced to ESCOs. An ESCO (energy service companies) is a commercial business providing a broad range of comprehensive energy solutions, including; designs and implementation of energy saving projects, retrofitting, energy conservation, energy infrastructure outsourcing, power generation, energy supply and risk management.

ESCOs typically provide services such as:

- development, design, and arrange for financing to ensure energy efficient projects
- install and maintain energy efficient equipment
- measure, monitor, and verify a project's energy savings
- often assume the risk that the project will save the amount of energy projected

For major lighting projects, project managers, and even some ESCOs will turn to organizations that are a part of the National Association of Lighting Management Companies (www.nalmco.org). Their primary members are solely focused as lighting technology organizations.

TCO Impact from Lighting Control Systems

Businesses that benefit most from energy efficient lighting technology include, but are not limited to:

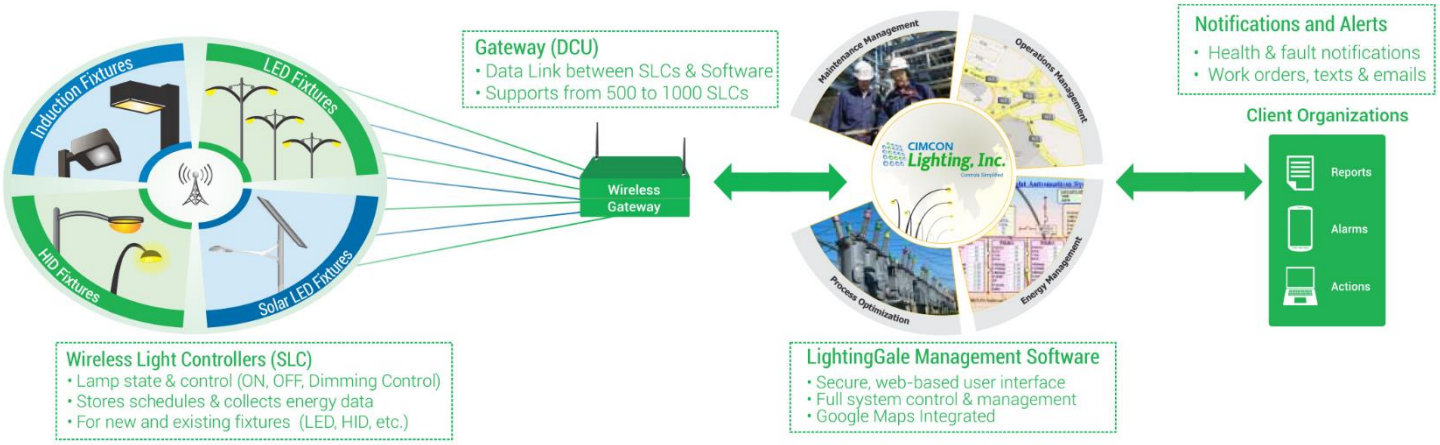
- Warehouses
- Large scale cold storage facilities
- Large retail stores
- Distribution centers
- Manufacturing facilities
- Convention centers & Arenas
- Auditoriums
- Gymnasiums
- Streets and roadways
- Parking facilities

The total cost of ownership in a lighting control system can best be understood when looking at the system's architecture.

An advanced control system is made up of three primary parts:

- SLC units (Street Light Control units)
- DCUs (Digital Control Units) which support 500 to 1000 SLCs
- RF-Wireless and GPRS/GSM technology

Web-based Management and Control Software are used to operate traditional, LED and Solar-based LED lamps. In addition to above, light fixtures, can be utilized in a wide variety of outdoor applications, including but not limited to: Street Lights, Highway Lighting, Area Lighting, Parking Lots and Garage Lighting, and Industrial Lighting. The diagram below illustrates how a typical system would operate.



Key Benefits to Expect from a Lighting Controls System:

- Maintains Public Safety:

  The system assures that lights are ON when they are needed and scheduled

- Failure-based Reporting:

  Notification is provided automatically in real-time to the responsible individual(s) as soon as a fault occurs

- Reduced Light Pollution and Increased Lamp Life:

  By dimming or turning lights OFF when and where they are not needed, light pollution is reduced and lamp life is increased

- Easy Expansion:

  Scalable to new or remote areas quickly and easily since no cables are involved

- No Photo Cell Required:

  The controller has a built in astro-clock that can accurately compute Sunset and Sunrise times, eliminating the need for a photocell. A photocell option exits as a backup

- Power Savings:

  Reduces energy costs by as much as 30% through intelligent scheduling and by minimizing wastage

- Maintenance and Repair Savings:

  Save 50-80% on repair costs with the "1 Trip Repair" capability on certain control units

- Low Initial Costs:

  Very low investment cost because no cable installation is required

- No Training Required; Simply "Plug and Play":

  Often as easy to install as a typical photocell

- Robust and Reliable:

The system has been designed and proven in field operations to offer unmatched reliability for sustained performance over a wide range of operating conditions

Conclusion

When it comes to considering TCO in lighting environments, there are many factors to take into account. Even comparative investment costs can vary widely depending on volume purchased and location. While LED lighting is at the forefront of energy savings, it is also becoming apparent that when considering all factors (lamp and luminaire cost, installation and maintenance), the savings of LED product versus other traditional technologies (i.e. HID) are significant.

Other considerations of choosing LED over HID when looking at the total cost of ownership in a lighting control system are:

- HID lamps take a few seconds to obtain maximum illumination (time is taken to form the plasma) while LEDs provides full brightness instantly
- HID lamps are less durable and need to be handled with care, while LEDs are covered in solid translucent or transparent plastic, making them more rugged than HID lamps
- LED lamps have a considerably longer service life than HID

It is imperative to consider all factors in the calculation, including installation labor in both new & retrofit, and ongoing maintenance. To ensure proper products are employed, consult a local lighting designer or a member of the National Association of Lighting Management Companies (www.nalmco.org)

Though Total Cost of Ownership analysis is a critical calculation that should provide the framework for any project, it is not the full picture. TCO does not cover other business benefits such as acquisitions, improved product quality, increased sales revenues, faster information exchange or an improved competitive environment. TCO is the primary focus of as much of "the all of it" that we can impact when it comes to energy savings, certain business deficiencies and environmental impact.

It is the "payback" part of TCO that needs to be understood before an initial investment can be recouped. As explained above, one needs to consider and calculate savings in electricity, lamp replacement, maintenance, and disposal costs. The payback time varies based on the size of the lighting project, the electricity rate, location, the particular fixtures selected, and other variables, some that continually change.

In addition, the TCO of retrofit lighting projects should be analyzed differently than new projects. Yet each need to take into consideration improved lighting for safety and productivity, above the benefit of financial payback.

Before purchasing a lighting system, buyers should consult a lighting professional, an ESCO or a member of NALMCO, who can analyze the entire project for energy efficiency, lighting level, appropriate color rendering and safety.

Finally, as part of any long term lighting project, organizations should prepare ongoing plans for the recycling of all mercury-containing products, including all HID lamps, T-Lamp fluorescents, and induction systems.

About the Author

EYE Lighting International is a leading provider of lighting products with more than 22 years of innovation in lighting technology. EYE Lighting manufactures technically superior products featuring solid-state LED luminaires and High Intensity Discharge (HID) lamps. The products are specified by lighting designers, utilities, municipalities, and energy service companies, and are used in commercial and industrial applications and for sports and infrastructure lighting. EYE Lighting's products provide long-life, reliability, excellent color rendering, and superior quality. Every day satisfied customers use EYE-brand products to reduce energy use, save money, and meet their sustainability goals.

Sources include:

1. Business Case Analytics
2. IIIE *Xplore* Digital Library
3. green Manufacturer
4. The Potomac Energy Fund
5. Inform, Inc.
6. Edmunds
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