White Paper

Better work environment with Led lights

Productivity Gains

MY LED LIGHTING GUIDE
YOUR GUIDE TO ENERGY EFFICIENT LED LIGHTING

Executive Summary

Improvement in work environment is closely tied with improvement in the performance of workers. Studies have demonstrated that a 3 % gain in worker performance can be obtained with better lighting. Often the gains in worker productivity are enough to offset the cost of lighting projects in less than a year. Better lighting leads to better group performance, enhances employee satisfaction, and output.

Several studies in US and Europe have demonstrated that gains in productivity can significantly alter financial projections of lighting projects. Per square foot employee costs are 8 to 15 times higher than property costs. Investing in high quality LED lighting results in significant performance gains.

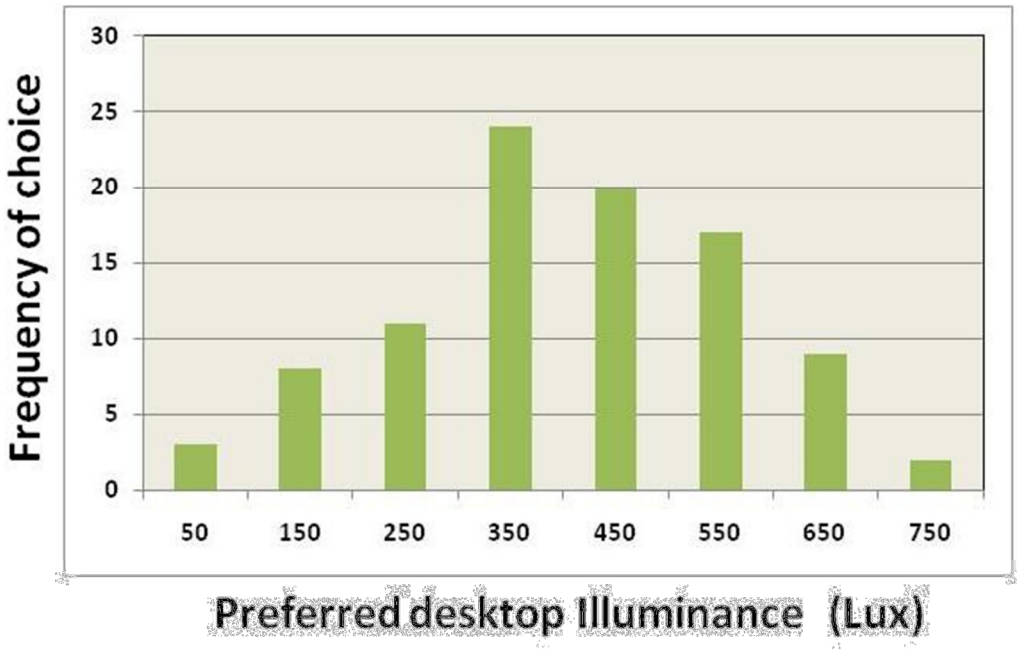
Effect of light on workplace performance

Three important goals of lighting in an office are (Keeling and Kallaus 1996)

a) Create an appropriate and safe work area
b) Provide for aesthetic and glare free pleasant vision
c) Save energy.

Light has a direct correlation with ease of reading, lower eyestrain, reduced errors, better turnaround time, reduced risk of musculoskeletal injuries and psychological well being. There is a vast amount of data indicating that light is one of the biggest challenges to workplace productivity and an area where investments have the fastest payback time and highest return on investment. Bachner (2000) has demonstrated that employees working in good lighting conditions work faster and with fewer errors.

A 1983 study by Merck showed that 20 % employees were dissatisfied with indoor lighting conditions. Eyestrain has been cited as a leading cause of physical stress. IESNA recommends a horizontal illumination of 300 Lux if computer use is frequent and 500 Lux if computer use is infrequent. But these are average figures. They do not take into account the variation in individual preference for lighting levels. For example older people need more light. Similarly variation in the nature of job causes differences in individual light preference.

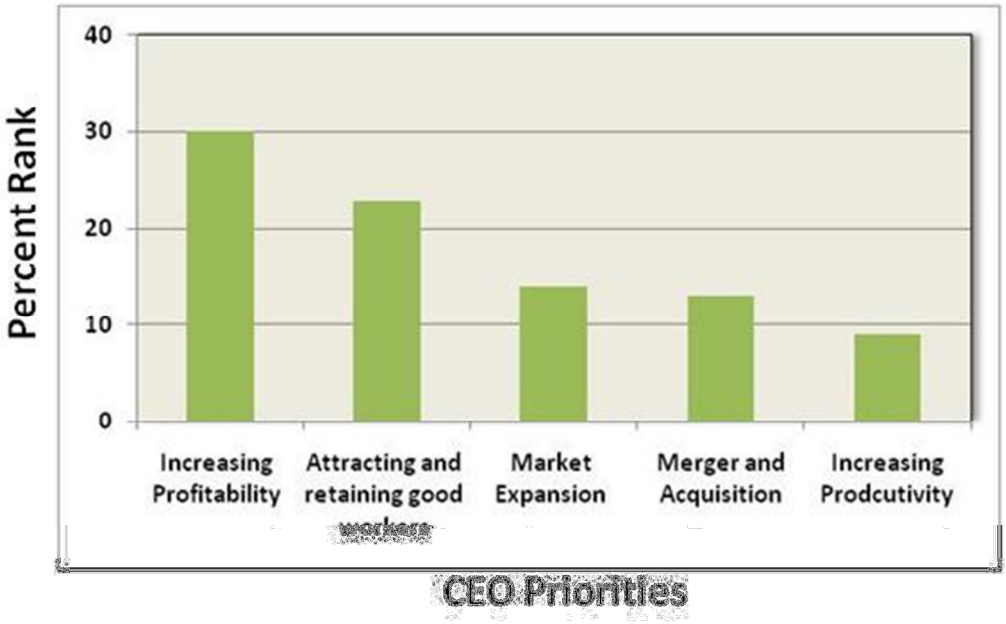


The graph above shows that a majority of workers prefer lighting levels other than those prescribed by IESNA. As outlined before, research has indicated that dissatisfaction with lighting conditions is tied in with adverse effects on employee performance. It is possible to provide for individual preference for light levels by using dimmable LED lights. Dimming controls offer an additional 10-30 % savings in lighting bills over and above the 50-80% lower energy bills obtained with LED lighting technology.

Gains from LED lighting are not limited to energy efficiency alone. Against an IESNA recommended lighting uniformity ratio of 3:1 employees tend to prefer a better lighting uniformity ratio of 2:1.Owing to the use of prismatic light diffusers in LED bulbs these light from these sources is more uniform than its incandescent, fluorescent or HID counterpart.

Lighting and its relationship with top CEO Priorities

A survey of business executives has demonstrated that increasing productivity, attracting top talent and increasing profitability are amongst the top most priorities of CEOs.



Lighting has a role to play in fulfilling each of these diverse CEO priorities. Here is what research tells us

a) Eyestrain associated with poor lighting has been cited as a major cause of headache in workers.
b) A study by the American Society of Interior Designers demonstrated that almost 70 % of office workers were concerned about lighting conditions and a vast majority considered the quality of the physical workplace as the third most important factor influencing their decision of accepting or rejecting a position.
c) A Cornell university study estimated good lighting could improve employee productivity by 3-5%.

Clearly, high quality, energy efficient lighting boosts employee satisfaction, increases productivity and bolsters the image of a caring corporation.

We shall now demonstrate how gains in employee productivity lead to quick payback periods for lighting upgrades.

Cost benefit analysis of LED Lighting

My LED lighting Guide favors a data driven approach to issues. When expressed in dollars, the gains in productivity are easier to evaluate. The table below demonstrates the building and employee costs of a typical facility. The data used in the table below is based on a study by NEMA.

Economic Analysis of Costs	
Baseline data	
Building Area (Sq. Feet)	10,000
Number of Employees	65
Average occupancy (Sq. feet/person)	154
Operating costs /Property related costs ($/ Sq. Feet/ Year)	
Rent	21
Utility Charges	1.9
Taxes	2
Total operating costs	**24.9**
Cost of Human Resources ($)	
Hourly pay	12
Benefits	3.5
Total hourly cost	15.5
Total annual salary (per person)	32240
Total Annual Salary Bill (Entire company)	2095600
Normalized Salary Costs ($/sq. feet/person/year)	**209.6**

Comparison of Operational and Salary costs	
Ratio of Salary Cost to Operational Costs	8.4
Salary as % of total costs	89.4
Loss of productivity	
Loss of productivity due to poor lighting	3%
Loss ($/Sq. foot/person/year)	6.3
Total Annual Productivity Loss ($)	**62868**
Savings in Utility costs with LED lights ($)	**4750**
Total gains with LED lights ($)	**67618**

NOTE – The values used in the table are estimates only and may vary from one facility to another.

The table above shows that factoring in only the savings from energy in a lighting upgrade project can lead to a gross underestimation of the potential gains by as much as 93 %. This in turn will have important consequences for payback period and ROI calculations. Typically LED lighting projects have a 2 year payback period based on energy savings alone. Factor in the productivity gains and you are looking at payback periods of a month or less.

Studies on Productivity Gains with Better Lighting

Our table shows that workforce costs are almost 90 % of the total costs of a facility. Clearly any gains in this area will be significant. Since these costs are 8 times more than the property costs, a gain of 1 % in the productivity of the workforce equals an 8 % reduction in property costs.

Adams has reported that reduction in glare leads to a 3-7 % increase in reading speed and errors. Similarly, the Federal Energy administration reports a 5 % increase in proofreading speed and the production of drafting drawings went up by a substantial 13 % in a study conducted by Pennsylvania Power and Light with better lighting. A 1994 study demonstrated a 6 % gain in productivity, 25 % less absenteeism and gains in product quality valued at $ 25,000 with improvement in lighting facilities.

Our foregoing discussion does not take maintenance costs and staff time lost due to outages into consideration. On average it costs $ 75 to process a complaint of light failure and $ 100 or more in terms of lost staff time due to lighting failure problems. We shall look at the maintenance savings of LED lights in a separate document.

Lighting Success Stories

Most stories outlined above are the result of efforts to scientifically estimate gains from improved lighting. To drive home the point that your organization cannot afford to lose the opportunity of generating significant gains through savings in utility costs and performance gains let us look at the experience of organizations that actually benefitted from lighting upgrades.

Reno, Nevada, 6 % productivity gain, 150 % ROI, Annual gains of $ 450,000 per annum

The renovation of the Nevada post office is perhaps the oldest and the most well known story. $300,000 were spent on the lighting improvement project. The estimated payback period of the project (energy savings and lower maintenance costs) was 6 years. After the implementation of the project, the rate of mail sorting went up by 6 % - a productivity gain of $400,000 – 500,000 per annum. The actual payback period was reduced to less than a year and the ROI was 150%.

Metal industries, Elizabeth, 5 % productivity gain, Annual gain in excess of $ 1,725,000

A lighting upgrade project in this 10,000 Sq feet facility resulted in productivity gains of $ 1,500,000 per annum. Savings in terms of reduced accidents, compensation claims, lower insurance rates etc amounted to an additional $ 225,000. Gains from lower maintenance costs were an added bonus.

Superior Die Set Corporation, Oak creek, Wisconsin, 11.3 % productivity gains.

The $ 3,000 lighting project was expected to generate energy and maintenance savings of $ 1750 annually. In reality the gains from fast turnaround of drawings by drafters valued at $ 37,500 per annum reduced the payback time to less than one month. The ROI was a stupendous 1308 %!

On a national scale LED lights can lead to gains to the tune of $ 10 billion per annum. Enough to ensure that United States widens its lead over its rivals on political, economic and climate leadership fronts. The aforementioned studies demonstrate how LED lights can be an important source of savings and for boosting employee morale in a highly competitive world.

The task of transforming your lighting system from one based on archaic technology to modern LED lighting is made easier by the rebates offered by Utility companies and state energy offices.

Tax deductions under the energy policy act and the energy independence and security act among others.

AS the leading source of energy efficient LED lighting technology MY LED Lighting Guide is trusted by individuals , corporations and government offices all over the country for fulfilling their need for LED lighting products. We offer American made, lighting products for both new installation and retrofit purposes.

References

1. Newsham, G.R., Veitch, J.A., Arsenault, C., and Duval, C. "Effect of dimming control on office worker satisfaction and performance," Proceedings of the Annual Conference of the Illuminating Engineering Society of North America (Tampa, FL), 2004.
2. Veitch, J.A and Newsham, G.R. "Preferred luminous conditions in open-plan offices: Research and practice recommendations," Lighting Research and Technology, 32(4), 2000, pp. 199-212.
3. Illuminating Engineering Society of North America (IESNA) (Ed: Rea, M.), Lighting Handbook 9th Edition, New York, NY, 2000.
4. Ries, R.B, Melissa M. G, Nuri M. N, Kim LaScola. The economic benefits of green buildings a comprehensive case study, Engineering Economist. 2006.

