

# Daylighting, LED Lighting and ROI:

## Opinion Editorial / Discussion Piece

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Daylighting of architectural space is an integral part of architectural design. After all, humans occupy buildings, and humans desire a physical and psychological connection to the “outside” world. Additionally, all life on Earth, including human life, evolved under sunlight and our Circadian rhythms, which govern our daily living cycles and influence our mood and control our sleep patterns, developed in response to a connection to the outdoors. Apertures which connect interior building spaces with the exterior environment, such as windows, skylights, and atria, help define and shape the architectural character of the building, and thus are important elements of architectural design. Throughout history, these apertures have served multiple functions – view, fresh air, emergency egress, communication and so on. After the OPEC oil embargo of the mid-1970s, use of building apertures for their lighting energy saving potential – turning off or dimming electric lights when adequate daylight levels exist – has become an established strategy in new and existing commercial ( non-residential ) buildings. Thus began a trend which has had some serious unintended consequences. Let me explain.

Building owners and architects began viewing daylight strategies, and daylighting in general, just like any other energy saving design strategy, such as increased envelope insulation levels, high efficiency HVAC equipment, high efficiency electric lighting, and so on. The inherent benefits of views, occupant well being and health, improved productivity, and psychological connection to the outdoors have been forgotten or diminished, and rigid energy-related cost-benefit analysis has taken their place. Building owners and developers are now asking their architects “What is the payback or return on Investment (ROI) on integrating these daylighting strategies and daylight responsive electric lighting controls into my building?”. And worse yet, this ROI calculation can only consider the energy savings achieved by turning off electric lights, not any of the occupant productivity, well being and health related benefits of daylighting. With this rigid definition of ROI, it is impossible to achieve a simple payback or an ROI that will satisfy the building owner / developer.

This whole matter has been compounded by the widespread introduction of LED lighting technology. When incandescent and fluorescent lighting technology dominated the commercial building market, significant energy savings were achievable by turning off or dimming electric lighting when adequate daylight was present. For example, with a 1 to 2 Watt per square foot lighting power density with incandescent or fluorescent lighting, a 50% lighting energy reduction generated significant energy cost savings. However, with LED lighting at a 0.5 to 0.6 W/sf lighting power density, a 50% reduction due to daylighting generates very little energy cost savings. Consequently, daylighting is no longer considered a viable energy saving design strategy because it does not “pencil out” from a simply payback or ROI point of view. And because most architects have bought into this way of thinking and have become hostage to it,

they have lost the ability to forcefully argue against this narrow energy economic view of daylighting.

If architects care about improved occupant comfort, health and productivity, and about achieving significant energy savings, then aggressive daylighting is an essential design strategy. However, it must be an integral part of all their designs, just like indoor plumbing, and not subject to the vagaries of ROI calculations and simplistic energy economics. Architects make thousands of decisions and trade-offs during the course of designing a building, and ensuring the inclusion of aggressive daylighting into their designs is easily accomplished if it is a high priority, particularly if an “integrated Design” approach is used.

Because market place economics do not properly value ALL the benefits of daylighting, and demands that it meet narrowly defined energy economic criteria before being considered and incorporated into buildings, daylighting must become a mandatory requirement in building codes and standards. Daylighting codes requirements must address both quantitative (illumination levels) and qualitative ( glare ) issues in the “daylit zones”, and do so in a performance-based approach. Current, daylighting code requirements address only electric lighting controls ( require daylight harvesting controls ) in the perimeter zones of buildings, and do not address occupant visual comfort ( glare, high contrast ratios ) issues.

Architects must become better educated in understanding and applying daylighting design principles, and must be more forceful and effective in advocating for daylighting with their clients. They should not condone or participate in the misdirected conversations regarding daylighting economics, unless ALL the energy AND non-energy benefits of daylighting are allowed to be included in this economic analysis.

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