Changing the Concept of Light in Commercial Spaces

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Even as recently as the early 2000s, if you asked someone to define lighting, they probably would have described a bulb and switch. If you asked about the type of bulb, they'd tell you fluorescent or spotlight or a standard power denomination such as 60W or 100W bulb. While directionally proportional to the amount of light emitted, the wattage described only the power level, not the quantitative or qualitative characteristics of the light in terms of lumens or color. For decades, the incandescent light bulb has provided basic, barebones light.

Today, the entire concept of light is changing dramatically. Light is no longer described as a constant power level. Light means color and direction. Light interacts to inform function and create ambiance. Connected lighting via Internet of Things (IoT) technologies was once a novelty found only in luxurious residences and office spaces. Now it has become a reality and economically within reach for most homeowners and residential developers.

Transcend the traditional concept of lighting

The good news is modern workers no longer have to face glaring light from T8 fluorescent tubes once common in office spaces. For building developers or facility managers of commercial spaces, the challenge is to keep pace with new and changing lighting technologies. That's where Transcend comes in. Leveraging the latest in Power over Ethernet (PoE) technology to deploy smart lighting throughout a building, the Molex Transcend PoE connected lighting system delivers energy savings, with automatic, progressive and dynamic lighting.

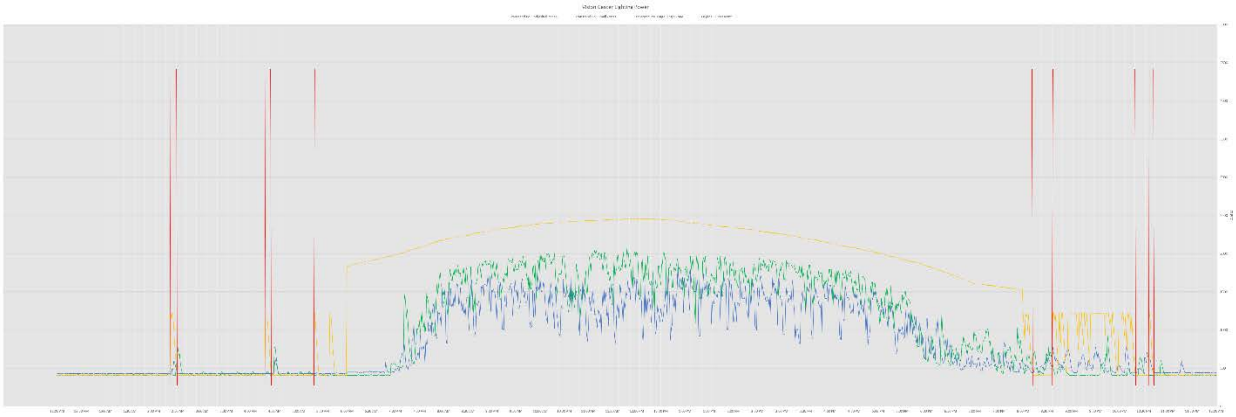
A Transcend system allows lighting within a building to react to current conditions in real time. Each light has its own set of sensors to allow control down to the individual fixture. This approach is revolutionary compared to other control systems that put only one or two sensors in room. Now every fixture can have its own sensors, increasing the amount of information by orders of magnitudes. Each fixture can have up to a dozen sensors and actuators that are viewing and interacting with the environment. The light changes color temperature and intensity throughout the day to mimic natural sunlight and increase productivity and wellbeing. With an IP-based system such as Molex transcend the lighting infrastructure becomes a real IoT asset for the entire building leading to a greater efficiency, augmented comfort and productivity while providing more data and seamless integration with other Building Automation System.

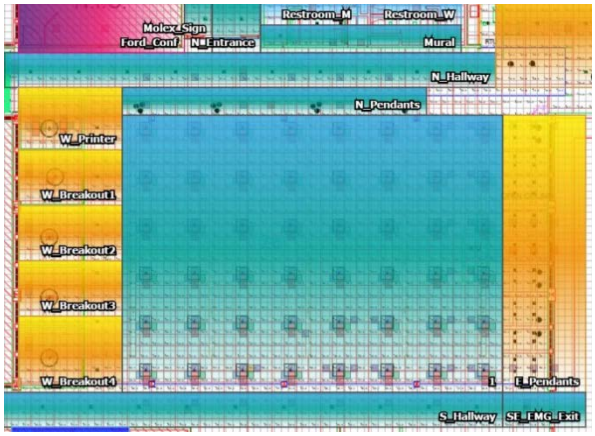
Easy to install, use and configure

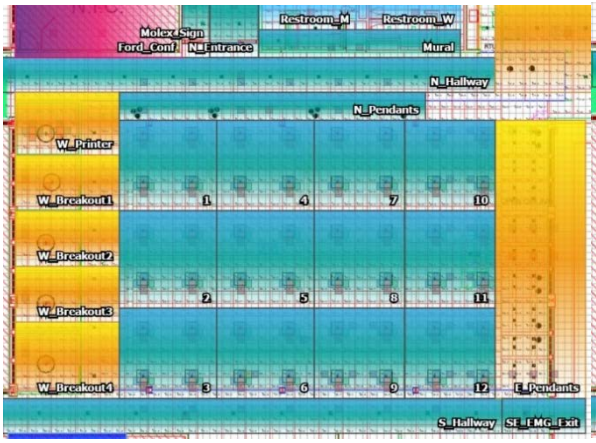
An IP based connected lighting system has the big advantage that every device such as light, sensor, actuator, local control has an IP address. The system is easy and flexible and allows to configure spaces to meet functional requirements and efficiency target. Digital zoning and SW based configuration completely changes the paradigm. Space can be configured and re-configured in few minutes without a costly electrical rewiring.

How does a Transcend equipped commercial building measure up from energy efficiency stand point?

Delving into details—three different configurations were installed in a Molex building PoE system. The chart below shows the results of the new PoE system compared with the previous fluorescent fixtures.







Three distinct zoning schemes were reconfigured into the system. Then power was measured to gauge the energy savings.

The first zoning scheme was one large zone and behaved in such a way that the lights were always on as long as someone was in the office space. This is noted in the yellow curve tracing the circadian pattern that the Transcend system implements.

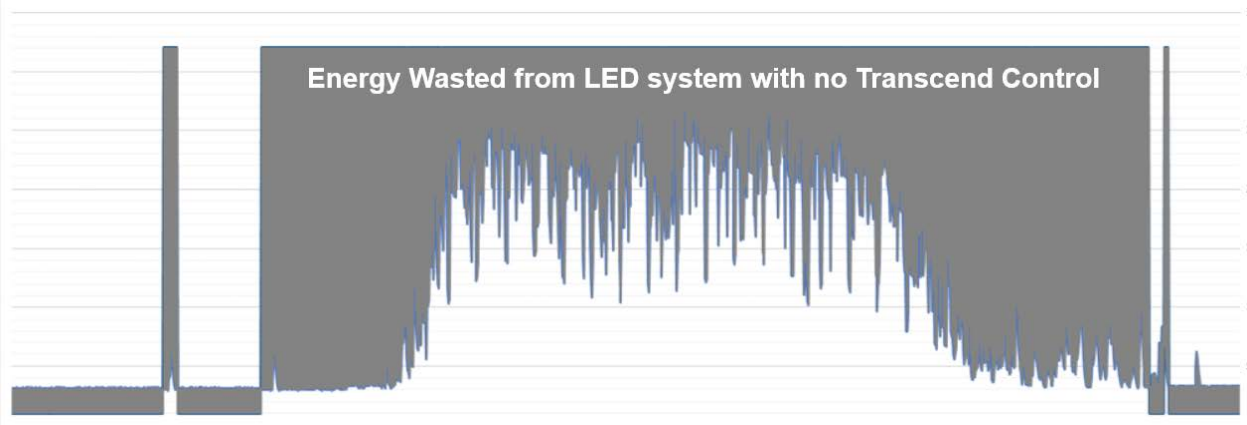
The second zoning scheme puts the four lights in a cube 'pod' of four cubicles zoned together. If there was any employee in one of the four 'pods' the lights above would stay on. This allowed for significant savings as any time the 'pod' was empty because, the lights would quickly turn off.

In the last zoning scheme, the lights were all in individual zones. This scheme delivered the highest granularity of light control and power savings.

The study has been conducted to quantify the effect of occupancy control in combination with the zoning. The occupancy control was keep the same in all three cases in terms of "time off" (the lapse of time after which transcend start to dim the light after the last occupancy event trigger) and fade time (the duration Transcend was set to dim to off).

The results are astounding. The PoE system can be configured to save over 75% of the energy of the standard fluorescent lighting. The building used for this demonstration has limited external light and this number could have been driven even higher by daylight harvesting. Depending on the building it would be possible for 80% or even 90% savings with an optimized PoE system.

The graph below compares a new AC LED fixture vs a Transcend PoE LED system.

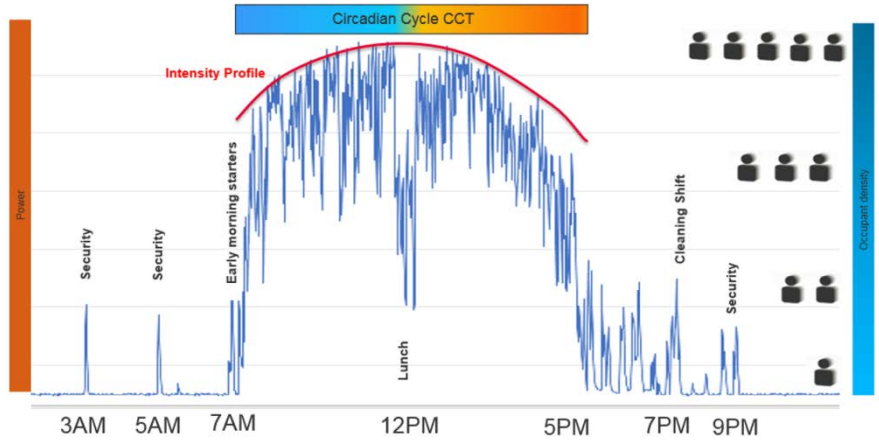


The Transcend lights react in real time to activity and sunlight levels in the building, in order to perfectly optimize the amount of light at any given time and accurately harness the greatest amount of energy savings. The gray area on the graph reflects wasted energy from a non-optimal system.

An integrated lighting network infrastructure can provide more efficient control, leading to significant energy savings, increased occupant comfort and improved productivity, and more meaningful data collection by distributed sensor systems. For example, the graph below shows monitored data from one type of sensor (power) in the Molex building equipped with the Transcend system during one of the week day in the case of 48 zones set up.

The first aspect to be noted is the intensity profile envelop of the power usage across the day. The intensity curve is a result of the dynamic circadian cycle implemented. Transcend implementation of circadian cycle used in this study featured a simulated natural light implementation.

It is also easy to see the correlation between power usage and occupancy. An advanced system like transcend do not implement a binary state for occupancy (lights on/off in reaction to occupancy) but a more functional response of the building to presence.



Extrapolating when and how the building was being used clearly highlights the power of the Transcend system:

- The first employees begin arriving just prior to 7am. As people flow into the building, the lights increase to full brightness.
- The arc of the circadian power levels depicts the lights throughout the day as they transition from cool to warm, with a mid-day peak intensity. Because of the granular zones, small portions of the room dim throughout the day saving the energy, without the employees even noticing a change.
- At noon, the power takes a noticeable dip. During lunch hour many people exit the building to eat out or head to the cafeteria. Throughout the afternoon, the power curve fades with circadian.
- At 5pm, as people wrap up their work day and head home, the power curve starts dropping dramatically as activity level drops.
- Several slight spikes at night reflect a cleaning shift and security detail. Facility managers no longer need to wonder whether night staff perform required upkeep or walk their entire building rounds. The lighting system can show their exact path taken as sensors triggered in those areas.

Bringing commercial buildings into the future

By adapting to building usage, mood and circadian cycles, Ethernet connected lighting systems can be used to customize the user experience using direct, indirect, ambient, and decorative schemes in a dynamic and purposeful control. LED luminaires with bio-adaptive functionality can mimic natural daylight by gradually changing from cool temperature, high intensity in the morning to a warmer, less intensive light later in the day. Subtle changes in lighting intensity provide a more natural work environment that fosters higher productivity, while optimizing energy savings through sensor feedback.

The Transcend system allows for ultimate flexibility that leads to optimized energy savings. At this granularity, the results go beyond occupancy detection to provide a dynamic response of the lighting to real time activity levels. PoE takes quality lighting to the next level, with smoother intensity and dimming functions and dynamically adjustable color temperature to create an inviting and comfortable space that encourages well-being and productivity.

The ability to migrate lighting controls to IP-based infrastructure transforms that lighting system into a service and valuable IoT asset able to be controlled synergistically along with other building functions. The owner or operator has ready access to light status, real-time energy consumption, sensor-based occupancy reporting, air quality, temperature and other environmental monitoring. That aggregate data translates into tangible business insights—flow patterns and space utilization, conditions within those spaces, and how different spaces, floors, or buildings rank or compare in terms of utilization, energy usage and productivity.