

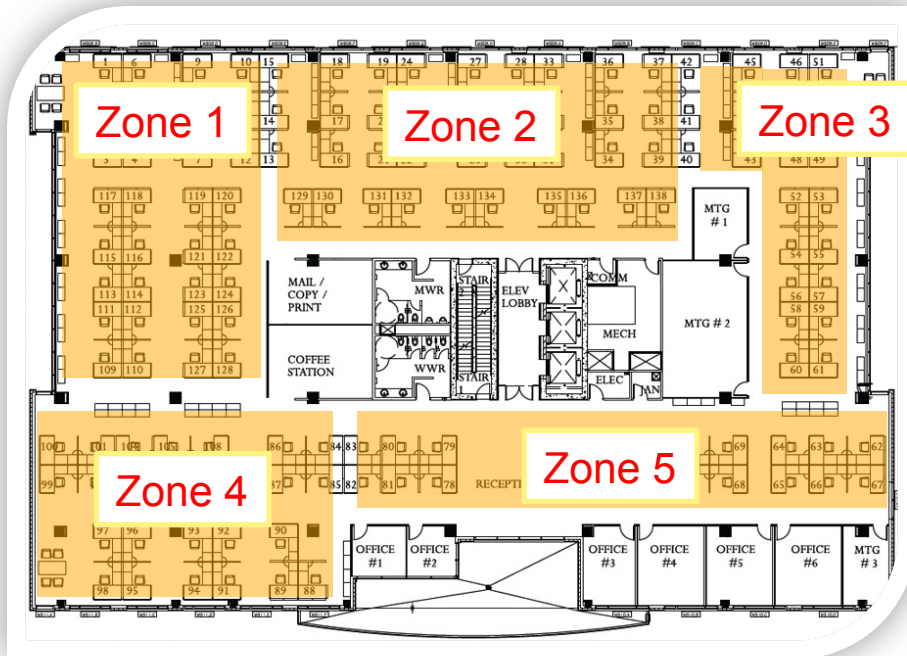
PHILIPS

sense **and** simplicity

Intelligent Luminaire for
GSA Green Proving Ground

30 November 2012

Existing Offices in U.S



Existing Buildings are plagued with pre-existing zones and circuits, which has been a primary barrier to deep energy savings in open plan offices.

- The **primary barrier** to lighting controls within the Open Plan Office Application is the existing wiring, which restricts lighting improvements and energy efficiency strategies due to large zones and pre-existing circuits.
- The opportunity before us with LEDs, digital drivers, and wireless controls, is to gain access to this **massive footprint** of existing space and create granular dimming where it was not possible before
- Philips can bring this to market using our advanced technology and lighting/ applications knowledge to **keep lighting quality intact and save energy**
- Granular dimming includes **several strategies** in open plan such as daylighting dimming zones, small zone dimming due to occupancy patterns, and uniform light reductions required by code

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Occupancy-based dimming, one of numerous strategies available with luminaire based intelligence

Granular dimming breaks through pre-existing zones to allow layered and application appropriate dimming. None of our competitors have achieved this.

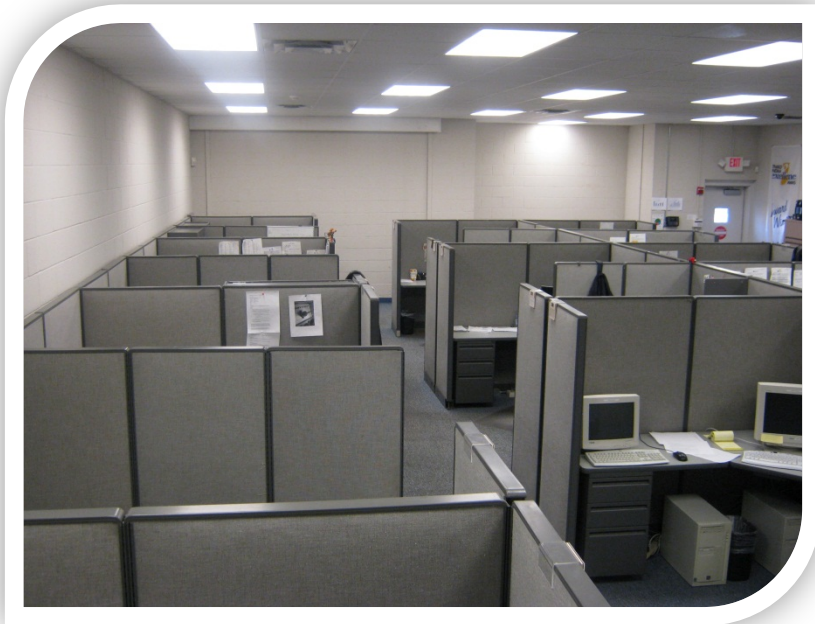
Use Case – EB Tenant Fitout



Improved lighting with plug and play controls embedded within the luminaire and easy enough for a facility manager to commission would add value for tenant and owner as well as reduce energy bills.

- Tenants changing space-- sometimes a lease, other times it's churn within a user owned facility
- When a space upgrade is desired as part of the move, lighting can be part of the capital budget or amortized over time within the lease
- Economic criteria are strict, so design fees and complex controls are usually not an option
- Replacement-in-place (1 for 1 changeout of the luminaire) is a priority strategy for this reason
- Minimum energy code is required, but utility incentives are very frequently used in high energy cost regions
- Having a new luminaire is desired (if affordable); tenants want a *tangible* visual and comfort improvement, they want to like their new space
- Building owners benefit also- lighting improvements will increase asset value and improve NOI (Net Operating Income)

Use Case – EB Energy Project



Differentiate our approach to the Energy Services market by adding value with lighting improvements and a breakthrough solution offering granular dimming in open plan using intelligent luminaires.

- Energy Services Companies (ESCOs) change the lighting as a way to reduce energy bills
- Historically the projects are limited to lamp and ballast retrofits with occupancy sensors
- Economic criteria are strict not only because of the customer, but also because ESCOs are often using the lighting as low hanging fruit to support other bundled savings measures (e.g., HVAC)
- Replacement-in-place (1 for 1 changeout of the luminaire) is viable but new design layouts are very unlikely
- Minimum energy code is required, but utility incentives are very frequently used in high energy cost regions
- Application-based granular dimming is a new energy strategy, not possible with 0-10v control and existing electrical conditions.

Typical controls barriers: complexity and cost

*If a system does **everything** you could want but you have to work hard to get **anything** you want, then it will never be high volume.*

Design & procurement process is complex and costly

- Controls intent document needed to describe required lighting control functions
- Design also required for sensor locations
- Compatibility issues between various sources, control protocols and BMS
- Multiple name specifications & proprietary products
- Bidding confusion
- Changes from spec results in shop drawings that don't match the control intent

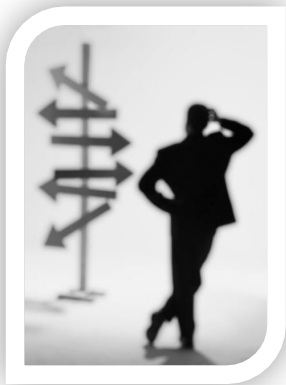
Installation & commissioning is error prone and costly

- Equipment costs are high, and over budgeted to mitigate risk
- Installation is always wrong
- Contractor's goal is simply to get lighting installed, not necessarily operable; commissioning can't start until the system is fully functional
- Average cost of factory start up of lighting controls system is \$20/device, not including the 2nd trip to the site, because the lighting system was not ready for start up at the scheduled time
- Commissioning of the system after factory start up averages \$1.16/sf

Ongoing costs are significant

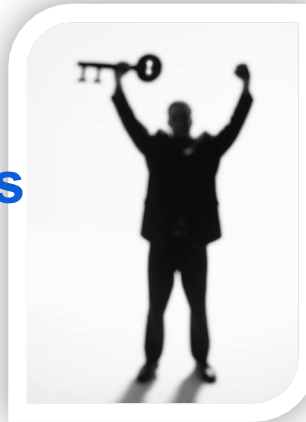
- Ongoing documentation of system performance can be costly; sub meters average \$2200/space
- Ongoing re-commissioning is costly; "retuning" lighting controls can cost \$10-30 per square foot
- Ongoing training of facility teams and introductory training of new hires may cost an additional \$50,000-\$100,000 over the life of a project

Solving controls problems for Existing Buildings



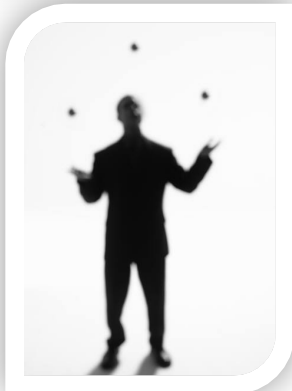
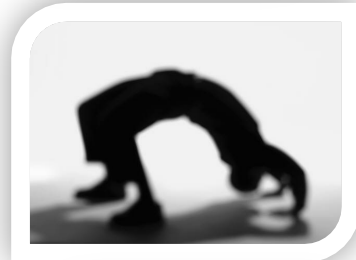
Conventional “add-on” Wired Control Systems

- Design cost
- Design errors
- Controls Intent
- Complexity
- Compatibility
- Installation Cost
- Installation Errors
- Commissioning Cost
- Re-Commissioning



Wireless & Intelligent

- Plug & play luminaires, default setting works out of the box
- Commissioning only requires simple grouping via IR-remote.
- Embedded algorithms will contain controls intent, sequence of operations
- Firmware updates, can sell more value remotely through contracts & leasing
- Granular dimming will provide previously unachievable savings



Importance of the Integrated Lighting Approach

Quality issues relevant to granular dimming

Room surface brightness

Luminance and illuminance ratios

Appearance of dimmed luminaires

Dimming amount and duration

Integration of lighting and shading

Personal control



Other lighting quality issues

Glare from overhead

Direct and reflected glare

Color temperature, rendering, consistency

Luminaire aesthetics

Flicker free lighting

Quality of light is central to our success. Application based validation is part of the Intelligent Luminaire project scope.

