How Can Energy Reporting Accelerate Connected Lighting System Deployment

John K Scott

06/08/16

How To Connect Lighting To Occupant Efficiency

Lighting is the most commonly discussed, understood and utilized tool for energy efficiency.

One of the most stress-free and cost effect tool to implement due to short payback period

The most underestimated part of the conversation is the end user and their direct needs. ASHRAE & OSHA Standards

Balancing natural and direct lighting is one of the most difficult challenges in occupant comfort and efficiency

Codes

Codes set minimum baselines

Codes are reactionary to standards

Standards are reactionary to technology

Technology is emerging at an accelerating rate and standards must follow process

IBCC Building Codes

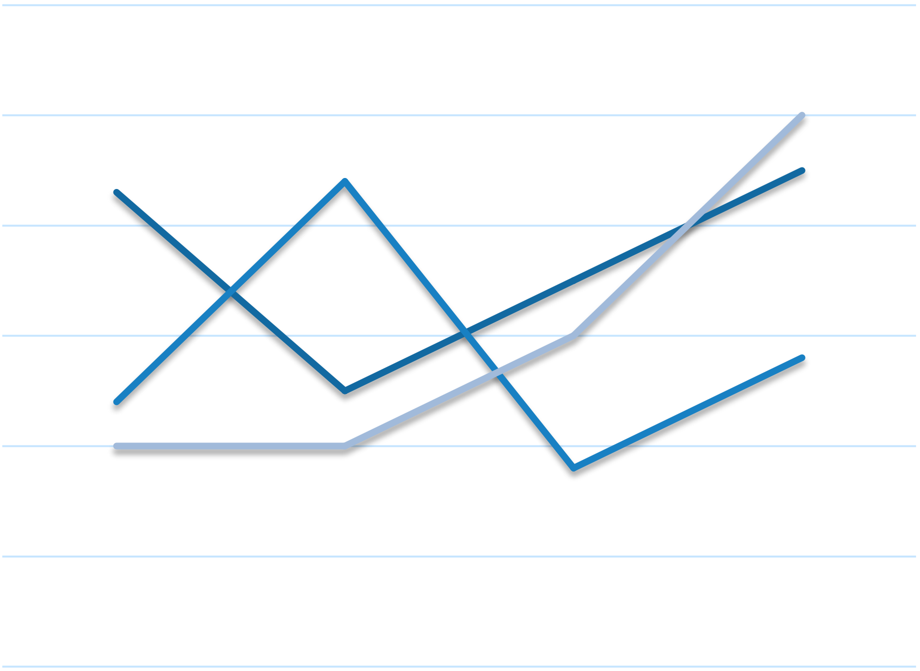
All new construction after June 2015 is supposed to be utilizing intelligent lighting controls also known as light harvesting

Electrical	Met or N/A
C405.2.1.1 Interior lighting controls: Enclosed areas have at least one (1) manual control for lighting in the area. Controls located within area served, or a remote switch is provided. Exceptions may be applied.	
C405.2.1.2 Light reduction controls: Each area required to have a manual control shall also allow occupant to reduce connected lighting load in reasonably uniform illumination pattern by at least 50%. Exceptions may be applied, including occupancy sensors	
C405.2.2 Additional lighting controls: Each area required shall have a manual control also must also have automatic controls that meet the requirements below.	
C405.2.2.1 Automatic time switch control devices: Automatic time switch controls shall be installed to control lighting in all areas of the building. Exceptions may be applied.	
C405.2.2.2 Occupancy sensors: Occupancy sensors shall be installed in all classrooms, conference/meeting rooms, employee lunch/break rooms, private offices, restrooms, storage rooms and janitorial closets, and other spaces 300 sf or less, set to turn off lights within 30 minutes. Exceptions may be applied.	
C405.2.2.3 Daylight zone control: Lights in the daylight zones shall be controlled independently of general area lighting via either **Manual daylighting controls** (C405.2.2.3.1) or **Automatic daylighting controls** (C405.2.2.3.2)	
C405.2.2.3.3 Multi-level daylighting controls: Multi-level general lighting in the daylight zone shall be separately controlled by at least one multi-level lighting control that reduces power in response to daylight.	
C405.2.3 Specific application controls: Specific application controls are provided for display and accent-lights; lighting in cases; hotel/motel sleeping units and suites; supplemental task lighting; nonvisual applications; lighting equipment for sale.	
C405.2.4 Exterior lighting controls: Lighting not designated for dusk-to-dawn operation shall be controlled by either a combination photosensor/time switch, or astronomical time switch. Lighting designated for dusk-to-dawn operation is controlled by astronomical time switch or photosensor. Time switches retain programming upon loss of power for at least 10 hours.	
C405.6.1 Exterior building grounds lighting: All operating at greater than 100 watts contain lamps having a minimum efficacy of 60 lumens per watt, unless luminaire is controlled by a motion sensor or qualifies for exception under Section 405.6.2.	
C405.6.2 Exterior building lighting power: Total exterior lighting power allowance is sum of base site allowance, plus individual allowances for areas illuminated and permitted in table C405.6.2(2). Exceptions may be applied.	
C405.7.4.1 Drawings: Construction documents require that, within 30 days after date of system acceptance, record drawings of actual installation shall be provided to building owner, including single-line diagram and floor plans.	
C405.7.4.2 Manuals: Construction documents require that an operating manual and maintenance manual provided to building owner. As a minimum manuals shall include submittal data, operation and maintenance manuals, names and addresses of qualified service agency.	
C408.3 Lighting system functional testing: Controls for automatic lighting systems are required to be functionally tested (commissioned), calibrated, adjusted, and programmed. Construction documents must indicate who will conduct functional testing.	

Note: Not all mandatory requirements are listed here. Wording of mandatory requirements has been condensed and paraphrased. Requirements in red are specific to FBC only.

Baseline Energy

Under typical building codes and standards; when energy calculations are concluded and then the structure is constructed, the energy consumption increase over the energy calculation of the project averages around a 20% increase over energy calculations



Flexlab

FLEXLAB™ IN ACTION

FLEXLAB HELPS GENENTECH BUILD STATE-OF-THE-ART BUILDING
Minimizing energy use and maximizing comfort

THE CHALLENGE: How to integrate and optimize technology to achieve maximum energy savings and comfort.

The biotech company Genentech had ambitious energy-efficiency and employee-comfort goals for its new 255,000-square-foot building in South San Francisco. But how could the company make sure the building would perform as intended?

THE SOLUTION: FLEXLAB

The newly operational FLEXLAB at Berkeley Lab provided a world-class facility for testing and optimizing integrated building systems under real-world conditions and maintaining the high performance of the building once it is occupied. FLEXLAB takes the guesswork out of creating a comfortable work environment in an energy-efficient building and provides other benefits, as well.

THE EXPERIMENT

- Webcor Builders constructed and equipped a section of Genentech's new building on FLEXLAB's large-scale rotating test bed, including furniture, façade systems, flooring, lighting and ceiling systems.
- With decisions on lighting and shading systems to be made, Berkeley Lab researchers ran comparison tests in FLEXLAB on different options, rotating the test bed each week to test solutions for three different building orientations.
- Each series of tests examined outside fixed shades, internal automated shades and dimmable lighting systems to test how sunlight from different solar orientations would affect interior daylight, room temperature, visual comfort and energy use.
- An array of high-accuracy sensors continuously captured quantitative performance data as well as high-dynamic-range photographs from which occupant visual comfort was assessed.
- Initial design solutions were refined in three successive stages over a four-month period. Between tests, FLEXLAB researchers analyzed the data, and suggested refinements to the systems for the next test series.
- The Genentech design staff spent several days "working" in the FLEXLAB test bed to confirm first-hand the final technology selections and design solutions.
- Once Genentech decided which lighting and shading systems it wanted to use, operations, maintenance and commissioning staff took them for a test drive in FLEXLAB before final installation in the building.

"FLEXLAB represents a handshake between science and architecture."
ANDREW KELLER | GENENTECH
Senior Principal Site Planner

Genentech
A Member of the Roche Group

THE RESULTS

at FLEXLAB months in
ded for a **higher-quality**
ne building
as opposed to one-time
verify performance of
technologies against
here necessary.

innovating
formed a
rkeley Lab to
ovation and
pplied it to
ptimization."

- Genentech was able to **maximize effective use of floor space**, since FLEXLAB testing showed how Genentech could set shading and HVAC controls to ensure both visual comfort (e.g. limited glare) and comfortable temperatures even if workstations are placed within a few feet of the windows.
- Genentech learned **how best to position workstations** near window systems to minimize glare. Since the building is designed for flexibility, with no permanently assigned desks, everyone needs to be comfortable no matter where they sit, so making sure all workstations are employee friendly is especially important.
- The FLEXLAB tests helped Genentech select shade fabric that provides the most transparency and fine tune the automated **shading** control systems to minimize glare, so employees can sit close to windows, be comfortable and enjoy magnificent views.
- FLEXLAB testing revealed that setting controls to keep shades open for six inches at the bottom would unlock substantial lighting-system **energy savings**.
- FLEXLAB was just coming online, and didn't get involved in the Genentech project until most of the building decisions had already been made, and yet FLEXLAB provided **great value** even at this late design stage. Bringing the FLEXLAB team on board earlier in the building planning process would unlock even greater energy savings.

- The FLEXLAB experiment showed Genentech how to reduce energy use for lighting by 60 percent in open-plan office areas.
  - That's energy savings of 60 percent on a baseline that already included daylight dimming.
  - These additional savings were achieved by aggressively tuning the lighting controls beyond the default daylight-dimming baseline commissioned by the lighting-control vendor.
  - The energy saved – documented in April/May as an absolute savings of 106 kWh per day – extrapolates to a savings of roughly $4,145 per year from this one lighting-control measure alone (assuming 15¢ per kWh).
- With an estimated payback time frame of three to five years, and continued energy savings after that, FLEXLAB testing made good business sense for Genentech.
- Genentech knows a comfortable workspace enables its employees to do their best work.

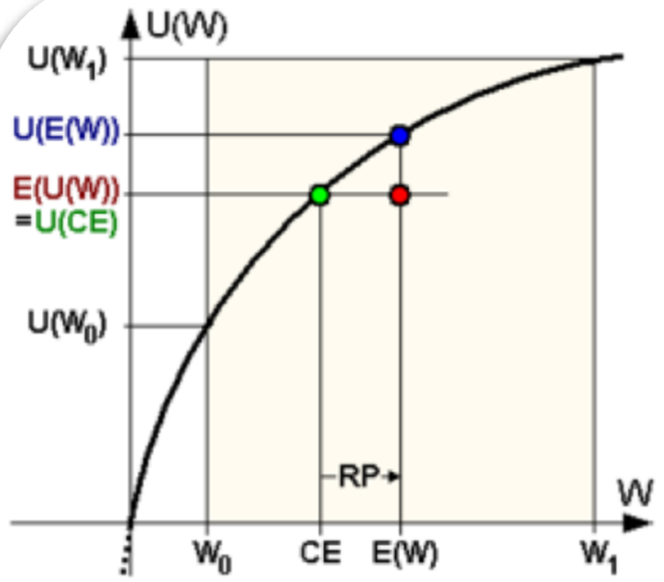
"FLEXLAB allows architects, builders, owners and others to take a whole-building approach and uncover new ways to design buildings and integrate systems for maximum performance."
CINDY REGNIER | BERKELEY NATIONAL LAB
Executive Manager of FLEXLAB

VISIT flexlab.lbl.gov FOR MORE INFORMATION.

BERKELEY LAB
U.S. DEPARTMENT OF ENERGY

Risk Adversity

In economics and finance, **risk aversion** is the behavior of humans (especially consumers and investors), when exposed to uncertainty, to attempt to reduce that uncertainty



Self Reporting Lighting Systems

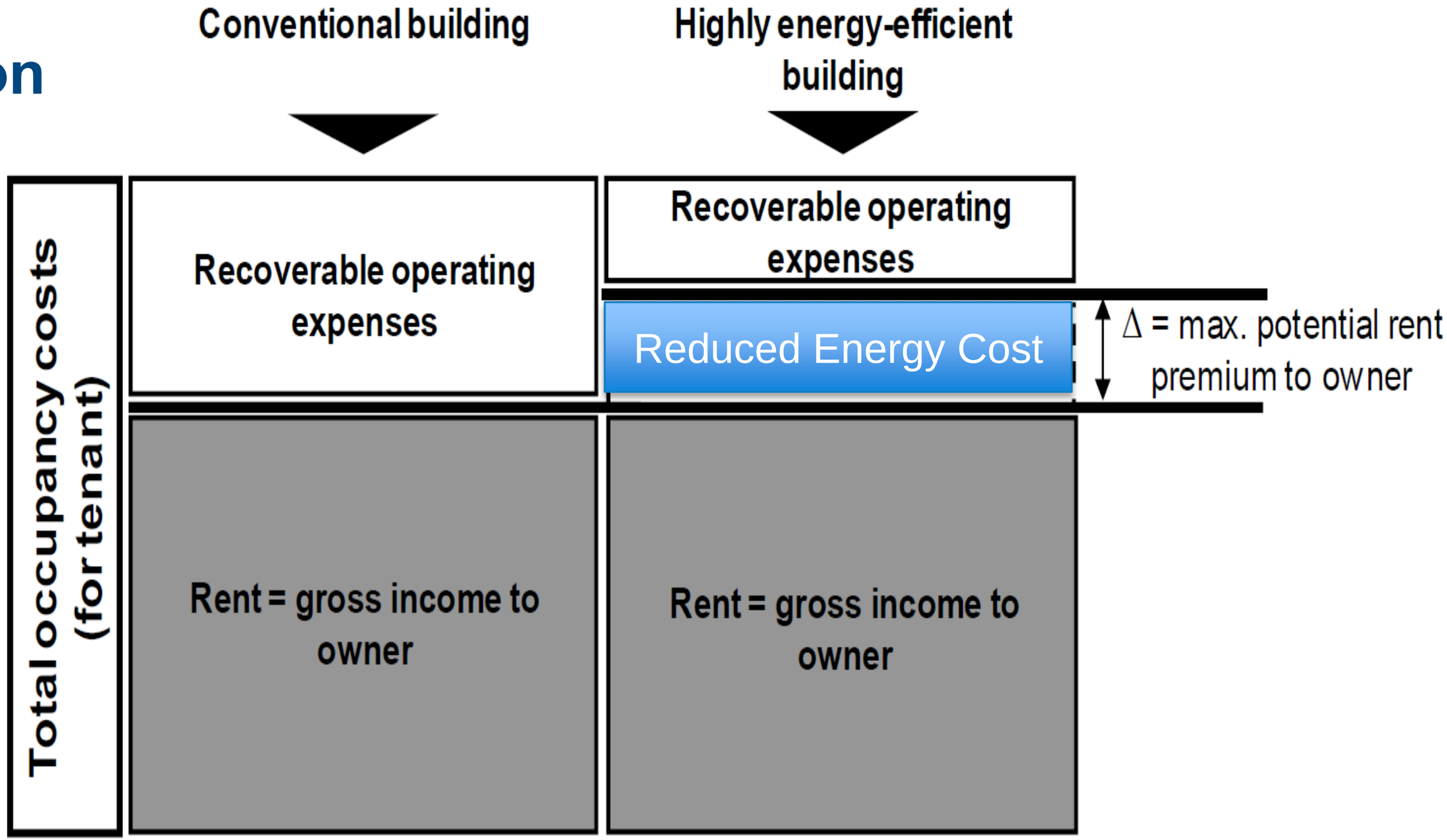
Past lighting efficiency projects were compromised due to lack of performance measurement.

New Lighting systems that self-measure and report energy usage make better business sense.

Some benefits of these new systems

- Reduces Risk
- Reduces Hassle
- Reduces Project Costs

Valuation



Source: **Integration of Energy Performance and Life-Cycle Costing into Property Valuation Practice, www.immovalue.org**

High Performance Feature

Energy Efficiency

Water Efficiency

Green Building Certification

Healthy Building Certification

Determination of Type and Scope of Benefits

Tangible Benefits: Operating cost Reductions

Intangible Benefits: Improved air quality

Preference for green certified spaces

Which Stakeholders Receive the Benefits

Owner Benefits

Owner/Tenant Benefits

Tenant Benefits

Public Benefits

Impact on Valuation Approach

Sales Comparison

Cost Depreciation

Income

Market Validation of Value

- ↑ Sales Prices
- ↓ Operating Costs
- ↑ Building Value
- ↓ Basis Points
- ↑ Occupancy Rates
- ↓ Duration of vacancies
- ↑ Occupant Satisfaction

Park Tower Case Study

Sterling American Property

TEAM

Claire Calzon, Broker

Mary Ayo, Senior Property Manager

Frazier Payton, Chief Engineer

STATISTICS

Park Tower was built in 1973 and has total rentable square feet of 472,462 The property is a 36 story high rise in the heart of downtown Tampa. Bordered by Tampa St. to the east, Kennedy to the west and Ashley to the west provides quick access to I-275, I-4 and Tampa International.

SERVICES PROVIDED

Leasing Services

Management Services

Acquision Due Diligence

CHALLENGE

Purchased in 2006 Park Tower is a 33-year young property. Most systems had exceeded began declining to the point of diminishing on investment. Park Tower no longer met the rigid perimeters of its GSA tenants who require the building to be energy star rated.

STRATEGY

While maintaining optimal tenant comfort, the management team investigates and chose the best performing and most energy efficient equipment as replacement for the existing outdated equipment.

- Modernized elevators
- 2 - 750 ton high efficiency chillers
- Variable speed drives for each floors air handlers
- State of the art energy management system
- 5,600 new high efficient light fixtures
- Motion sensor lighting
- New transformers for each floor
- New fire panel and rewired the building
- 750 kva generator
- Energy efficient roof coating
- Upgraded building security system and cameras to digital

SERVICES

Colliers International put together the top Team in Brokerage, Management and Engineering field to develop a comprehensive plan to bring Park Tower to the top in its class.

RESULTS

Park Tower changed from an average Energy Star score to a 99% rating in 2013

In January 2007 the buildings electric bill was $155,324 or 44,970 kwh/daily and in January 2014, the bill was $73,704.98 or 23,902 kwh/daily. Energy usage reduced by 47%. The savings also equates to a $13 million increase in Park Tower's value.

Received $32,611in rebates from Tampa Electric

2013 LEED EBO+M Gold certification

2013 BOMA Outstanding Building of the Year for the 250,000 to 499,999 category