LIGHTING SOLUTIONS ROADMAP

Control Service Company

1. IDENTIFY NEEDS

- Energy / Sustainability
- Workplace / facility improvement
- Code compliance (ASHRAE 90.1)
- Productivity
- Local support
- Centralized control

2. EVALUATION

- Market presentations
- Case studies
- Site survey
- State and Federal rebates / incentives and payback calculator
- Product demonstration
- Solution center tour of unified controls

3. SOLUTION

- Lighting retrofit
- Networked lighting controls
- Unified lighting controls to WebCTRL
- Human centric lighting
- Wireless outdoor lighting

4. PROCUREMENT

- Vendor and product analysis and vetting
- DLC listing confirmation (rebates)
- Identify how to best procure product for owner (Distributor, EC, direct)

5. SUPPORT

- Single support contact
- On-Going adjustment
- Rebate assistance

INTERIOR LIGHTING

Interior lighting upgrades allow for improved dimming control and energy and maintenance savings

RECESSED/LINEAR—Fluorescent to LED ~60% savings

HIGH BAY—HID to LED ~ 80% savings

DOWN / CAN - CFL To LED ~60% savings

EXTERIOR LIGHTING

Exterior lighting upgrades typically have a good payback from HID to LED reducing energy by 80%

BUILDING MOUNTED—HID to LED ~ 80% savings

POLE MOUNTED—HID to LED ~ 80% savings

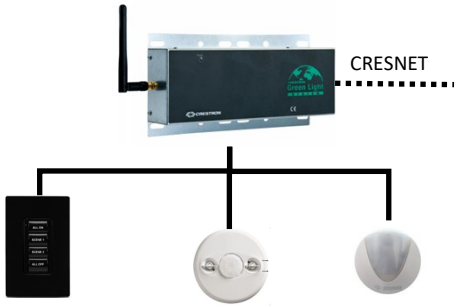
CANNOPY—HID to LED ~ 80% savings

LIGHTING

Allows for reduced energy consumption and connection to WebCTRL system.

ROOM BASED—Non Networked spaces that use occupancy or vacancy sensors to control lighting.

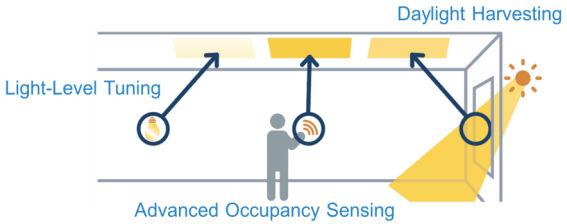
NETWORKED



SELLING POINTS

ENERGY SAVINGS

- LED upgrades from traditional lighting can reduce energy load by 70%
- Addition of ADVANCED LIGHTING CONTROLS can increase savings by 20-40% (Occ. Sensors, Daylight harvesting, High end trimming)



CODE COMPLIENCE

ASHRAE 90.1-2016

- Dimming and Scene control (9.4.1.1)
- Time clock / motion sensing (9.4.1.1, 9.4.1.2)
- Occupancy sensing (9.4.1.1, 9.4.1.2, 9.4.1.4)
- Daylight harvesting (9.4.1.1, 9.4.1.2)

WEBCTRL

- Devices managed through BAS can see 10-15% additional energy savings
- Ability to monitor and adjust traditionally static lighting environments
- No maintaining or training on other light management systems

HUMAN CENTRIC BENEFITS

Commercial / Office

- Circadian lighting in office settings can improve employee sleep patterns and wellness, potentially improving productivity
- 3/30/300 Rule

K-12 Education

- Improved classroom environment for students and teachers that can increase performance and learning objectives
- Tasked based color tuning and illumination (dimming) levels to optimize classroom activity.
- Special education classrooms

Healthcare

<u>Hospital</u>

- Circadian rhythm lighting allows for improved sleep patterns and wellness
- Staff wellness and improved productivity

<u>Assisted Living / Memory Care</u>

- Circadian lighting can impact behavior with patients

SUPPORT

No more install and abandon

- Local field support personnel Dedicated phone support 24/7
- Remote access support
- In-house and on-site training

3/30/300 Rule

Energy $3 / sqft	• 30% energy savings = $.9 / sqft	Energy savings directly impact Opex, but potentially have the smallest impact
Real Estate $30 / sqft	• 10% recalibration in space = $3 / sqft	Space utilization based on sensor network data and analysis can have a major impact on Capex
Employee $300 / sqft	• 2 % productivity = $6 / sqft.	Employee wellbeing can result in the greatest benefit to the organization

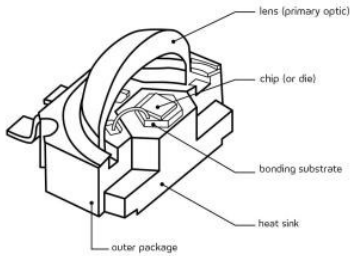
Benefits to the 300 can easily offset and outweigh costs to the 3 and 30.

MARKETING TOOLBOX

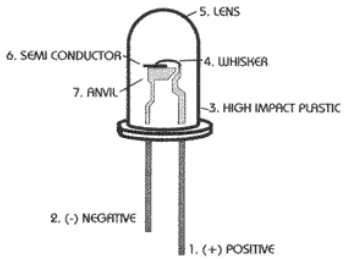
- Market based presentations (K-12, Healthcare, Commercial)
- CSC Solution Center Tour
- Energy Savings ROI Tool
- Case Studies
- Product demonstrations

LED, LIGHTING & CONTROLS TERMINOLOGY

SSL—SOLID STATE LIGHTING
Type of lighting that uses semiconductor LED's, OLED or PED as illumination



LED—LIGHT EMITTING DIODE
Semiconductor device that emits visible light when electric current passes through it.



ILLUMINATION
The distribution of light on a horizontal surface.

LUMINAIRE (Light Fixture)
A complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps and ballast (where applicable), and to connect the lamps to the power supply

LAMP (AKA Bulb)
Replaceable illumination source in a luminaire (light fixture)

LUMEN (LM)
Measurement of light emitted by a lamp. For example a 100 Watt incandescent lamp emits about 1600 lumens.

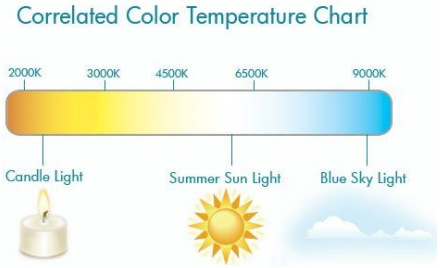
LUMEN MAINTENANCE (L70)
An indication associate to a Luminaire about the time it takes for a fixtures lumen output to decrease by 30% from its initial output.

EFFICACY (lm/W)
The ratio of lumens produced per watt of power. Efficacy minimums are typically dictated to meet certain code and rebate requirements.

LUX
The measurement of the intensity of illumination. A lux is the illumination produced by one lumen distributed over a 1-square meter area. 1 LUX = FC x 10.76

FOOTCANDLE (FC)
A foot-candle is a non-SI unit of illuminance or light intensity. One foot-candle represents "the illuminance cast on a surface by a one-candela source one foot away." This unit is commonly used in lighting layouts in parts of the world where United States customary units are used.

CCT—CORRELATED COLOR TEMPERATURE
Measurement of the color of a light source relative to a black body at a particular temperature expressed in Kelvin (k). LED fixtures typically can have a range



CRI—Color Rendering Index
A color rendering index is a quantitative measure of the ability of a light source to reveal the colors of various objects faithfully in comparison with an ideal or natural light source. Light sources with a high CRI are desirable in color-critical applications such as neonatal care and art restoration

CRI 97	CRI 90	CRI 80	CRI 70
2700K	2700K	2700K	2700K

DLC
non-profit organization whose mission is to drive efficient lighting by defining quality. Lighting fixtures will be noted if they are DLC compliant that may be required for some rebates and federal programs.

CONTROLS

2-Wire forward and reverse phase
Line Voltage interface/wiring used in incandescent lighting applications.

4-Wire 0-10v
The dimmer connects to the fixture using 4 wires (Hot and Neutral and a low voltage pair of wires for a 0–10V analog dimming control signal) typically used in LED lighting applications.

Digitally Addressed
A few of the most common are DMX & DALI. These advanced control types are primarily used where single fixture control, RGB color changing, or color tuning fixtures are employed.

Outdoor Wireless
Lighting controls for outdoor lighting that typically uses a Zigbee wireless mesh network to switch and dim the lighting. Value of wireless is the long runs on 0-10V circuits having voltage drop that can effect controllability.

Unified Controls to WebCTRL
Integrate lighting controls to the WebCTRL BAS through the common BACnet protocol allows for a single interface to control and manage a networked lighting controls system.

TYPICAL CRESTRON PRODUCTS USED BY SPACE / APPLICATION

SMALL OFFICE	OPEN AREAS	CONFERENCE ROOMS	OUTDOOR	EQUIPMENT ROOMS	CONTROL PANEL
 GLPP-DIMFLV1 1 Channel 0-10V Dimming		 GLPP-DIMFLV2 2 Channel 0-10V Dimming		 PIR Switch / Sensor	
 GLPP KEYPAD	 GLXP-DIMFLV8 8 Channel 0-10V Dimming	 Touchscreen	 GLXP-DIMFLV8 8 Channel 0-10V Dimming	 PIR Sensor	 DIN-AP3 W/BACnet License
 Dual Tech OS	 Cameo Keypad(s)	 Dual Tech OS			 DIN-HUB (Keypads,..)
 Daylight Photocell	 Dual Tech OS	 Daylight Photocell			 DIN-IO8 (Sensors,..)
					 DIN-PWSXX