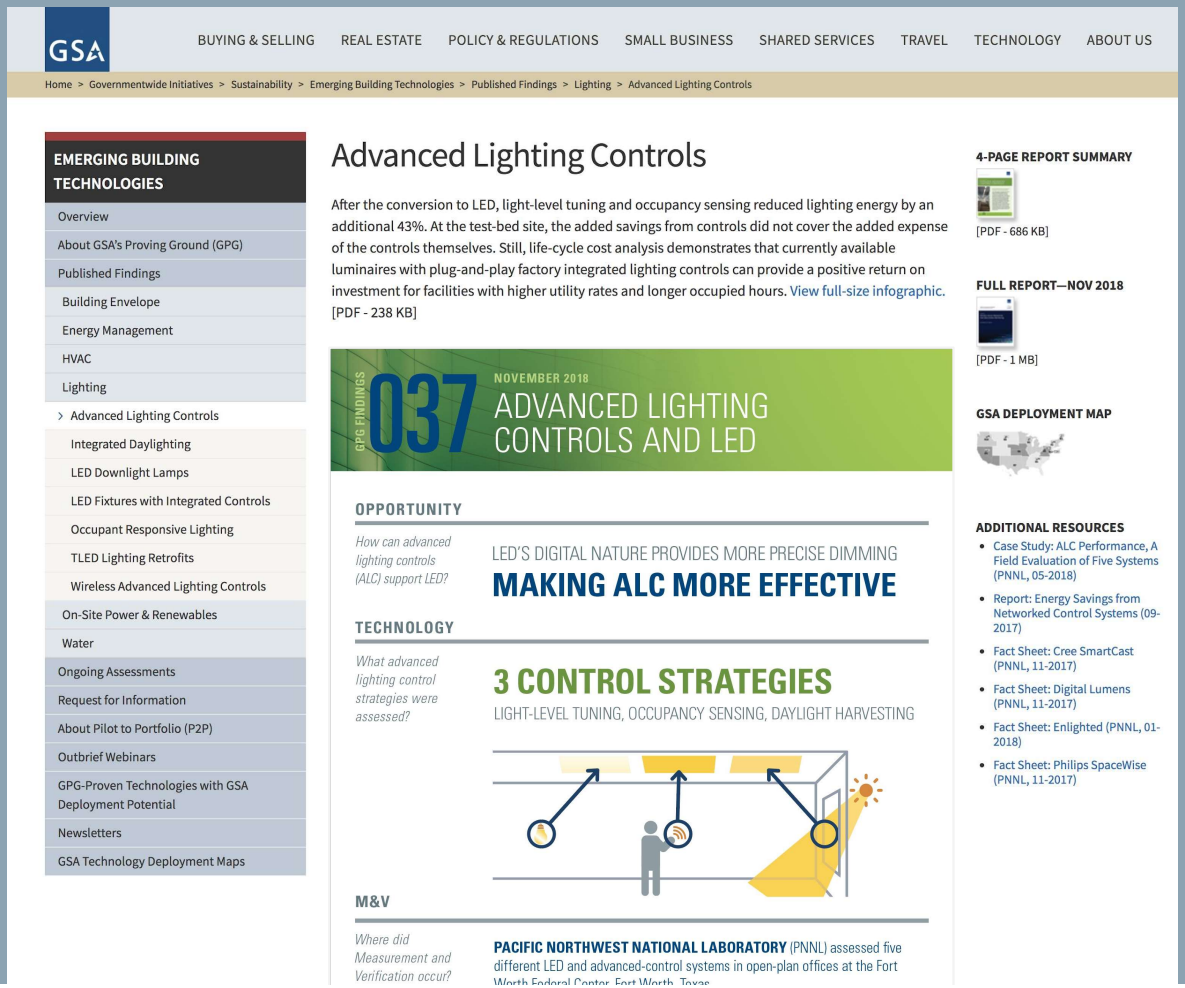
GPG Outbrief 17

Advanced Lighting Controls and LED

Emerging Building Technologies, GPG Program | U.S. General Services Administration | November 15, 2018

GPG-037 Advanced Lighting Controls @ gsa.gov/gpg

- Infographic
- 4-page Findings
- Full Report
- Additional Resources



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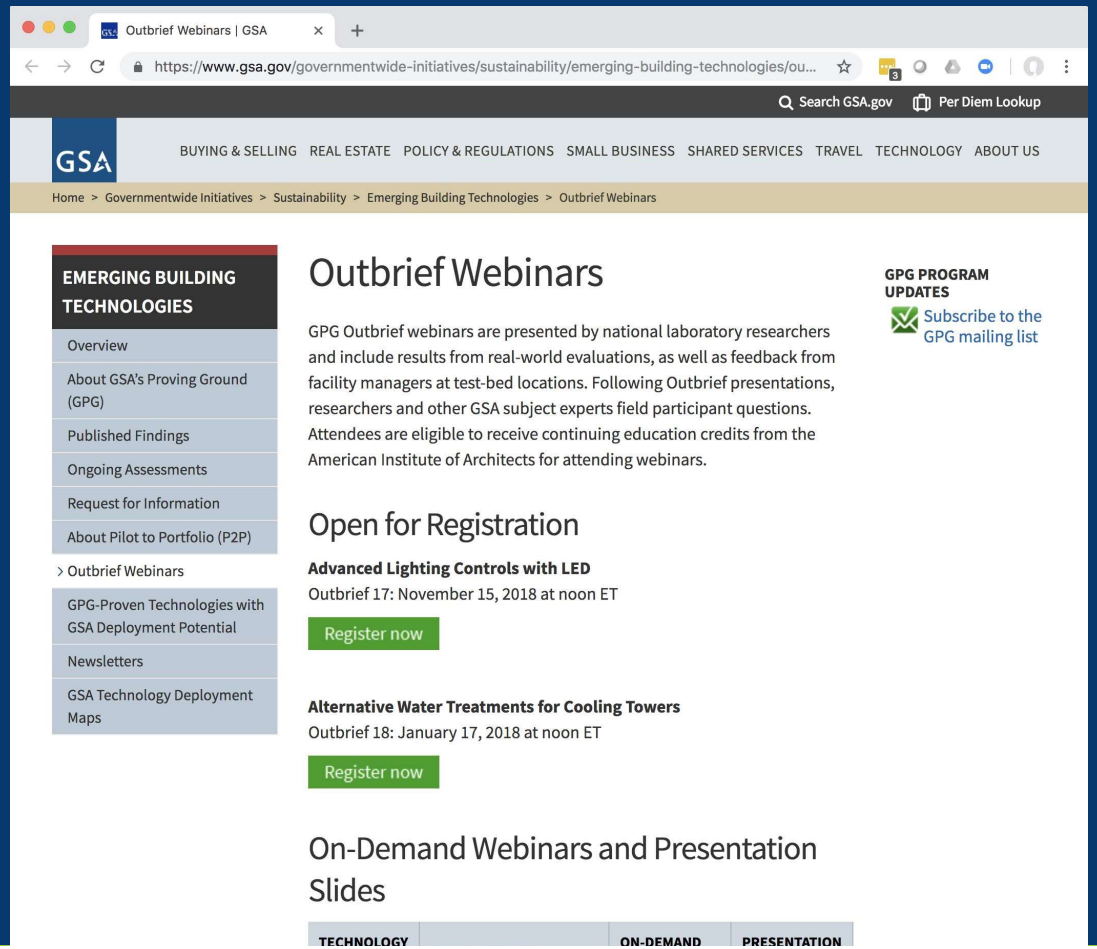

Upcoming 2019 GPG Outbriefs—Thursdays, 12 PM ET

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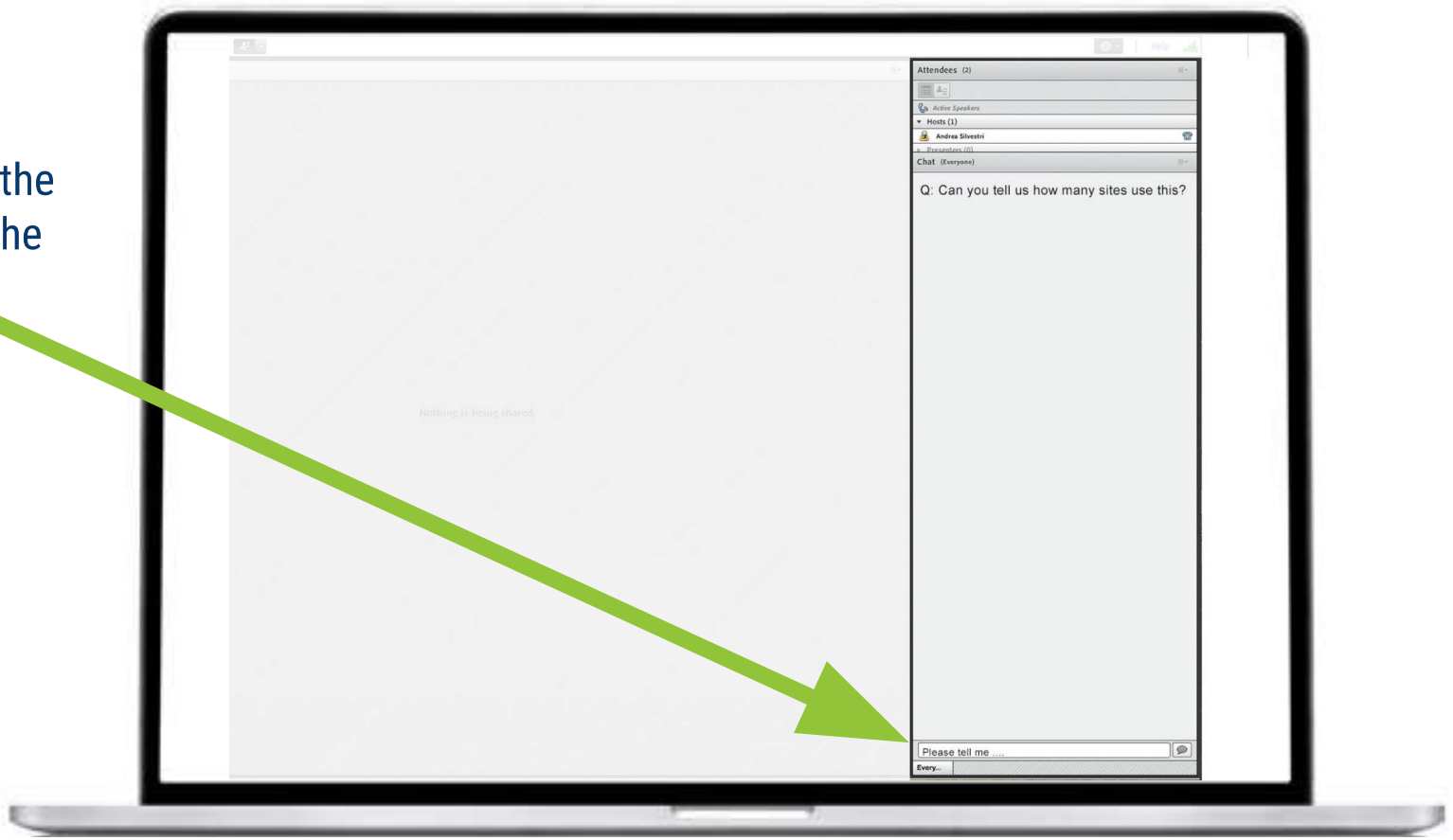

Introduction

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Webinar Agenda

- Introduction (5 minutes)
  Kevin Powell, Program Manager, Emerging Building Technologies
- Advanced Lighting Controls with LED Lighting (20 minutes)
  Michael Myer, Pacific Northwest National Laboratory
- On-the-ground Feedback R7, Building 23, Fort Worth, Texas (10 minutes)
  Frank Campagna, Stuart Lamkin
- Q & A (20 minutes)

Introduction

Kevin Powell
Program Manager, Emerging Building Technologies
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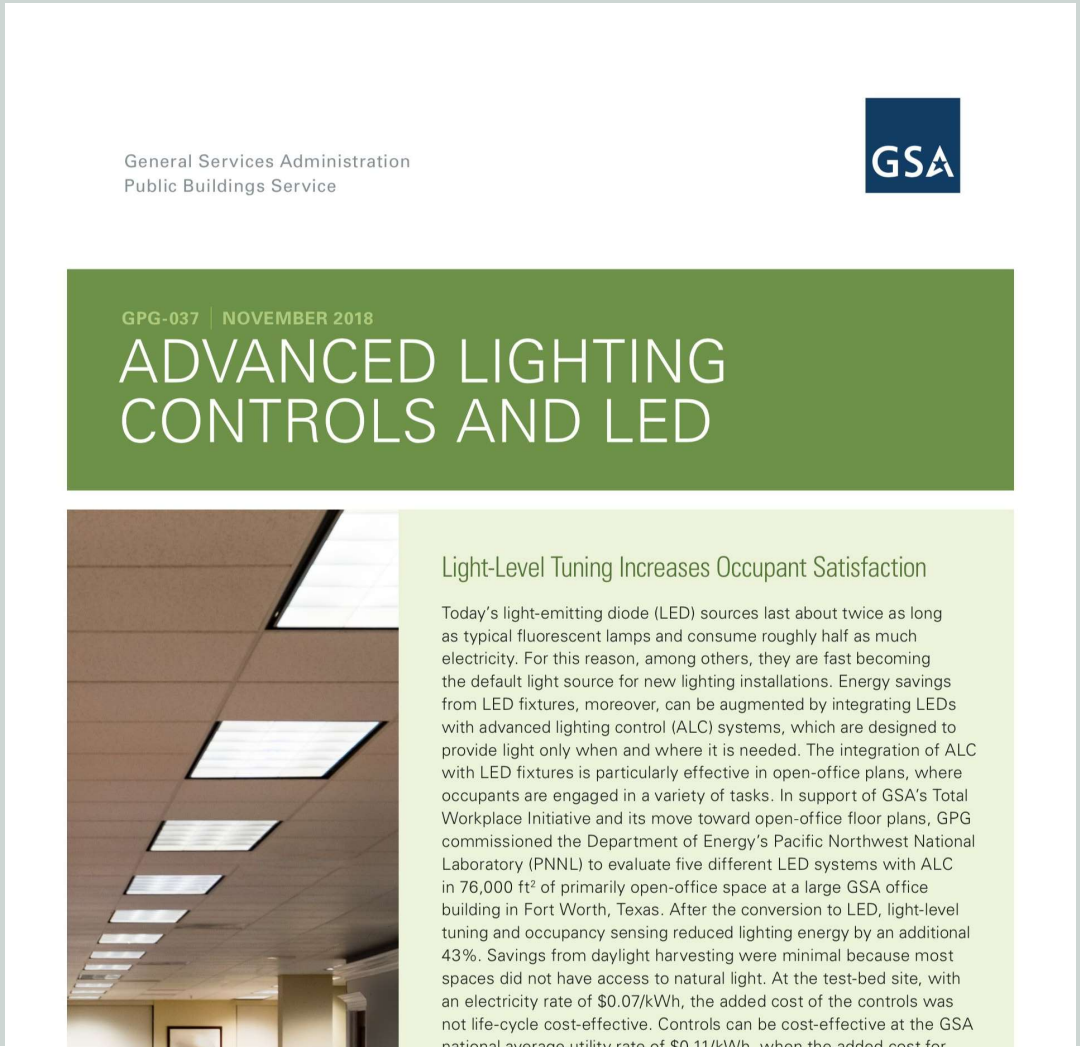
Emerging Building Technologies' two programs—GSA Proving Ground (GPG) and Pilot to Portfolio (P2P)—enable GSA to make sound investment decisions in next-generation building technologies based on their real-world performance

GPG-037

Advanced Lighting Controls and LED



General Services Administration
Public Buildings Service

GSA

GPG-037 | NOVEMBER 2018

ADVANCED LIGHTING CONTROLS AND LED

Light-Level Tuning Increases Occupant Satisfaction

Today's light-emitting diode (LED) sources last about twice as long as typical fluorescent lamps and consume roughly half as much electricity. For this reason, among others, they are fast becoming the default light source for new lighting installations. Energy savings from LED fixtures, moreover, can be augmented by integrating LEDs with advanced lighting control (ALC) systems, which are designed to provide light only when and where it is needed. The integration of ALC with LED fixtures is particularly effective in open-office plans, where occupants are engaged in a variety of tasks. In support of GSA's Total Workplace Initiative and its move toward open-office floor plans, GPG commissioned the Department of Energy's Pacific Northwest National Laboratory (PNNL) to evaluate five different LED systems with ALC in 76,000 ft^2 of primarily open-office space at a large GSA office building in Fort Worth, Texas. After the conversion to LED, light-level tuning and occupancy sensing reduced lighting energy by an additional 43%. Savings from daylight harvesting were minimal because most spaces did not have access to natural light. At the test-bed site, with an electricity rate of $0.07/kWh, the added cost of the controls was not life-cycle cost-effective. Controls can be cost-effective at the GSA national average utility rate of $0.11/kWh, when the added cost for

Measurement & Verification

Michael Myer
Energy and Environment Directorate
Pacific Northwest National Laboratory

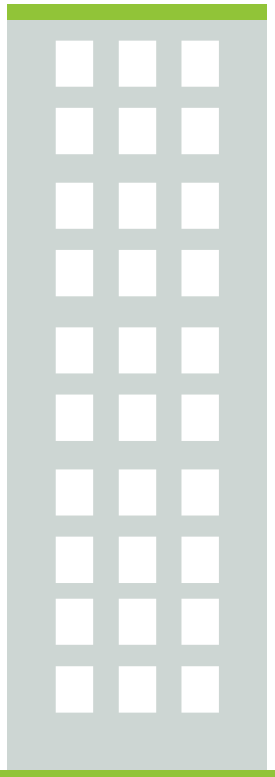
Opportunity for Savings from Advanced Lighting Controls (ALC)

25%–75%

REDUCTION IN LED ENERGY USE

With Advanced Lighting Controls

Savings are affected by many variables including baseline lighting power density, fixture density, occupancy, and availability of daylight

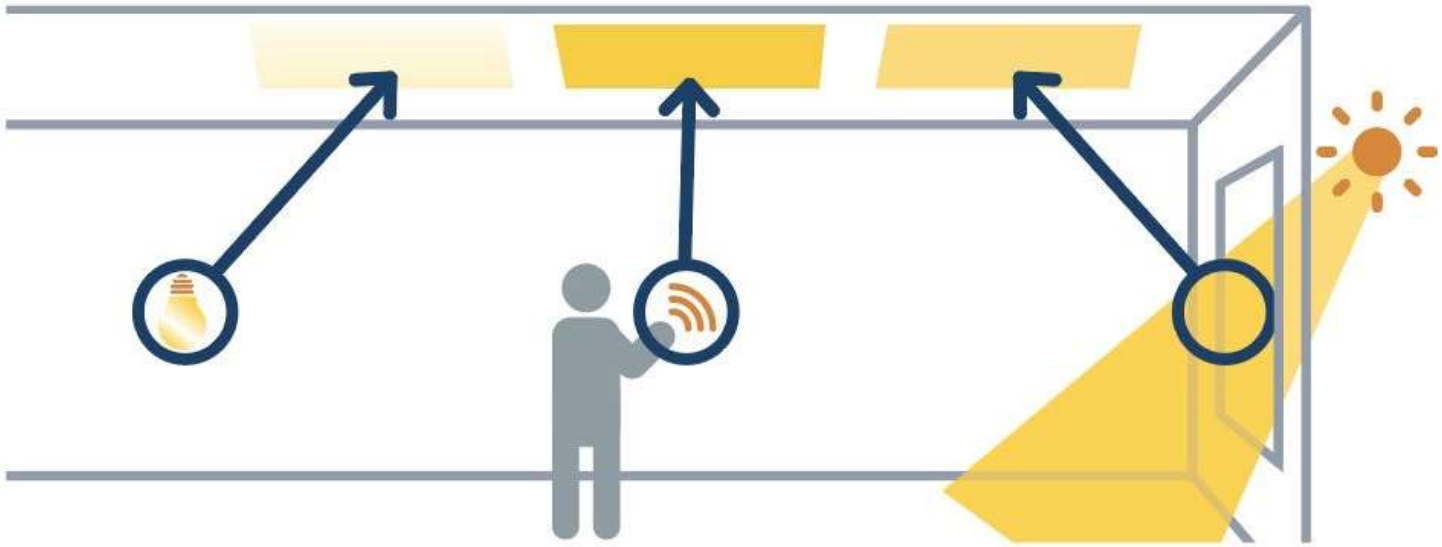


{ 2%

of commercial buildings implement ALC

Lighting Controls Assessed

Light-Level Tuning, Occupancy Sensing and Daylight Harvesting



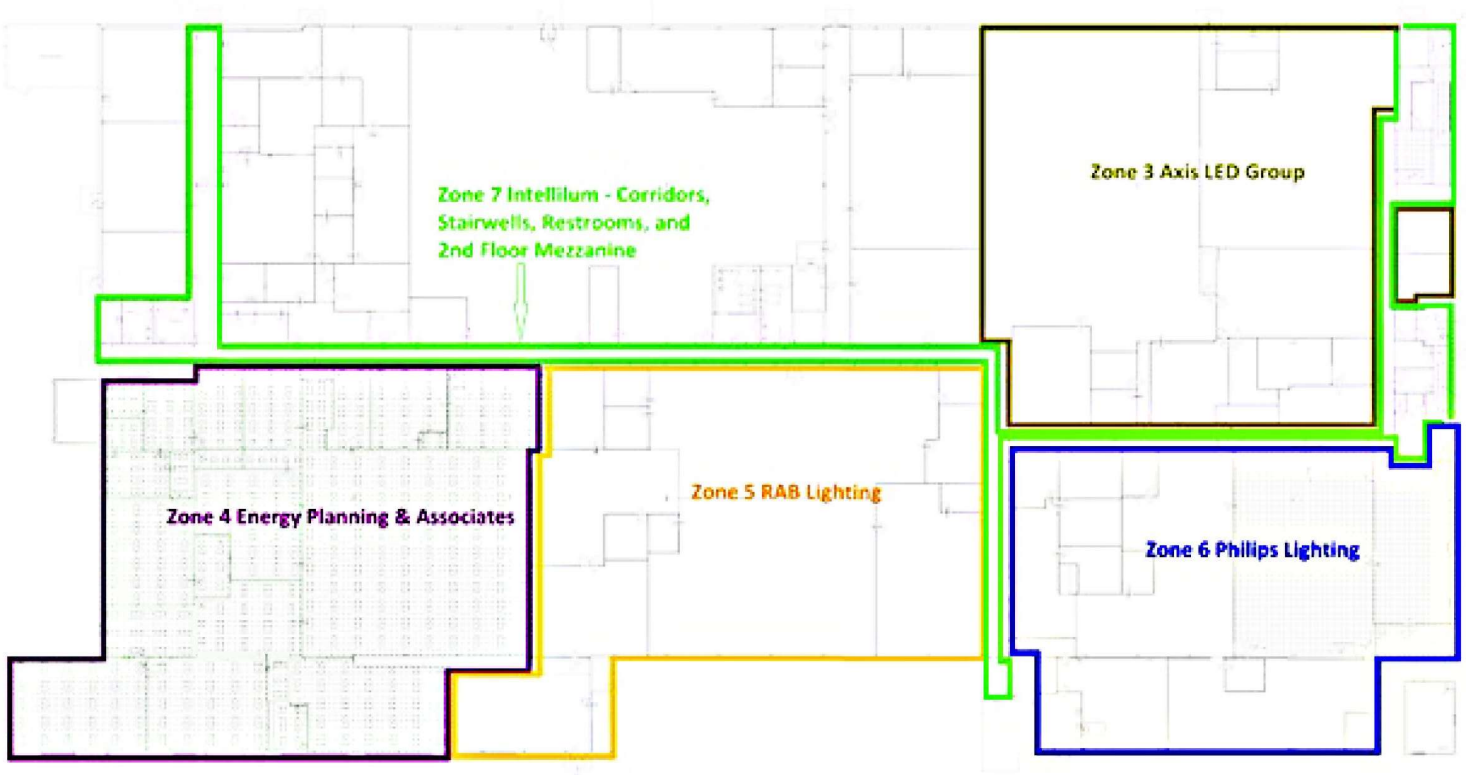
Measurement & Verification, Fort Worth Federal Center

Fort Worth Federal Center, Bldg 23

76,000 ft^2 of Office Space

Technology for test-bed measurement and verification provided by Patriot, Enlighted, RAB, Philips, Intellium (now Flow Lighting), and Lutron

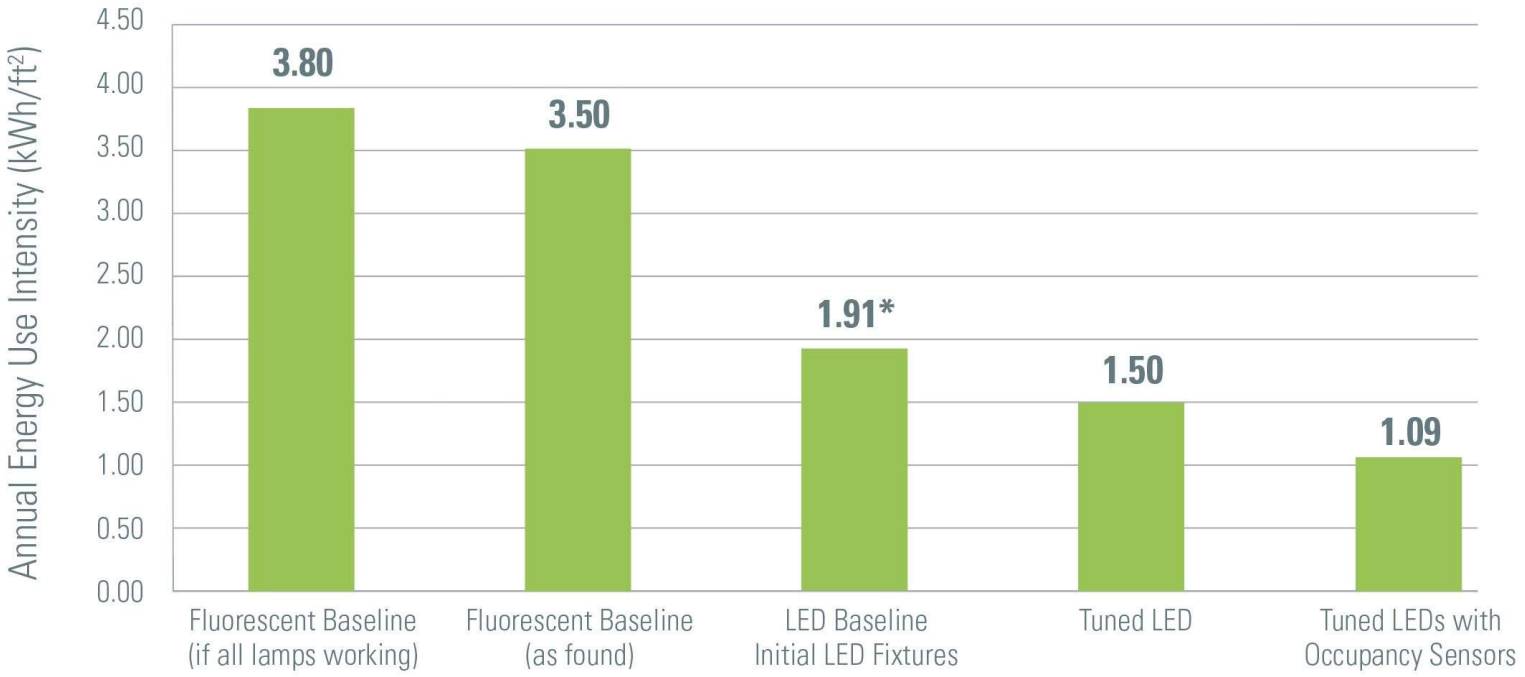
Five Different Zones and Systems Tested



Measured Changes in Illuminance

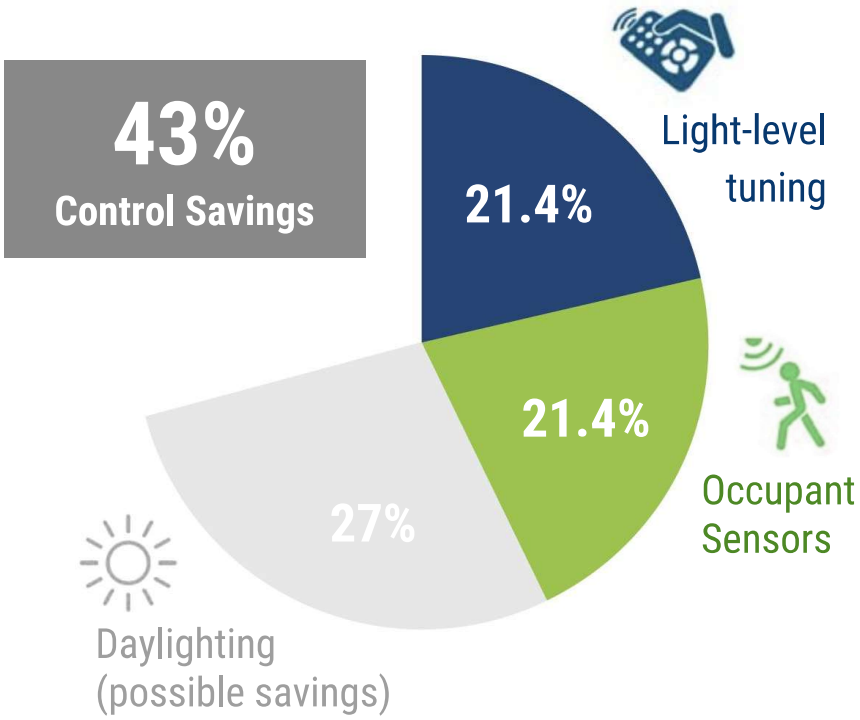
	Zone 3	Zone 4	Zone 5	Zone 6
Baseline Fluorescent (fc)	35.7	30.1	37.7	45.6
Tuned LED (fc)	35.4	7.3	24.7	27.0
Light Level Change (%)	**-1%**	**-76%**	**-35%**	**-41%**

Measured Energy Use



*Includes fixture count reduction from 1,212 fluorescent to 847 LED

Control Lighting Energy Savings from LED Baseline



Installation

Add-on controls increased installation time (10 to 15 minutes per fixture)

- Installed both retrofit kits and replacement fixtures
- Replacement fixture installation comparable to standard fluorescent
- Retrofit kits: slightly faster installation, ~5-minutes per fixture, cleanup time reduced; no need to open the ceiling

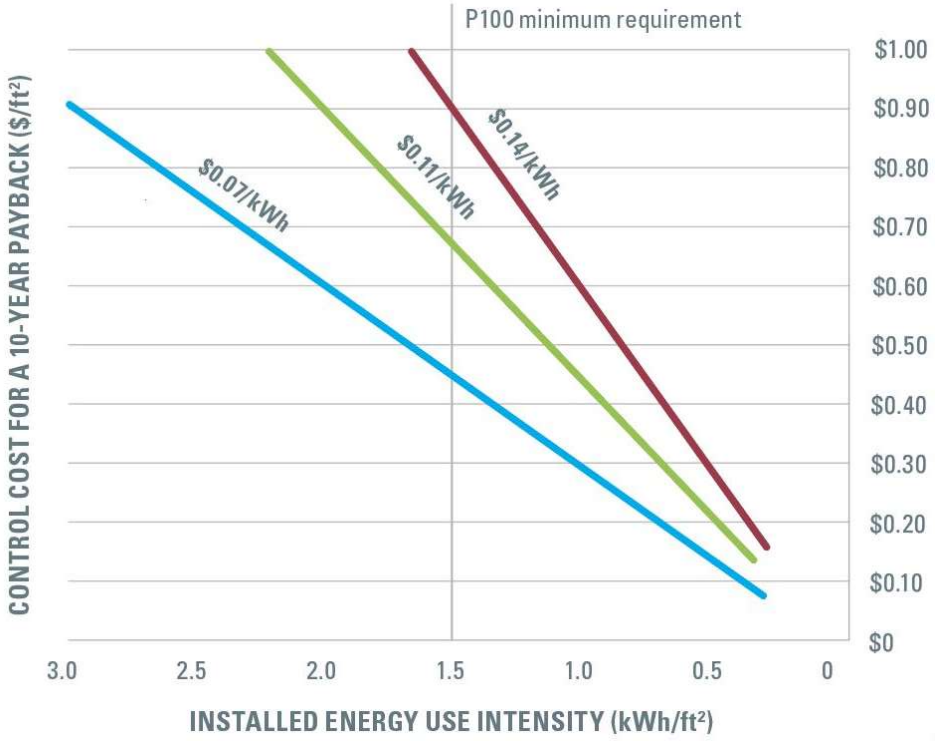
LED FIXTURE COSTS ARE CHANGING RAPIDLY AND VARY WIDELY

Your Mileage May Vary

Normalized Costs and Incremental Savings for Controls

	Fort Worth Average	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Baseline LED EUI (kWh/ft^2)	**1.91 kWh/ft^2**	2.86	0.98	1.99	1.95	1.66
% Savings from Controls from LED Baseline	**43%**	37%	45%	58%	47%	25%
Control Savings (kWh/ft^2)	**0.82 kWh/ft^2**	1.07	0.44	1.16	0.93	0.42
Annual Savings @ $0.11 (kWh/ft^2)	**$0.09/ft^2**	$0.12	$0.05	$0.13	$0.10	$0.05
Added Cost of Zone-Level Control $65 fixture, 1 fixture per 100 ft^2 ($/ft^2)	**$0.65/ft^2**	$0.65	$0.65	$0.65	$0.65	$0.65
Payback (years)	**7.1 years**	5.5	13.4	5.1	6.4	14.1

Average Control Costs for a 10-year Payback



Assuming a 10-hour, 5-day work week and 43% control savings

More efficient lighting makes positive ROI more challenging

ALC Deployment Recommendations

Consider where utility rates are high:

- Prioritize facilities with:
  - no existing lighting controls
  - lighting energy use > 3.25 kWh/ft^2/yr
  - open offices where occupants are engaged in a variety of tasks
  - the availability of utility rebates
- If ALC is not cost-effective, consider LED systems with 0-10V drivers. Tuning can be key to occupant satisfaction.

Tune Light Levels to Meet Occupant Needs

- Saves energy while improving quality of light
- Tuning at the time of installation is not widely implemented

Max: 100%

Max: 80%

How Stakeholders Can Support Tuning

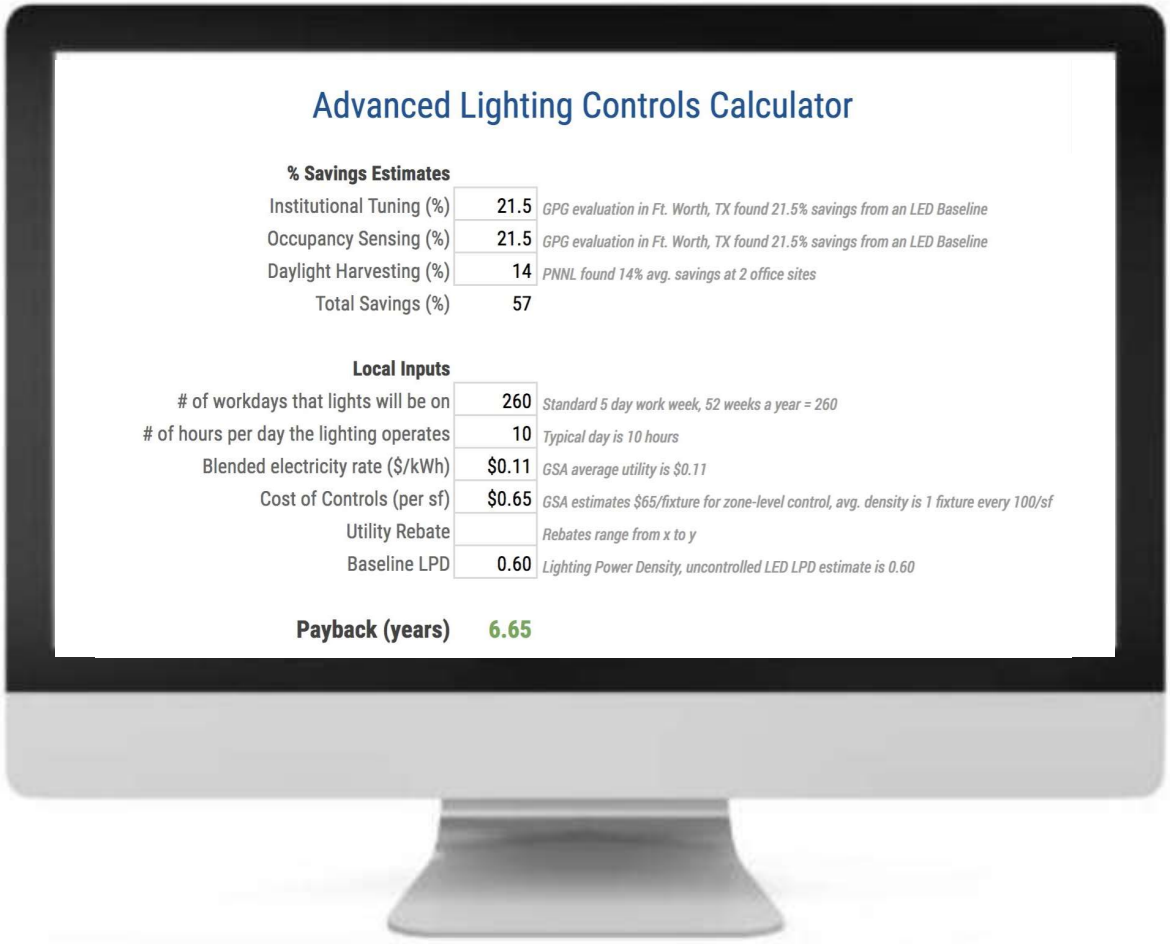
Manufacturers
Incorporate task tuning as a standard step into configuration apps and software

Contractors
Include task tuning as a standard installation step—don't forget your light meter

Specifiers, Procurement, End-users
Require task tuning in your specs, include in punchlists

Utilities
Support task tuning in your programs, consider providing rebates or financial incentives for implementing task tuning

ALC Calculator at gsa.gov/gpg



GSA Feedback—Fort Worth, Texas

Frank Campagna
Supervisory Energy PM
GSA Region 7

Stuart Lamkin
Property Manager
GSA Region 7

Installation/Commissioning

Installed both retrofit kits and new fixtures

- Identical look from the ground
- Different types of systems, had a lot of support from manufacturers

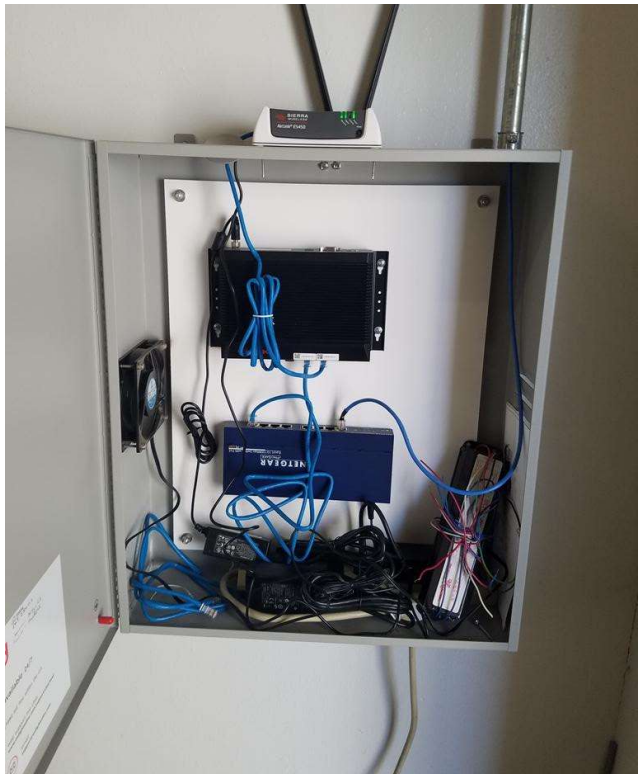
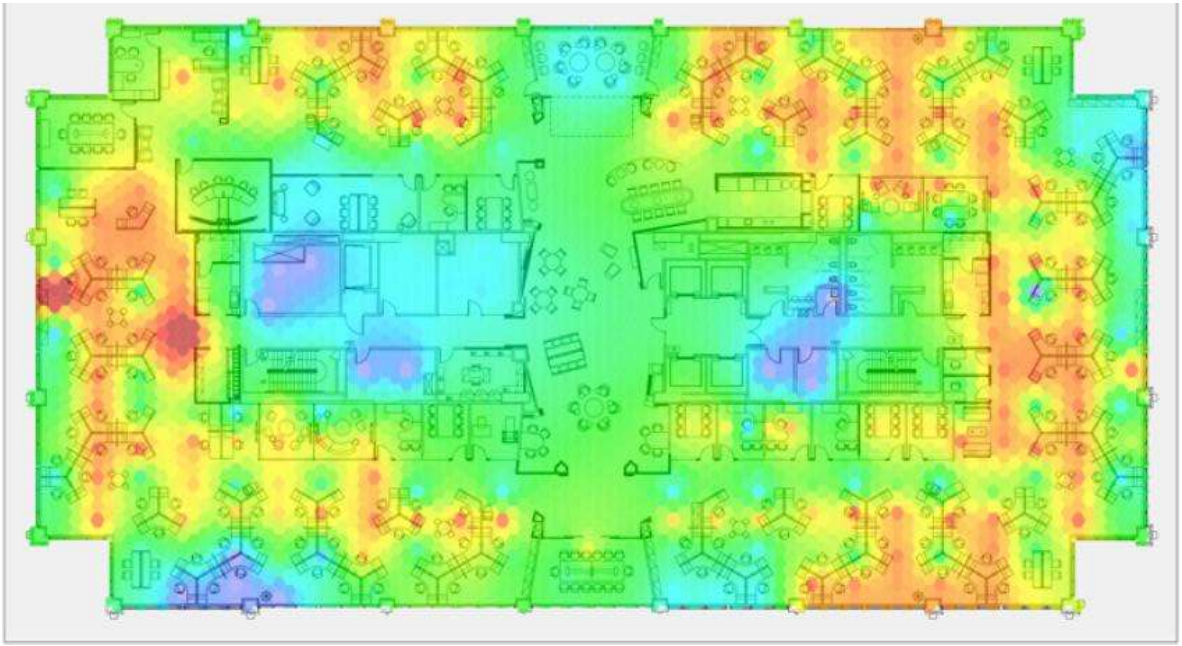


Image source: Phillips

Enlighted

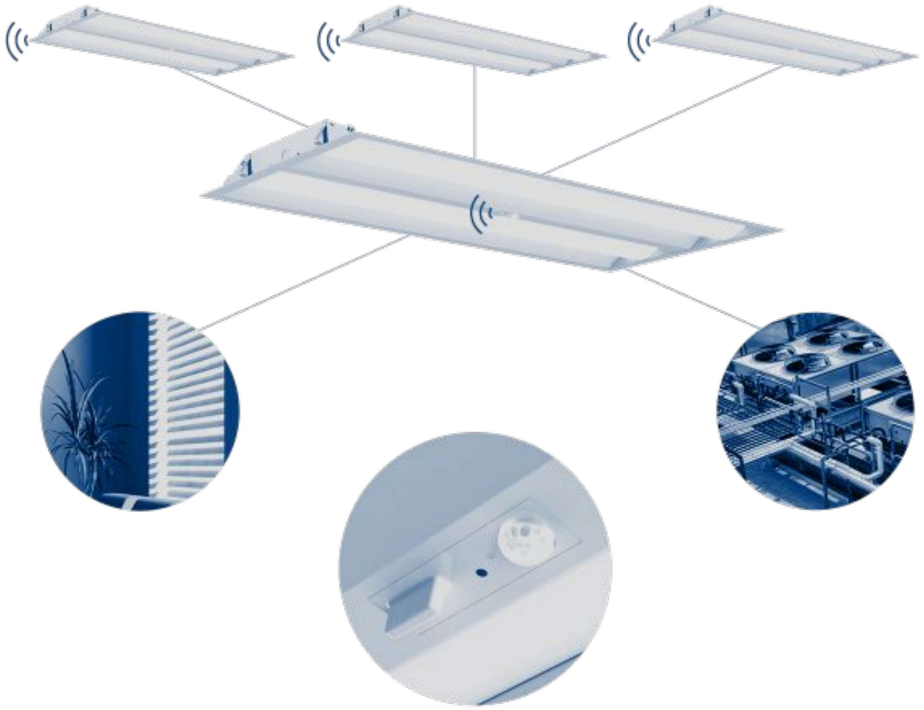


Granular information on energy savings, individual fixture control

HVAC and space utilization control

Image source: Enlighted

Flow Lighting



Can drill down to individual fixtures

Offers additional functionality such as HVAC and blind control

Image source: Flow Lighting

RAB and Patriot LED + Lutron Controls

Installed in the field

Individual fixture control

User-friendly interface can operate on tablet or phone

Easy-to-read user guides

Image source: Lutron

Philips, now Signify

Simple system with no granular information

Easy to commission; somewhat challenging to make changes with remote

Image source: Philips

Occupant Feedback

Most important feature was dimming

- Between lights going in and tuning, occupants covered lights with cardboard and paper, built barricades to block glare
- Occupants preferred a dark space, many fixtures had been de-lamped
- No windows, so any change in lights was perceived as bright

Cyber Security

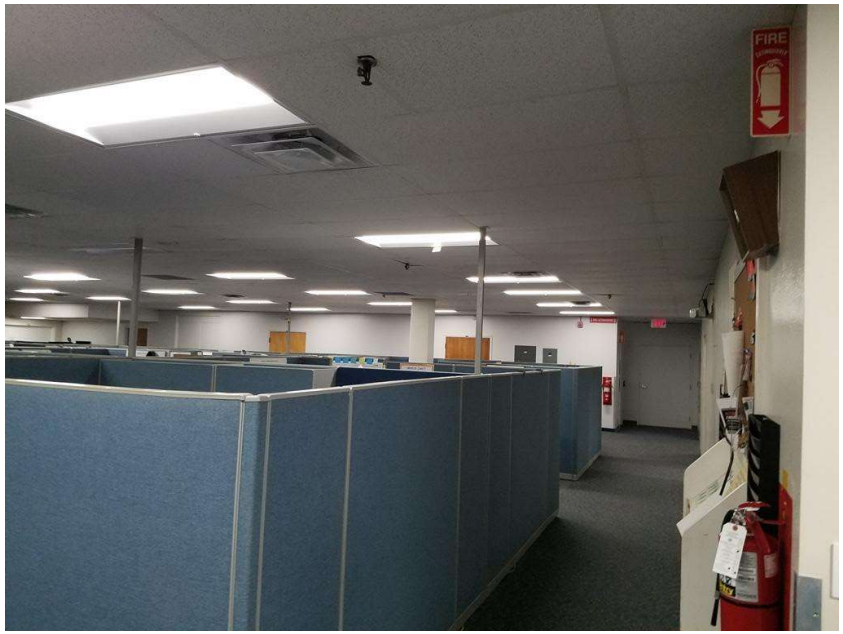
Hurdle to deployment

- Test bed used an islanded approach, not behind the GSA firewall
- All IT connected devices need to be reassessed every 3 years and with all major updates
- Enlighted, Flow Lighting, Lutron, Philips (now Signify) now all cleared GSA IT-Security for use behind firewall

Best Practices

Do your homework

- Match existing lumen output and color temperature
- Document before and after foot candles
- Consider dimming controls that don't need network access, simplifies IT security
- Mock-up proposed lighting to evaluate for any glare issues



Q & A

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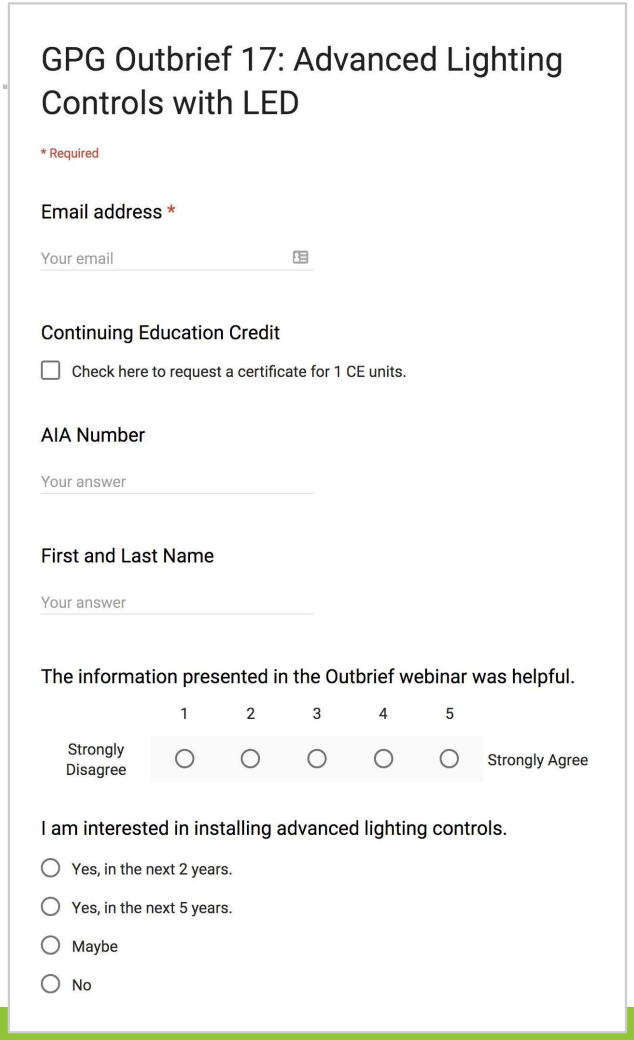

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The information presented in the Outbrief webinar was helpful.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I am interested in installing advanced lighting controls.

- ○ Yes, in the next 2 years.
- ○ Yes, in the next 5 years.
- ○ Maybe
- ○ No

Thank you

For more information: gsa.gov/GPG

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