



Better than CFL? Dimmable LED Downlights in Hospitality Facilities

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Next Generation Luminaire
(NGL) Demonstration Project:
Hilton Columbus Downtown

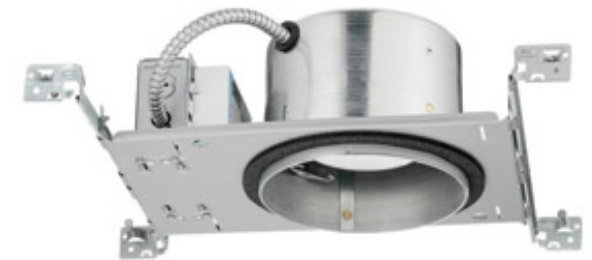
OUTLINE OF WEBINAR

- Introduction & Background
 - Why it matters
 - Overview of Hilton project & guest room lighting
- Guest room lighting details
 - LED downlights
 - Controls
- Performance data on installed system
 - Light levels & Color data
 - Energy analyses
- Lessons learned / Advice for today's projects
- Q & A

LED Downlight Demonstration Projects

Why study downlights?

- 700 million downlights installed
< 1% are LED
- Current technology
10-40 lms/Watt; 1-10k hours life
- LED technology
50-75 lms/Watt; 20k++ hours life?
- Huge energy & cost saving potential



BUT . . . First cost? Color? Dimming?
Light distribution? Reliability? Other
unknowns?

Lighting for Hospitality: Incandescent / Halogen



- **Low initial cost**
- **Shapes & sizes**
- **Easy to dim**
- **Good optical control**
- **Excellent color rendering**



Lighting for Hospitality: Incandescent / Halogen



- **Low lumens per watt**
- **Short life / Frequent replacement**
- **High operating costs**
- **Banned?**



Lighting for Hospitality: CFL



- Higher lumens per watt
- Much longer life
- Reduced operating costs (energy + maintenance)



Survey of Guest Rooms

5 hotels in 5 cities (AZ, NV, NY, OR)

62 Lamps

2 LED

3 Incandescent

4 LFL

53 CFL

Lighting for Hospitality: CFL



- **Higher initial cost**
- **Color quality?**
- **Instant on / full output?**
- **Dimmable?**
- **Guest satisfaction?**

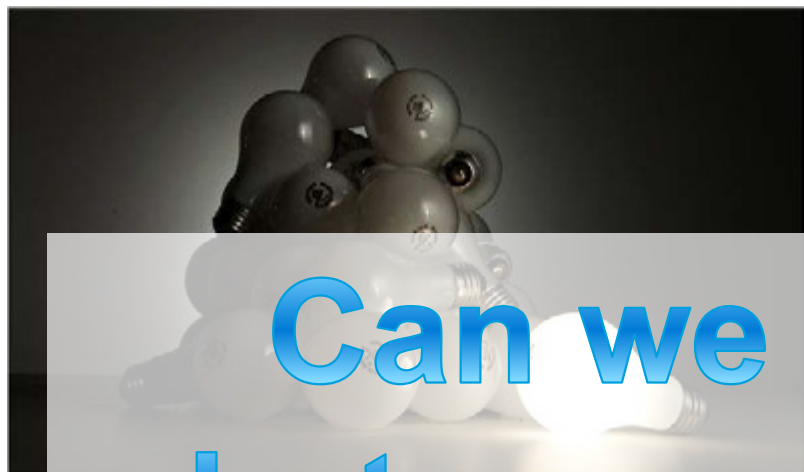


Lighting for Hospitality: CFL

“Though dimming is a persistent problem with CFLs, Gonzalez notes that major hospitality chains have standardized using switches instead of dimmers in their rooms. *Dimmability has been an acceptable sacrifice for energy savings.*”

“Meet the replacements”
Architectural Lighting, March/April 2013
- citing Domingo Gonzalez of Domingo Gonzalez Associates

Lighting for Hospitality



Can we get back
what we sacrificed . . .

And more?



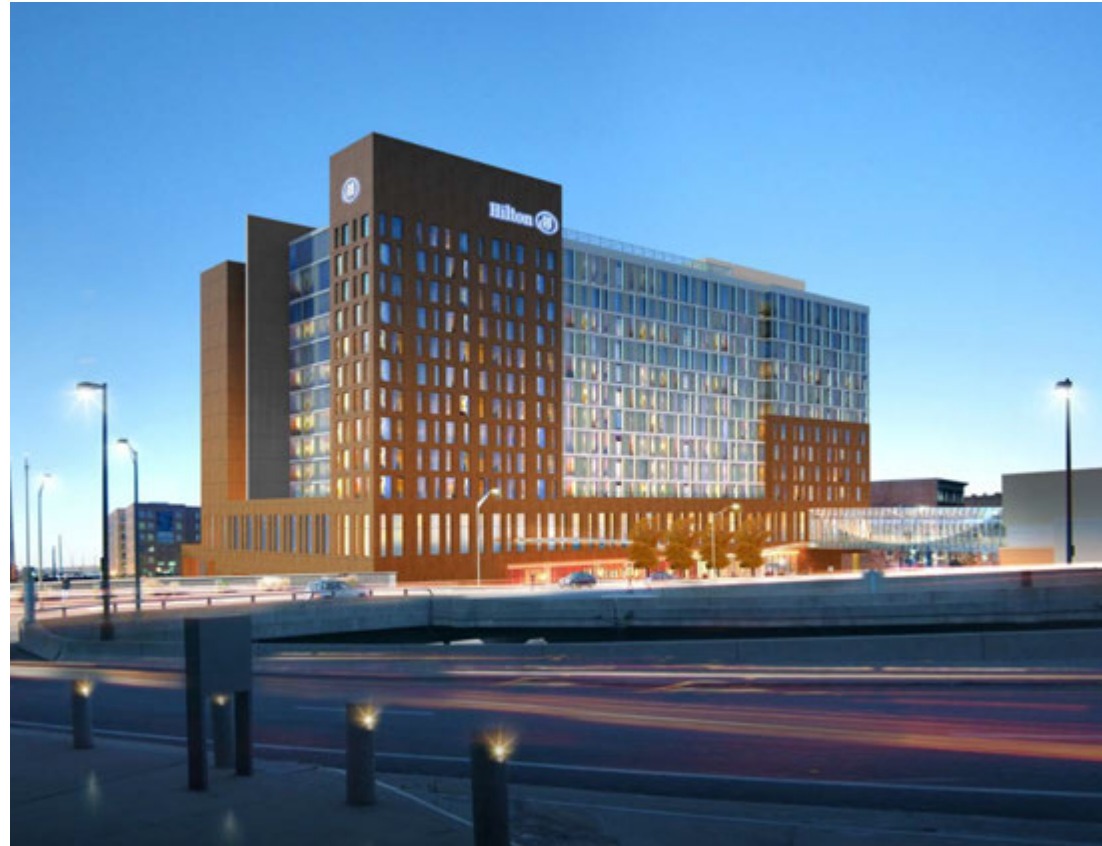
Hilton Columbus Downtown

- 450,000 square feet
- \$140 million
- HOK & Moody-Nolan
- LEED Gold
- Greater Columbus Convention Center
- Occupancy October 2012



Hilton Columbus Downtown

- 484 guest rooms + 48 suites
- 32,000 ft² event space
- 160 seat restaurant
- Large central atrium w/ 15,000 ft² skylight
- DOE post-occ study March 2014



Lobby Space



Lobby Space



Lobby Space



Restaurant

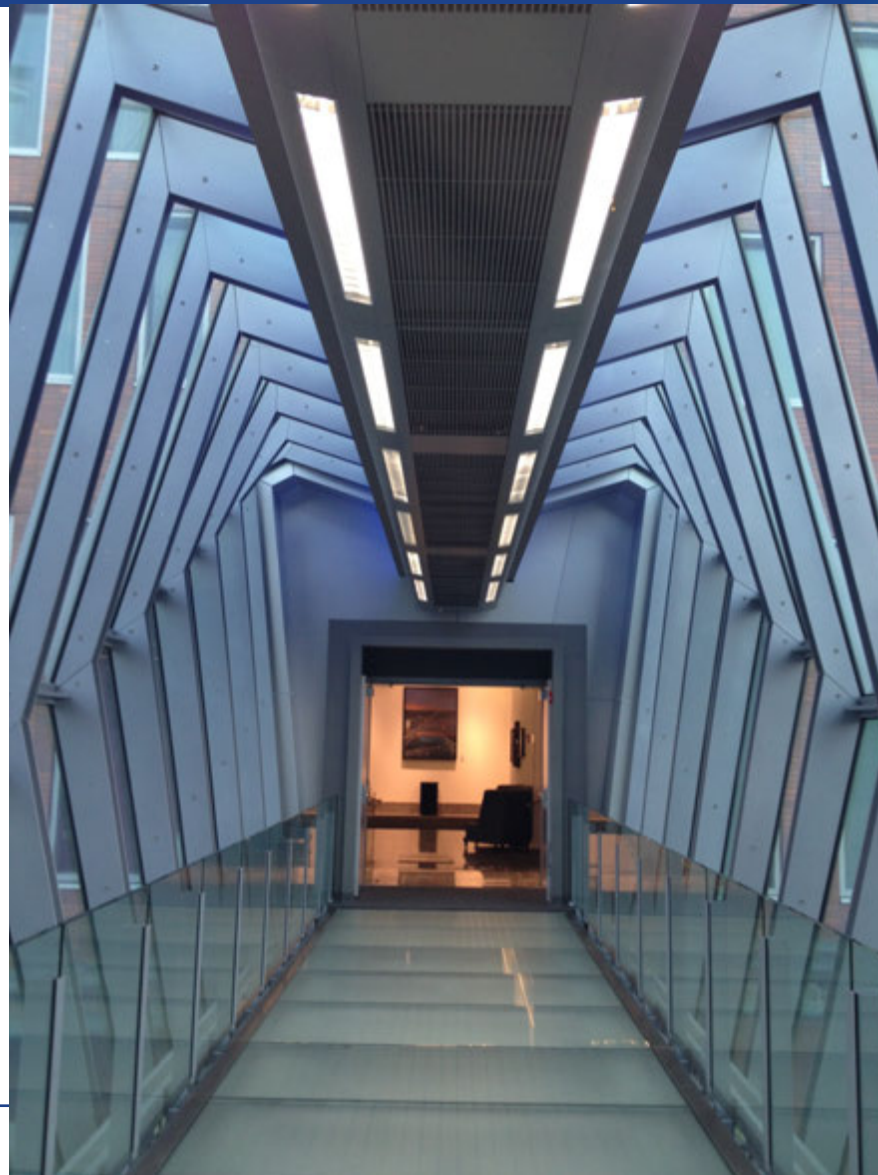


Pre-function

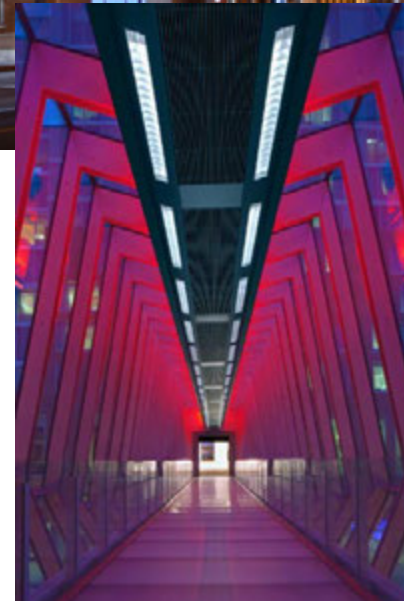
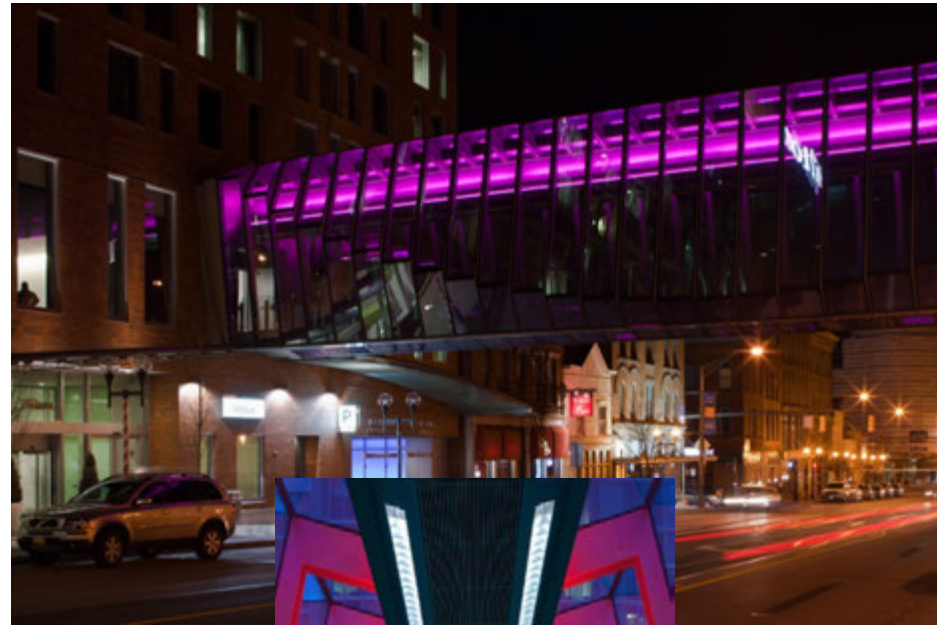




Glass Connector Bridge



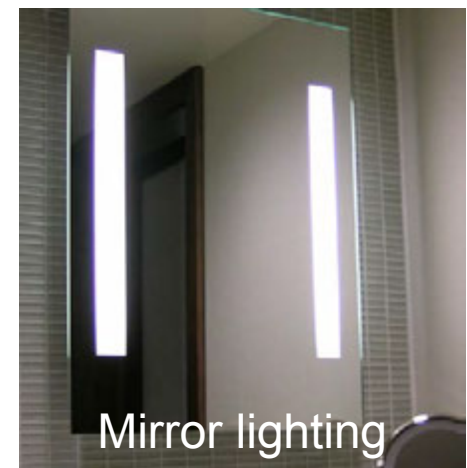
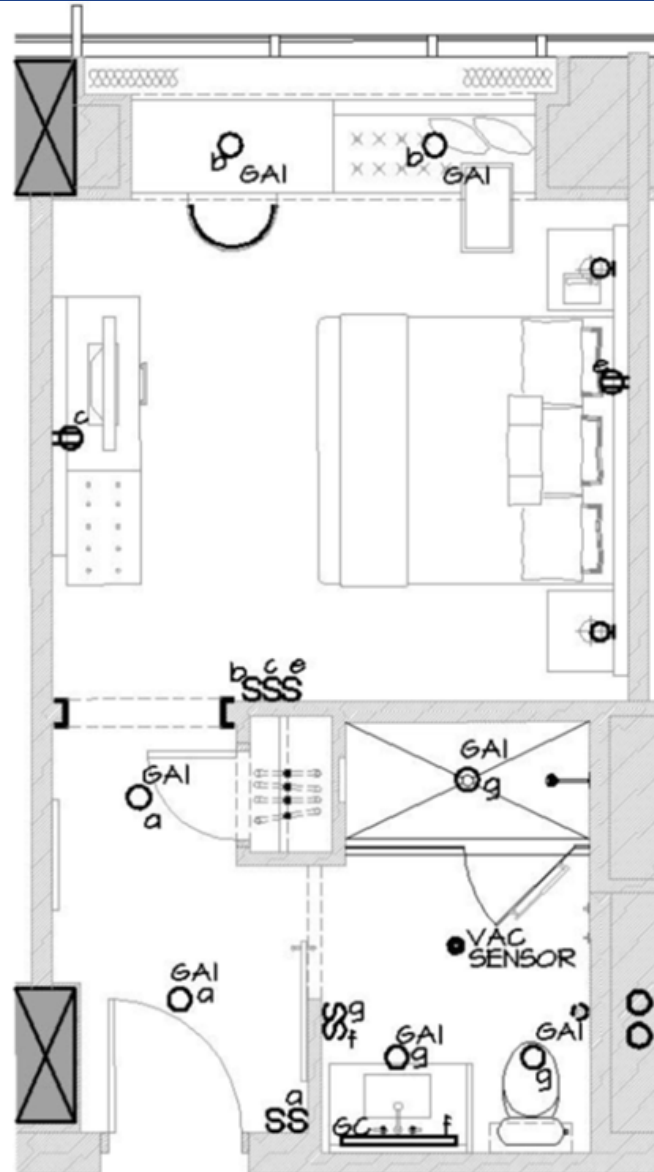
Glass Connector Bridge

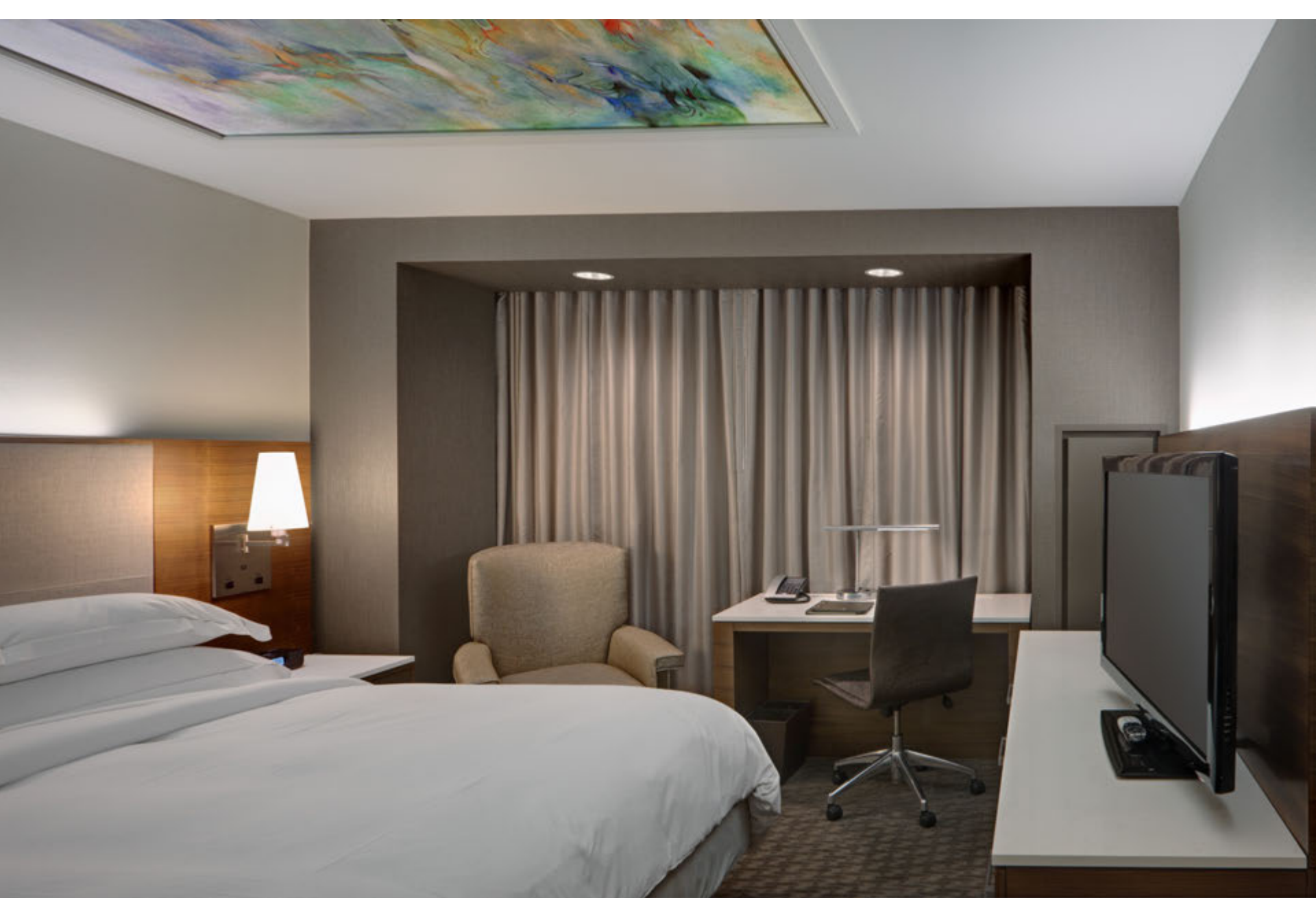


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 - Overview of Hilton project & guest room lighting
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Guest Room Lighting









Guest Room Lighting: Goals for downlights

- Energy efficient / LEED goals
- Long life & low maintenance
 - Life not affected by switching / controls
- Dimmable w/ *familiar* functionality
- Full output without warm-up
- Single light source appearance
- Fit within 6” height constraint
- Excellent color consistency
 - Downlights visible from atrium



Guest Room Lighting: Downlight selection process

- CFLs?
 - Dimmable? Color? Full output? Life?
- LED options?
 - Reviewed dozens of cut sheets and samples
 - Multiple sources? CCT? Binning spec? Lens / shower option?
 - Full-scale mock-up of two guest rooms
- Portfolio: Eaton's Cooper Lighting
 - Calculite: Philips Lightolier



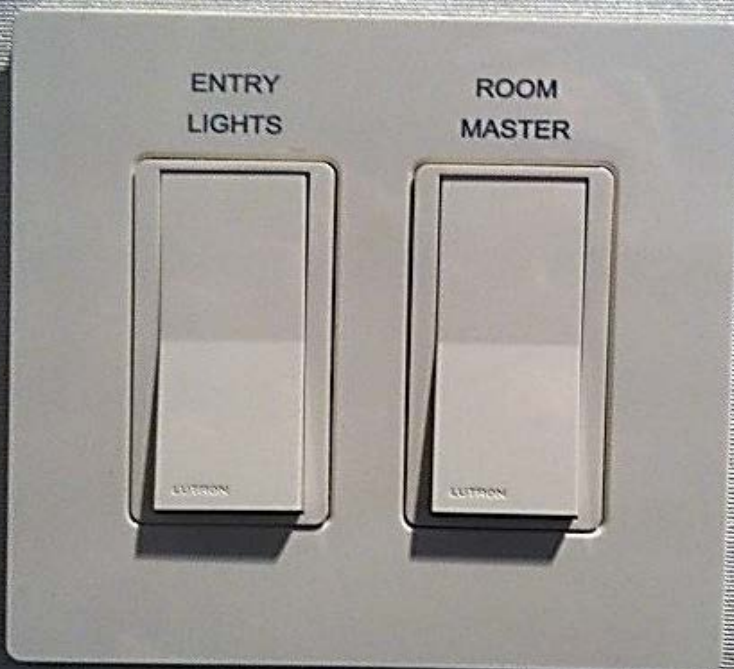
Guest Room Lighting: Controls

Priority: Vacancy control

- **Bedroom: Auto or manual?**
 - Locations made hard-wired sensors difficult
 - Wireless? Problems with dimming
- **Bathroom (not code required)**
 - Wireless PIR sensor on ceiling
- **Master switch (code required)**
 - Clear labeling
 - Custom placard



Guest Room Lighting: Controls



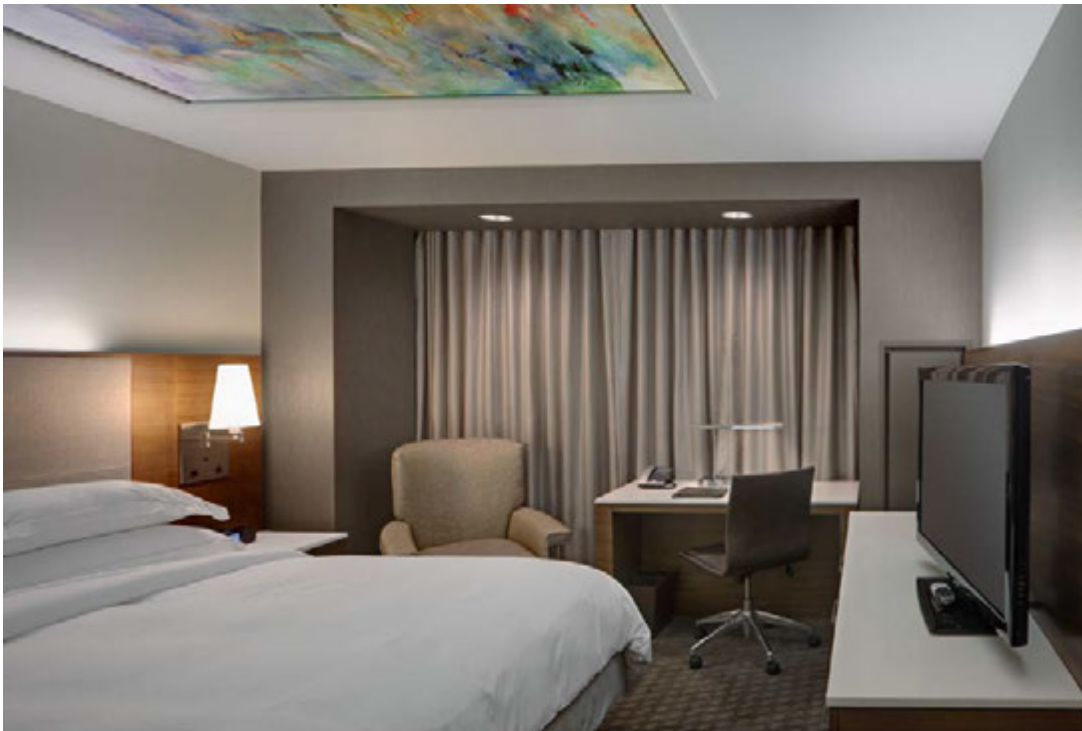
To activate the in-room lighting,
use the Master ON/OFF switch.

Please turn off the lights upon
your exit to help conserve energy.

Guest Room Lighting: Controls

Priority: Dimming control

- Downlights in bathroom
- Downlights near window



Simple rocker switches
with slide dimmer

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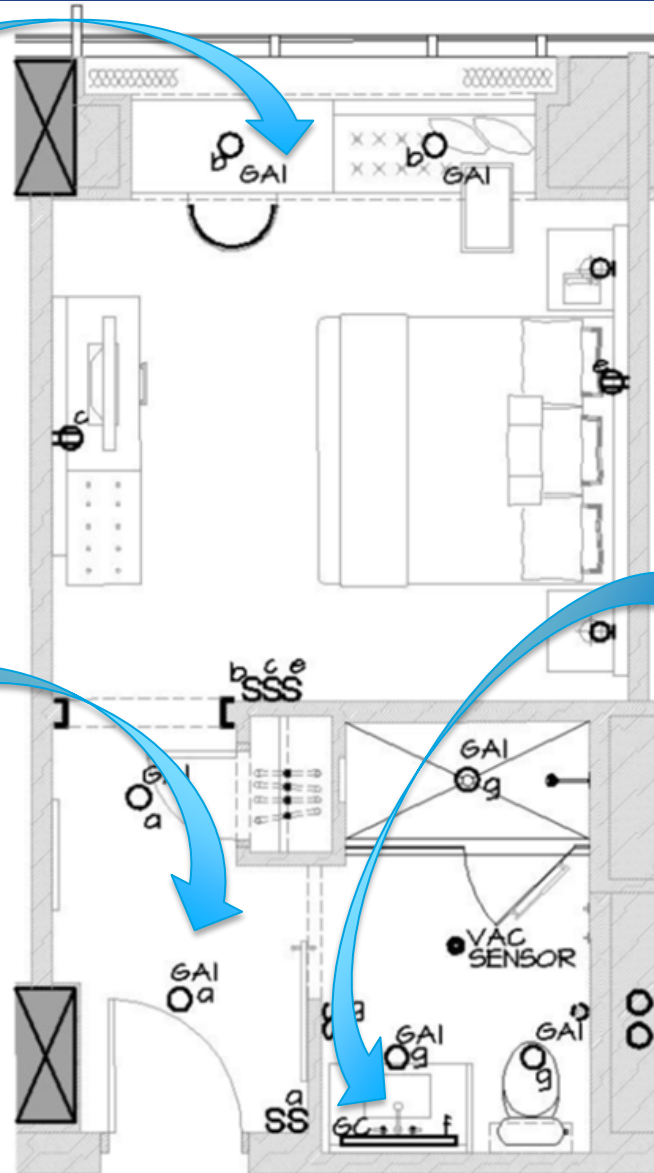
Photometric Performance

Desktop

- 177 - 275 lx
- IES: 200 lx
(400 for >65)
- Tasklight

Entrance

- 120 - 203 lx
- IES: 20 - 40 lx
- Mirror? Closet?



Bath - Sink

- 560 lx (H)
- IES: 200-400 lx
- 690 lx w/ mirror
- 250 lx (V)
- IES: 200-400 lx
- 425 lx w/ mirror

Color Performance

Fixture		CCT	CRI	R _g
LED Downlights	ENTRY1	3060	85	43
	ENTRY2	3091	84	43
	WINDOW1	3062	84	43
	WINDOW2	3075	82	37
	BATH1	3075	81	37
	BATH2	3071	82	37
	BATH3	3052	84	42
	Mean	3069	83	40
	Range	39		
CFL Bed Light Fixtures	BED1	2753	82	-2
	BED2	2843	80	-3
	Mean	2798	81	-3
	Range	90		
LFL Bed Millwork Fixtures	MILL1	3762	85	29
	MILL2	3841	85	29
	Mean	3802	85	29
	Range	79		
LFL Mirror Fixtures	LEFT	3022	85	8
	RIGHT	2979	85	8
	Mean	3001	85	8
	Range	43		

Energy Savings & Economics

Why LED?

- Guest experience: functionality, aesthetics, lighting quality

First cost?

- 10% less to 20% more than dimmable CFL versions at “book”

Energy code?

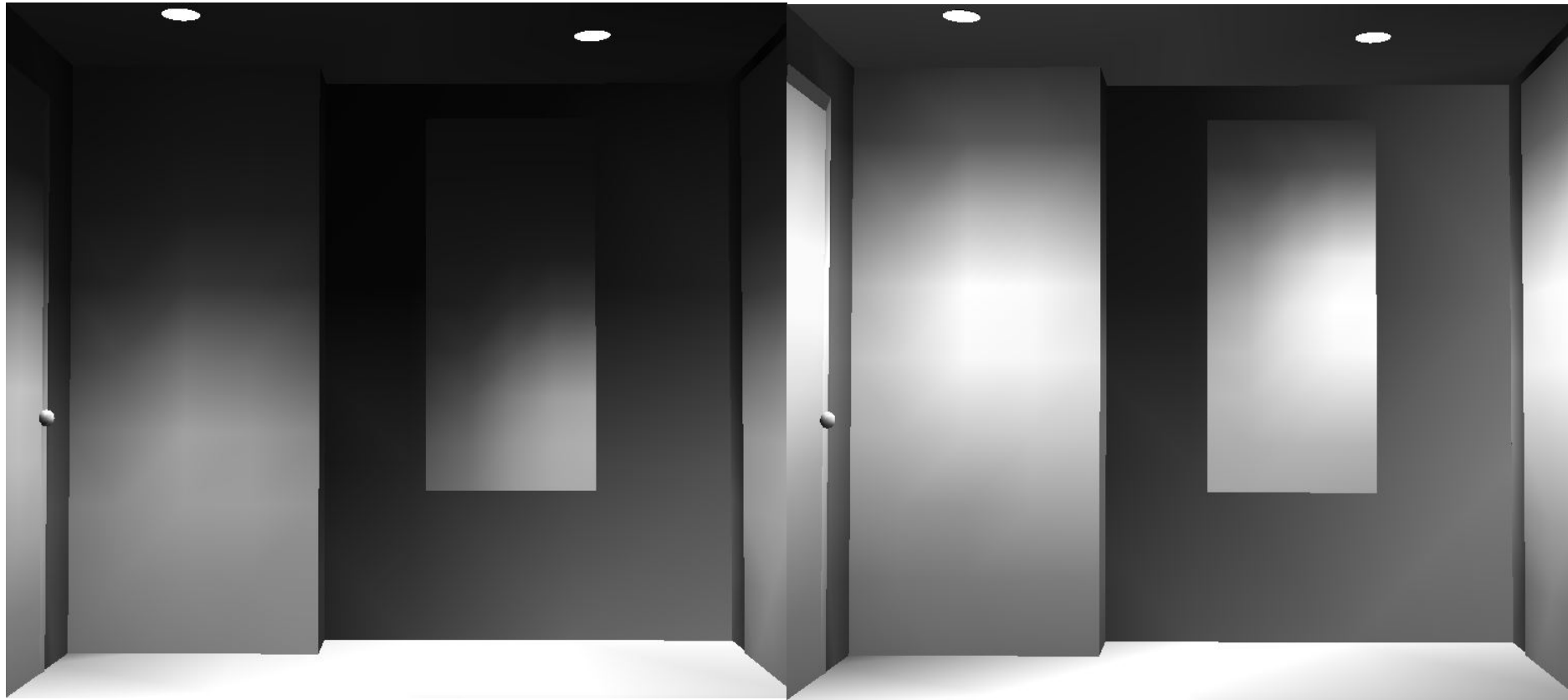
- Guest room lighting 20% below allowed power
(145k kWh saved per year)
- Controls to further reduce energy use
- Other SSL opportunities?



Energy Savings & Economics

	6" Downlights		
	LED	CFL: vertical	CFL: horizontal
Lamp output (lms)	N/A	2,400	2,400
Luminaire output (lms)	928	1,173	981
Input power (W)	15	29	31
Luminaire efficacy (lm/W)	62	40	32
Annual electricity use (kWh)	203,330	377,986	406,661
Average illuminance in entry (lx)	190	191	175
Illuminance on face at mirror (lx)	68	101	82

Lighting quality



Entry area renderings comparing PAR halogen (left) and LED (right) downlights

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Lessons learned from the Hilton Columbus Downtown

LED Technology

- Have clear evaluation criteria defined at the start
 - What is important for this project?
- Evaluate multiple samples for construction quality, color quality & consistency, visual aesthetic
- Mock-up fixtures w/ full controls to check compatibility & reliable operation
- Specified product \neq Bid product \neq Ordered product
 - LED technology is moving fast!

Lessons learned from the Hilton Columbus Downtown

Practical project considerations

- Communication challenges w/ multi-location teams
 - Team members in Columbus, Chicago, Atlanta
- Ownership of spec and ordering
 - Hard-wired vs. plug-in
 - Electrical vs. Interior / decorative
 - Lamping, color, voltages, etc.

The reviewers speak!

“The bathroom has self monitoring lighting which is huge for me. I can't stand screaming bright lights without any options for self dimming (sic) as it's the biggest pet peeve I have regarding hotel rooms. These are cool in that you can lighten up or lower down to your preference.” (Yelp)

“Nice uplights in the room.” (Expedia)

“Instructions for operating all electronics, including lights, were easy and evident.” (Hotels.com)

Acknowledgments

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 - Scott Pease Photography

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Related resources

Hilton Columbus Downtown reports

<https://www4.eere.energy.gov/alliance/activities/technology-solutions-teams/lighting-electrical/downlight>

DOE Better Buildings

<http://energy.gov/better-buildings>

DOE Solid State Lighting

- <http://energy.gov/eere/solid-state-lighting>
- <http://www.nglhc.org/>
- <http://www1.eere.energy.gov/buildings/ssl/gatewaydemos.html>