Illuminating The Future With LLLC

ANGELA PILANT, LC – SR. ENERGY SPECIALIST
DAN KUHL, LC – SR. ENERGY SPECIALIST

Evergreen Energy Partners

Today's Session

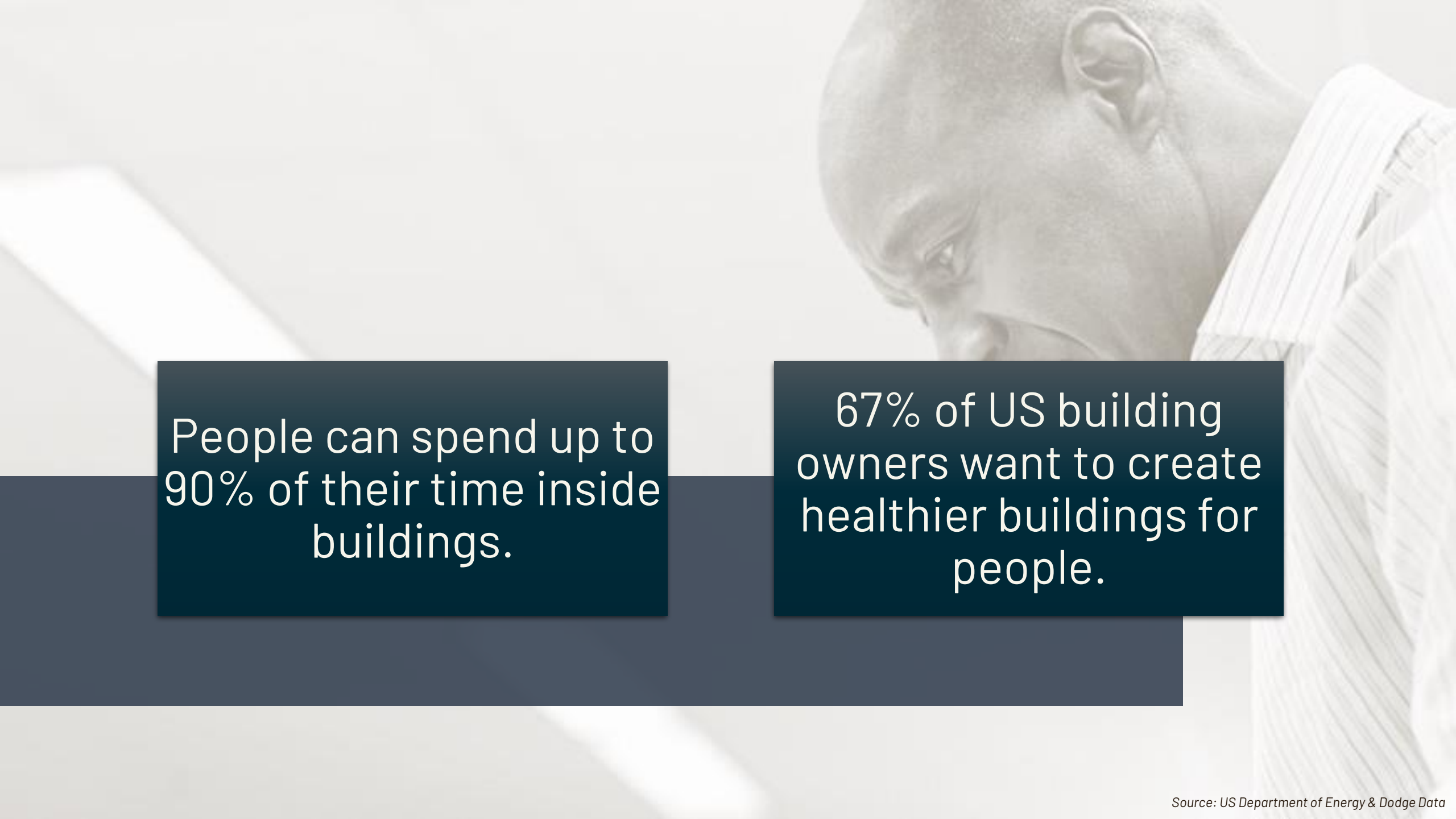
1. Luminaire Level Lighting Controls (LLLC)
2. LLLC Capabilities and Applications
3. Project Considerations
4. Resources
5. Q&A

The Future: Smart and Healthy Buildings

Benefits of Smart and Healthy Buildings

- Improved indoor air quality = 8 -11% higher productivity
- 80% average occupants are dehydrated
- Depression reduced by 27% by fruit & vegetables
- Views to outdoor environment increases concentration by 15%
- Too warm: productivity 4% lower
- Too cold: productivity 6% lower
- Noisy environment reduces concentration by 15%
- Concentration increases by 6% with views

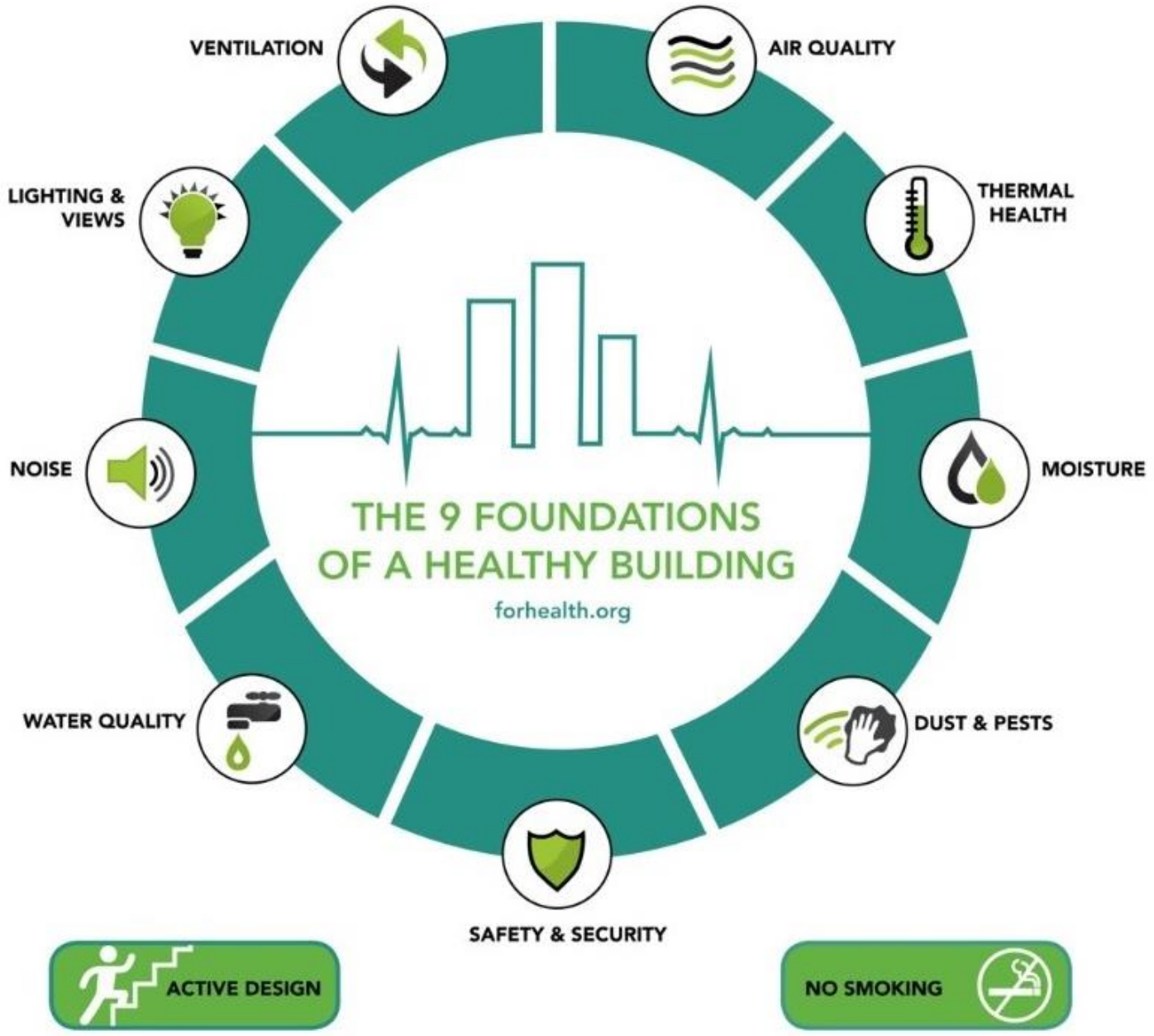
Source: Statistics from International WELL Building Institute (IWBI)



People can spend up to 90% of their time inside buildings.

67% of US building owners want to create healthier buildings for people.

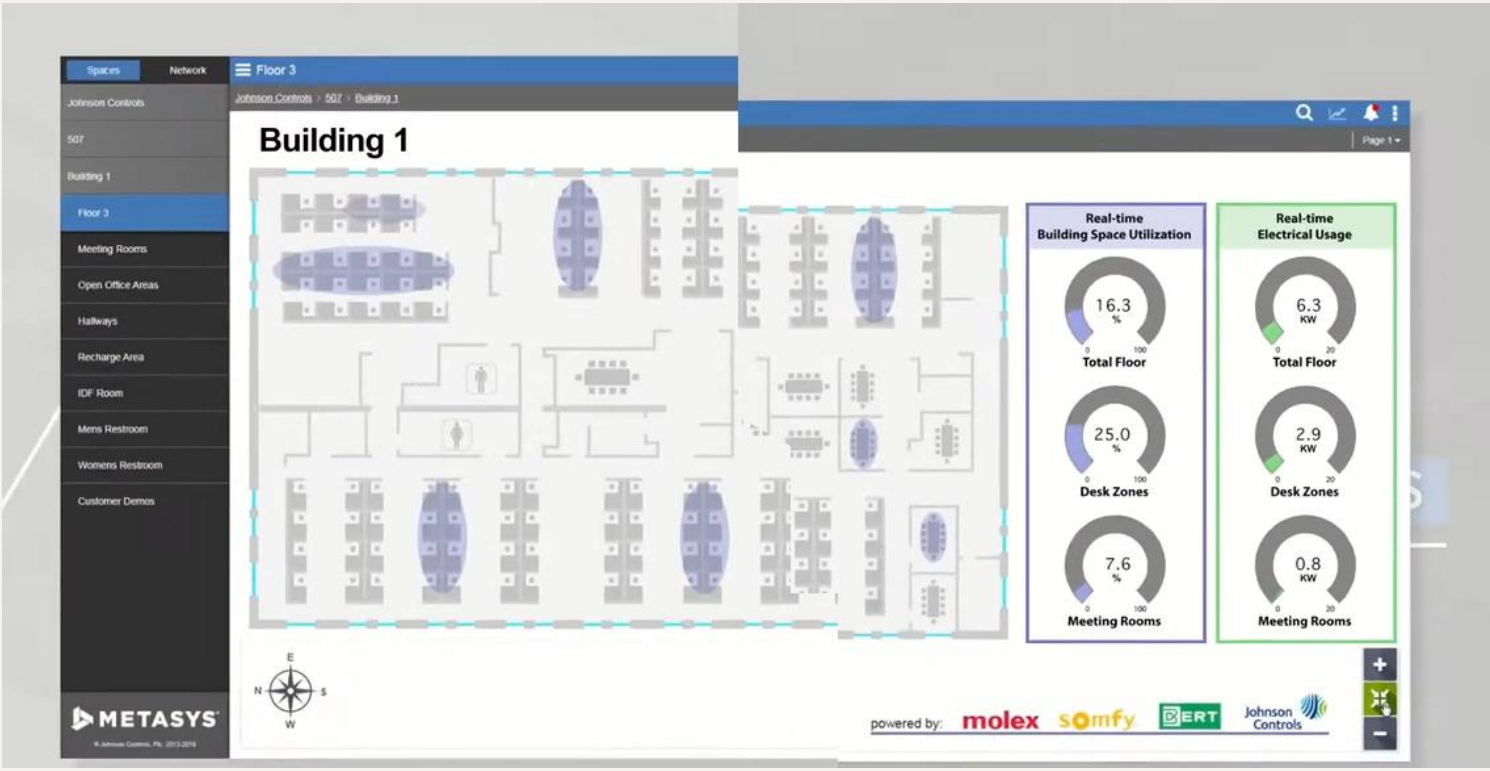
Source: US Department of Energy & Dodge Data



Harvard Study: 9 Foundations of a Healthy Building

www.9foundations.forhealth.org

The Future: Smart Buildings with LLLC



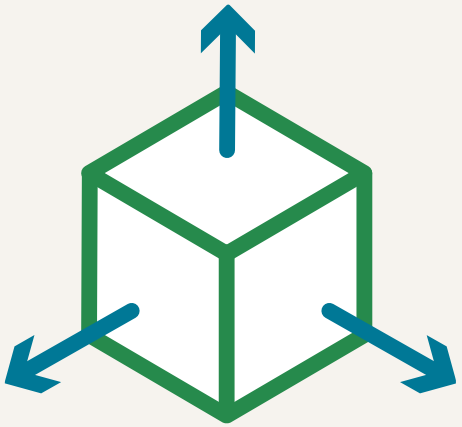
Lighting's Unique Real Estate

- Elevated above us all the time
- Distributed across the building
- Power access at every luminaire

Why Luminaire Level Lighting Controls?

Additional Energy Savings

Occupant Comfort and Flexibility



Occupied Space Adaptability

Energy Code Compliance

Ameren Illinois LLLC Program Offerings & Resources

System Type	Implemented Control Strategies	Incentive per Unit
Interior | **Non-LLLC** installation *(Single controller/sensor controls multiple luminaires)*	**Must include three:** • Occupancy • Scheduling • High-End Trim • Dimming • Daylighting	**$0.50/watt** controlled *(capped at $75/ fixture)*
		SBDI - $0.60/watt controlled *(capped at $75/ fixture)*
Interior | LLLC installation (Each luminaire has its own controller/sensors and DLC listing indicates LLLC)		**$1.50/watt** controlled *(capped at $75/ fixture)*
		SBDI - $1.75/watt controlled *(capped at $75/ fixture)*
Exterior | LLLC or non-LLLC installation (Garage/covered parking areas not eligible)	**Must include:** ✓ Occupancy and/or Scheduling ✓ Daylight shutoff ***Plus, one of:*** • High-End Trim • Dimming • Daylighting	**$0.50/watt** controlled *(capped at $75/fixture)*

Integrated Sensors: Director of Building Communications

Controls Market Adoption Myths

Controls are too expensive to purchase and install.

Lack of information about how controls can provide a more comfortable, human-centric focused building for owners and occupants.

The systems are complicated to design and take too much time to specify, install and commission.

LLLC Capabilities and Applications

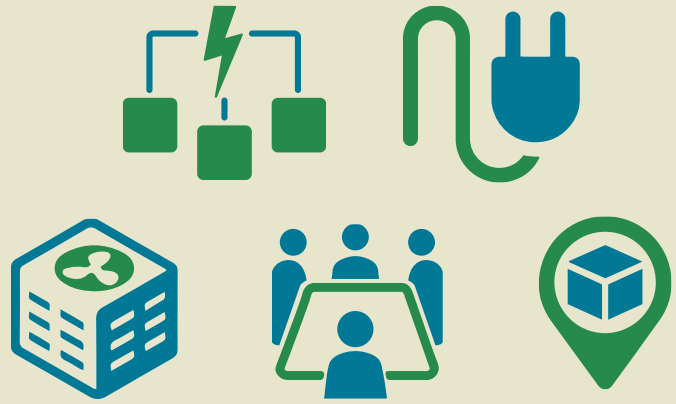
Simple and Expanded LLLC Systems

Simple

- Comprehensive or Simple Projects
- Minimal Components
- Standard Control Capabilities/Vocabulary
- Standard Configuration On-site

Expanded

- Larger Projects
- Additional Devices Required
- Optional Control Capabilities
- Third-Party Configuration/Training

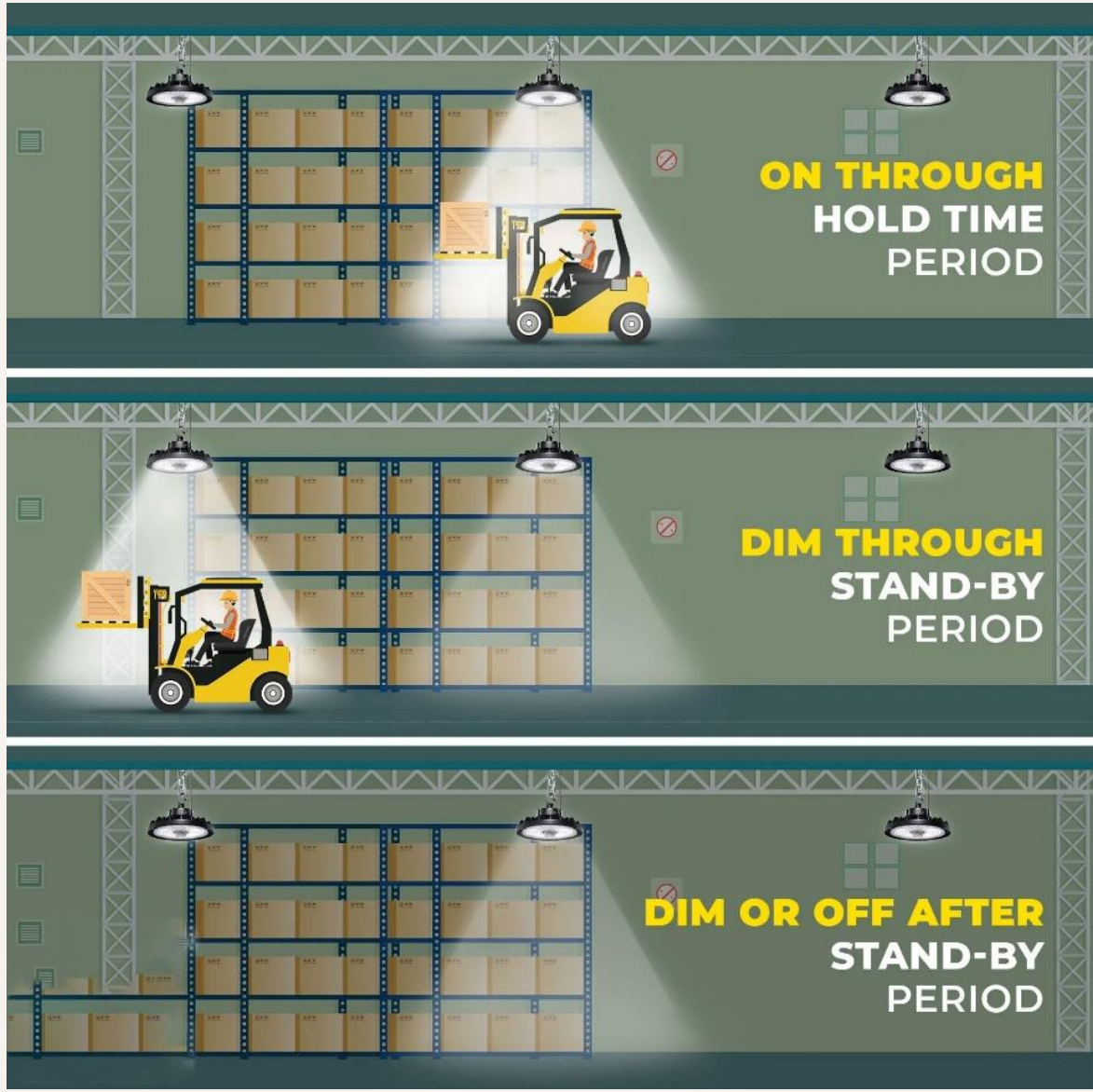


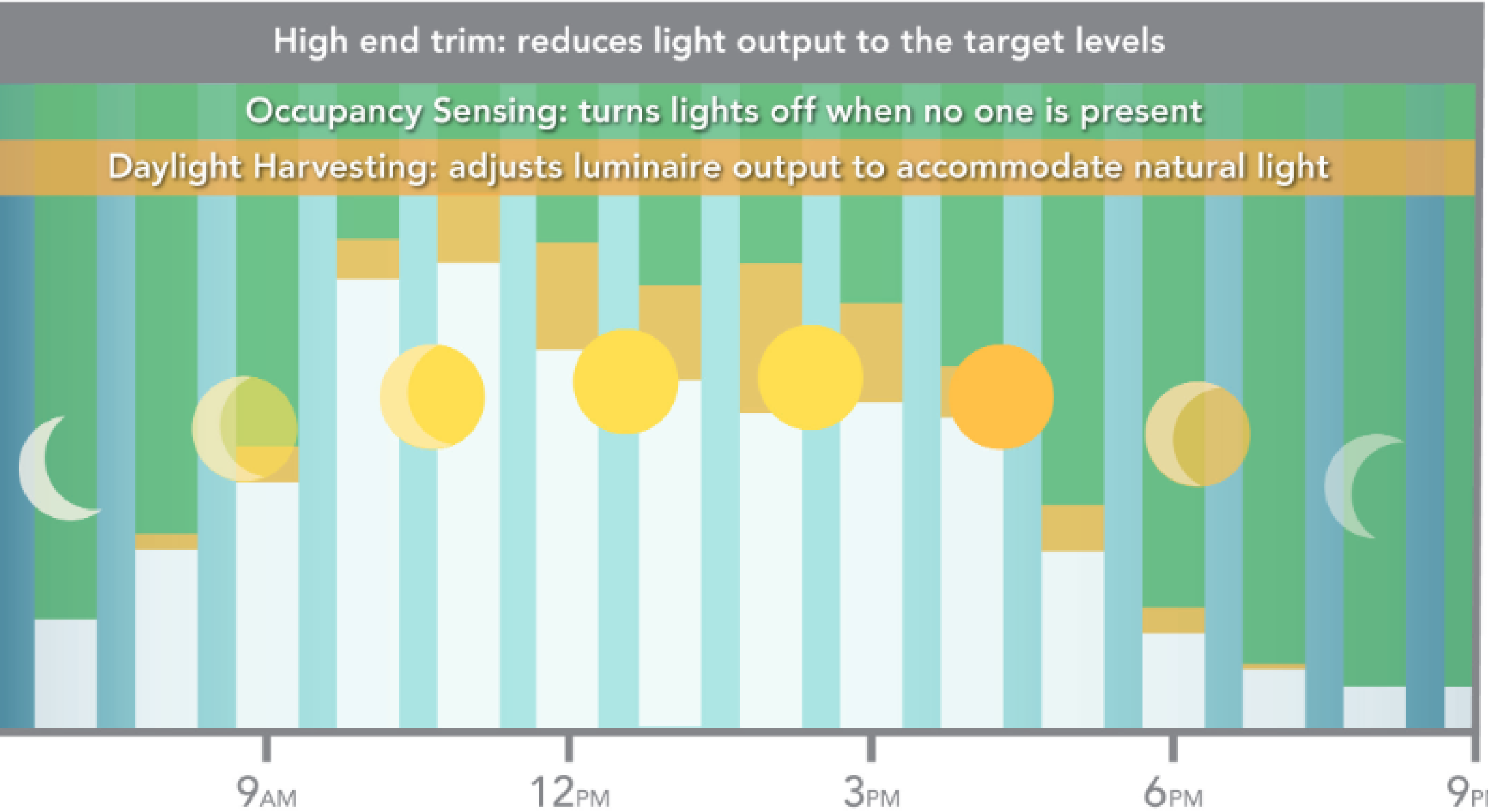
Simple LLLC Capabilities

- Occupancy Sensing
- Daylight Harvesting
- Continuous Dimming
- High-End Trim/Task Tuning
- Zoning

Occupancy Sensors

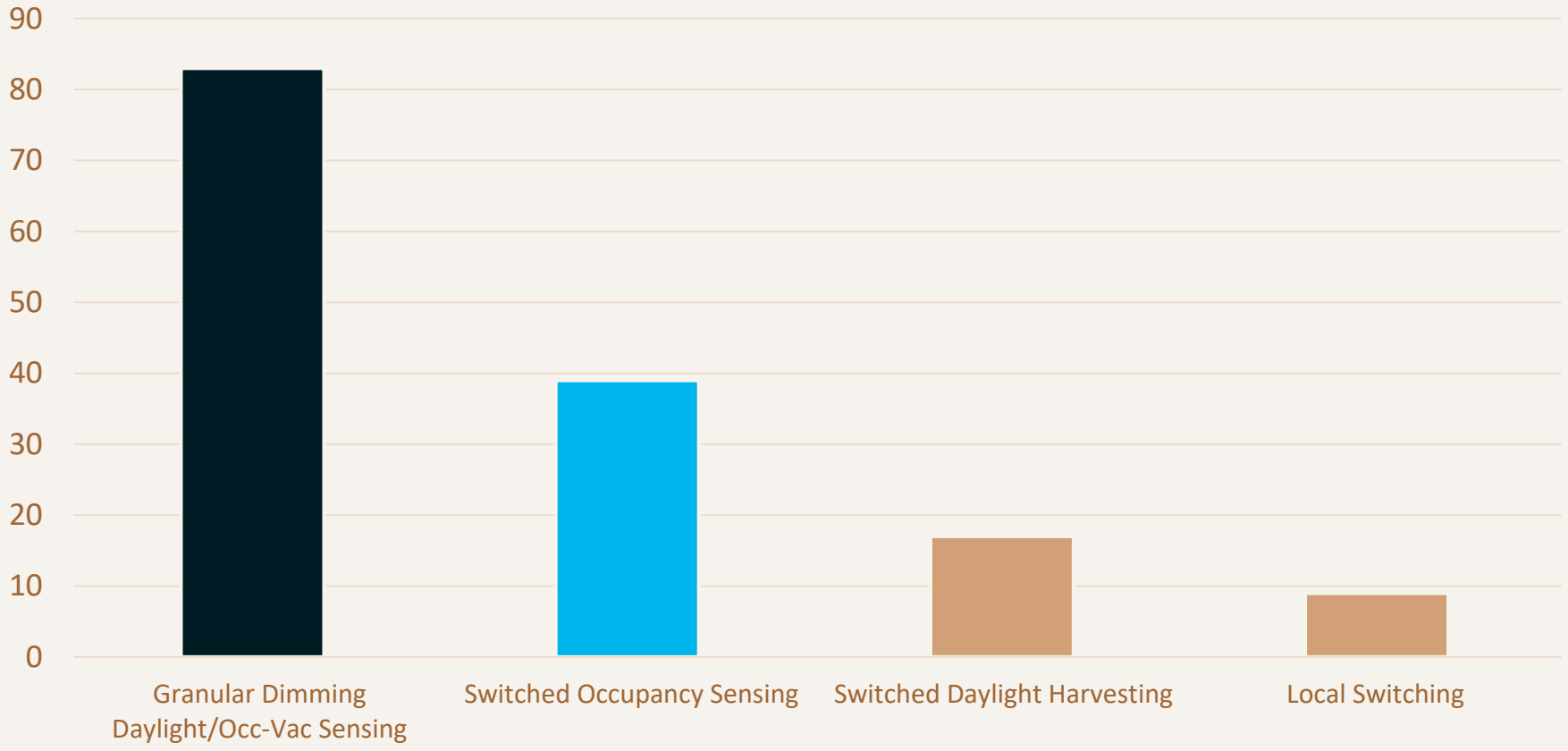
- Maximize savings during low/no activity periods
- Can provide safety benefits by altering unauthorized occupants
- Incorporate photocell to keep lights off by skylights to increase savings even more!




High end trim: reduces light output to the target levels
Occupancy Sensing: turns lights off when no one is present
Daylight Harvesting: adjusts luminaire output to accommodate natural light
9AM
12PM
3PM
6PM
9PM

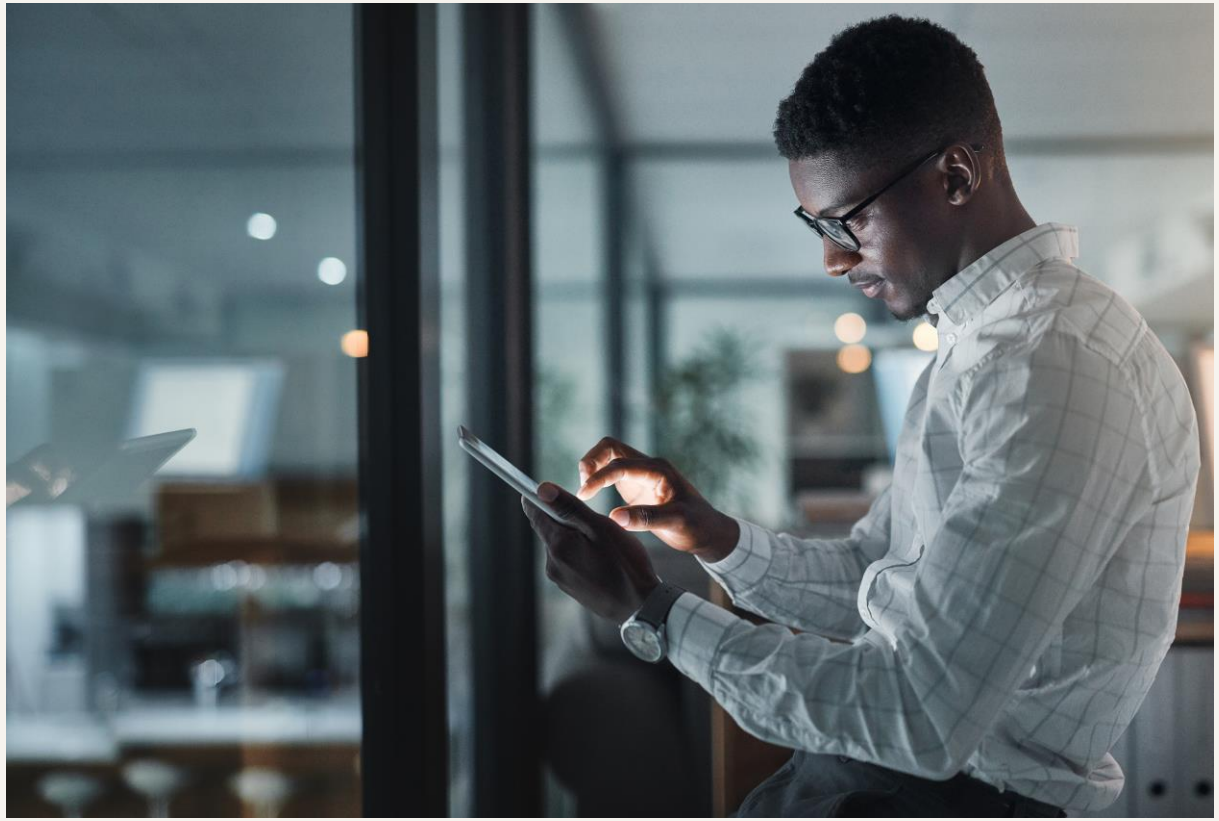
Deeper Energy Savings

Compounded Control Schemes



Industry Voices: Chris Gilmore

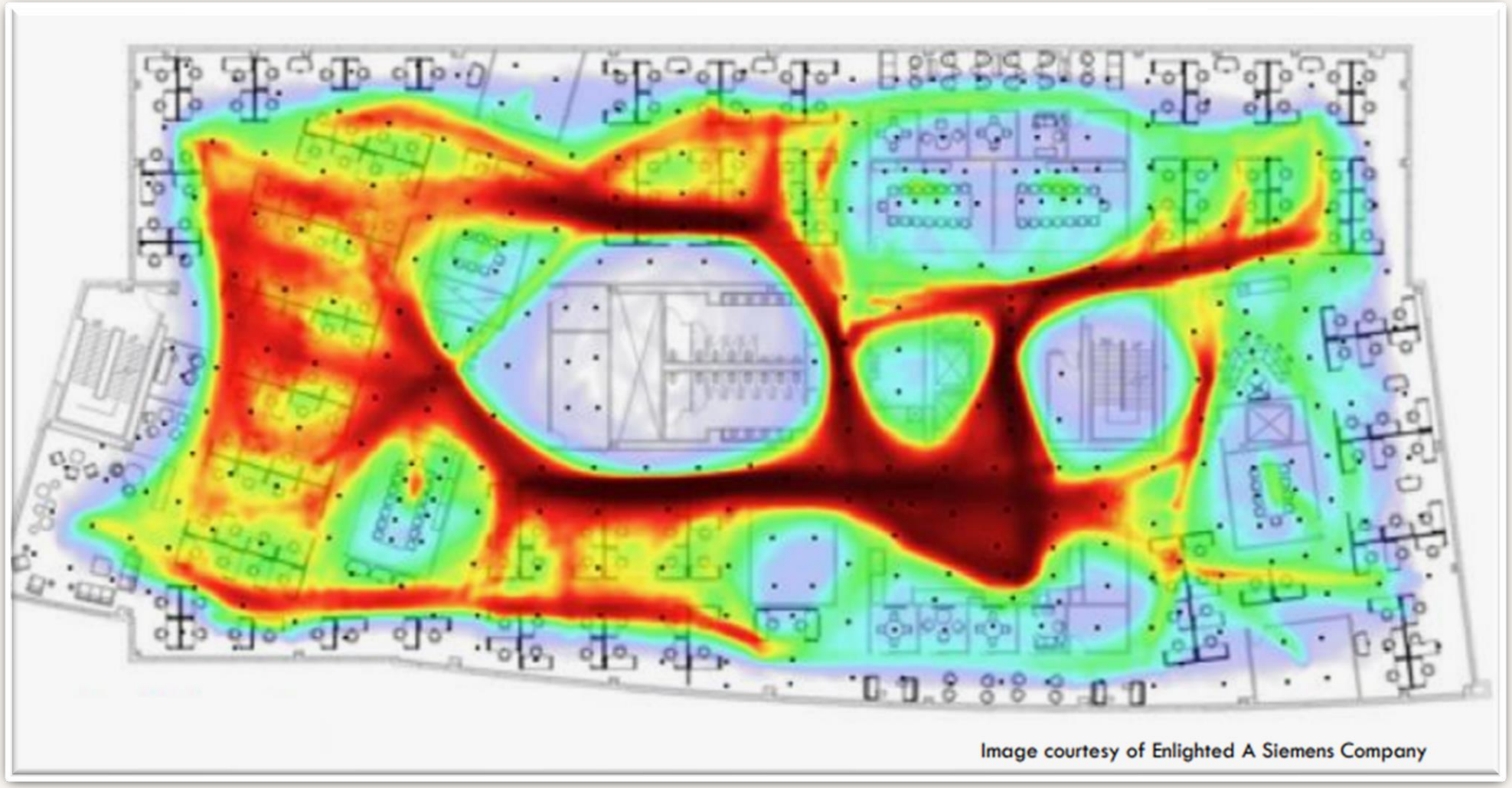
Expanded LLLC Capabilities



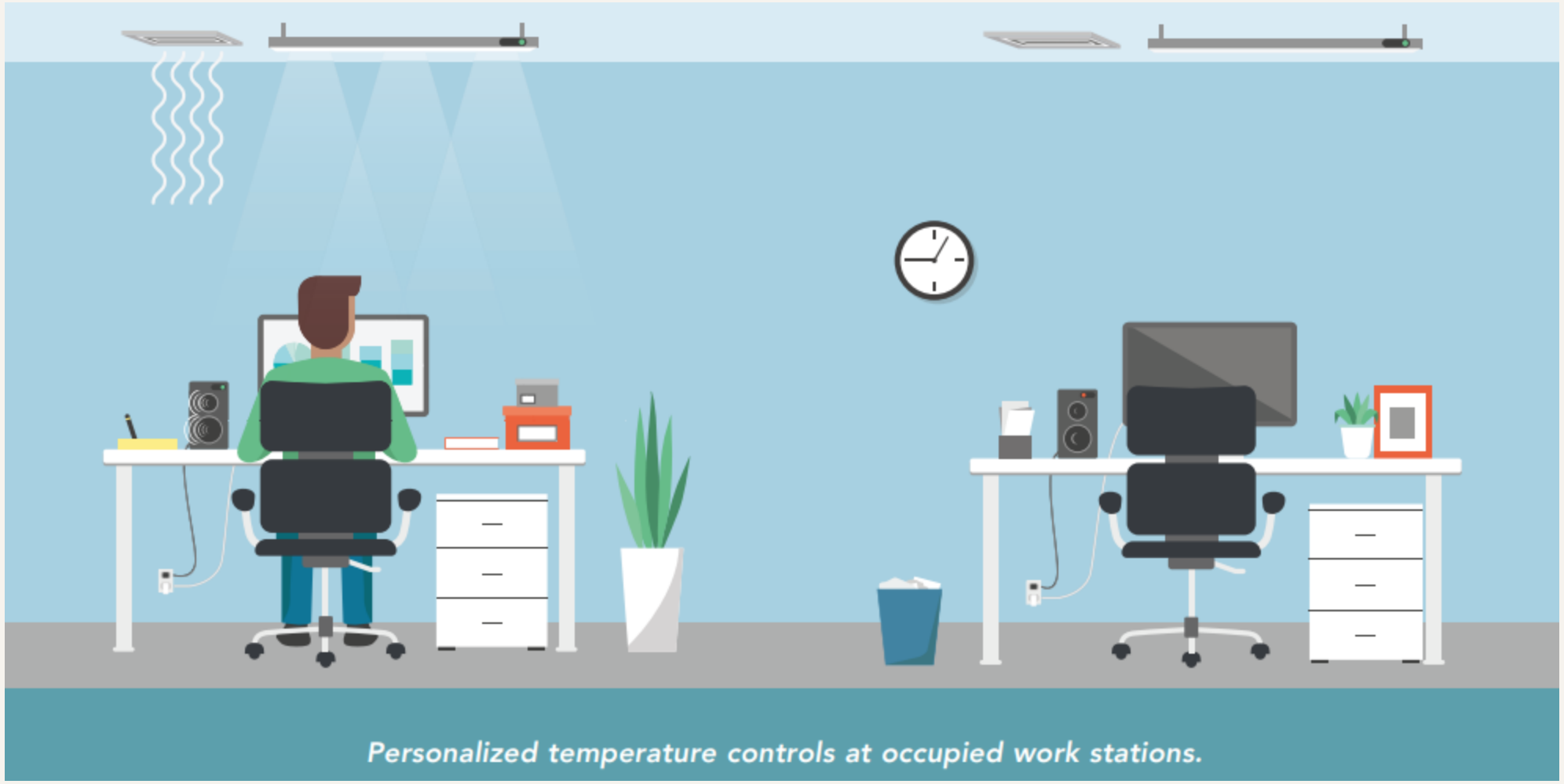
- Asset Tracking
- Space Utilization
- HVAC Integration
- Safety and Security
- Circadian Support

Asset Tracking

Space Utilization & Optimization

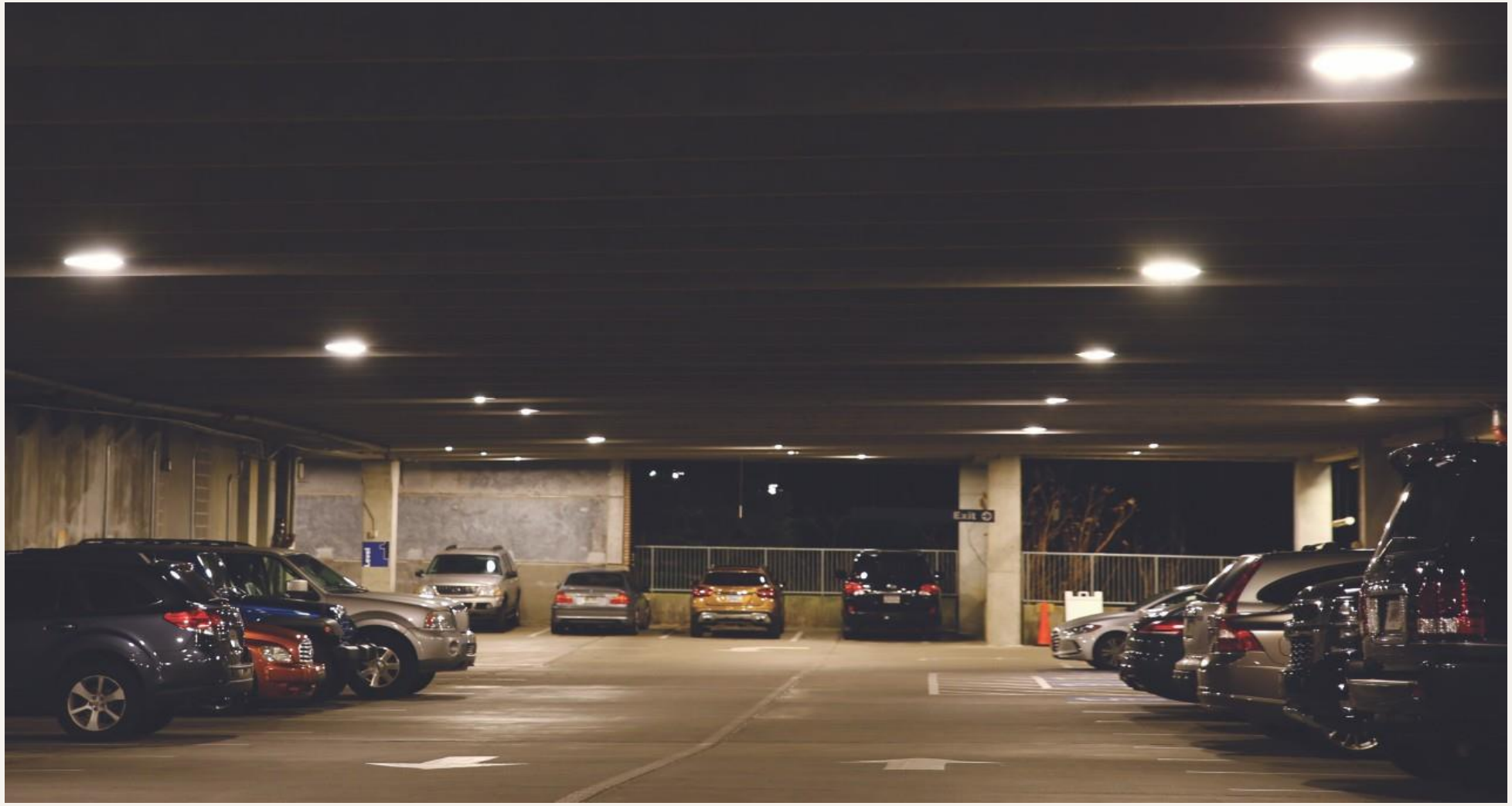


Ventilation and Thermal Comfort



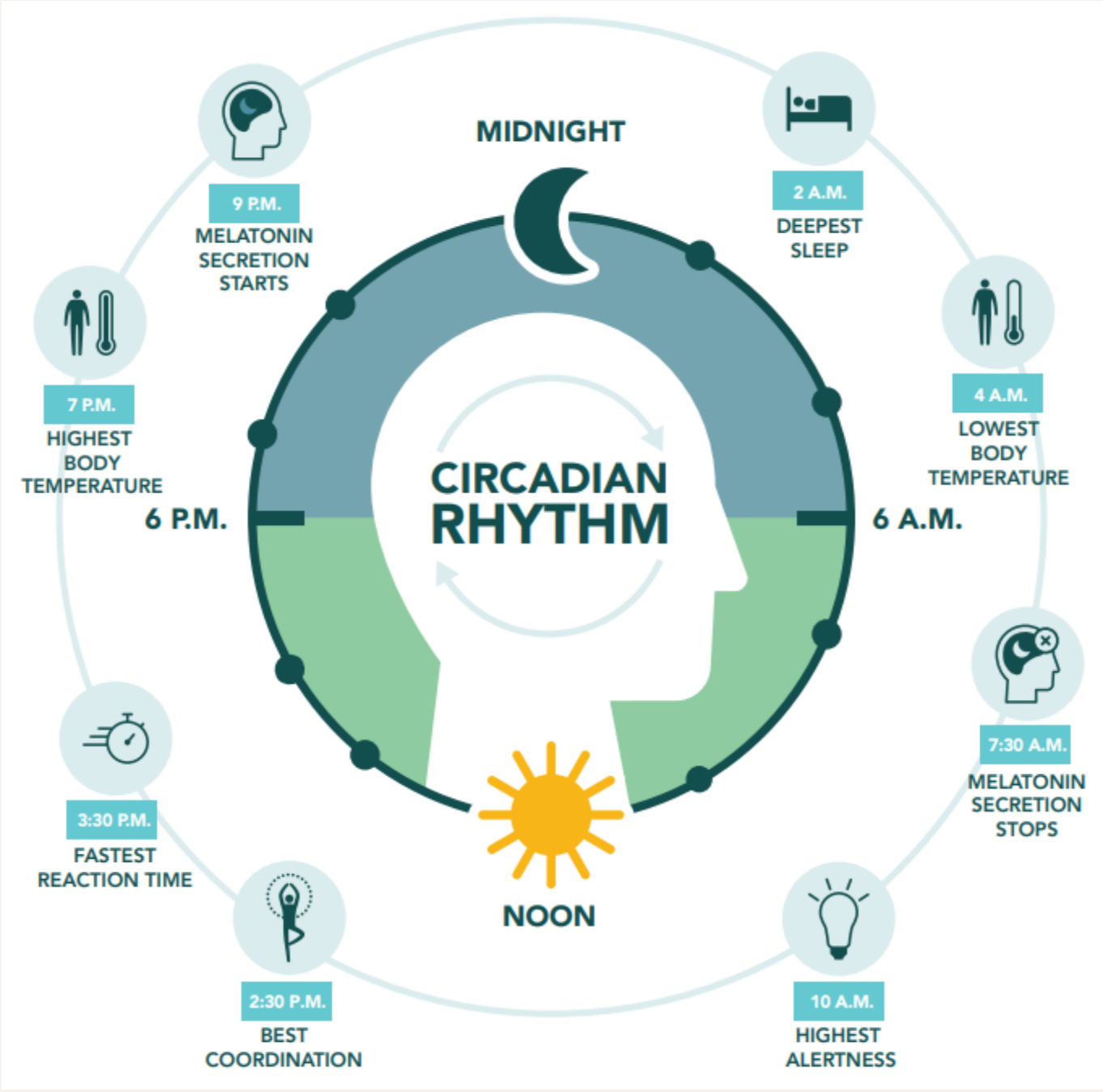
Personalized temperature controls at occupied work stations.

Safety and Security

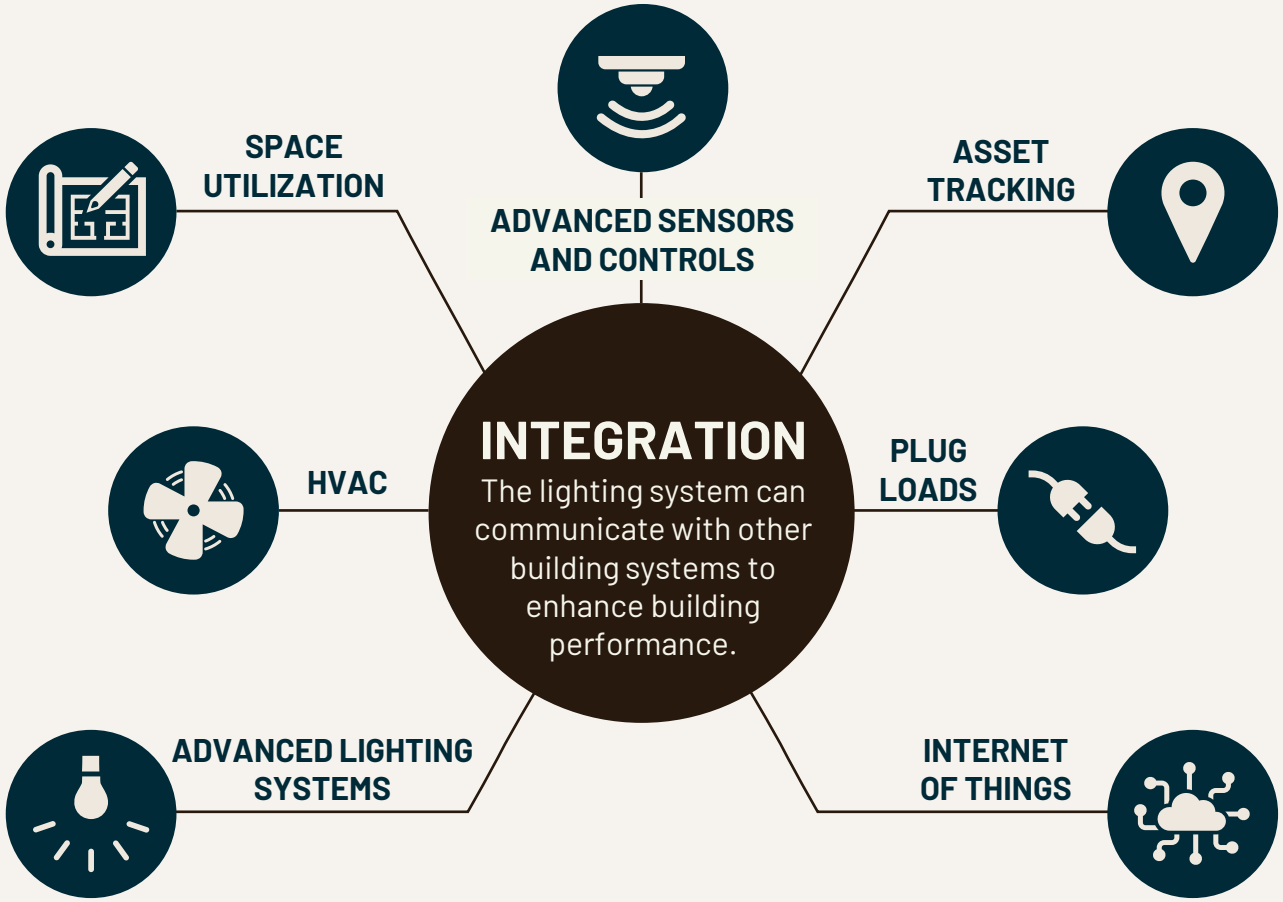


Circadian

The circadian rhythm is a natural physiological function associated with the human sleep-wake cycle and exposure to light.



US Department of Energy: Integrated Lighting Campaign



Technology campaigns work with **building owners and managers** who are open to adopting advanced and novel approaches to improve building performance

- Demonstrate **real-world savings and benefits**
- Provide resources that **make it easier for buyers** to consider new or underutilized solutions
- Recognize and celebrate **success!**

Source: Integrated Lighting Campaign

ILC 2024 Award Winner: Indian Community School

BUILDING TYPE
Community School

LOCATION
Franklin, WI

LIGHTING SYSTEM
Upgraded lighting to tunable-white LED fixtures with DALI controls, including dimming, daylight harvesting, and occupancy sensing

OUTCOMES
- Teachers have more control of learning environment
- Aligns with original lighting design intent
- HVAC setbacks are triggered by lighting system

Recognition Categories

- Advanced Use of Sensors and Controls for Lighting
- Integrated Controls for HVAC and Lighting Systems
- Energy Justice, Diversity, Equity, and Inclusion in Advanced Lighting

George Lambros Photography

Source: Integrated Lighting Campaign

Project Partners

MOR LIGHTS

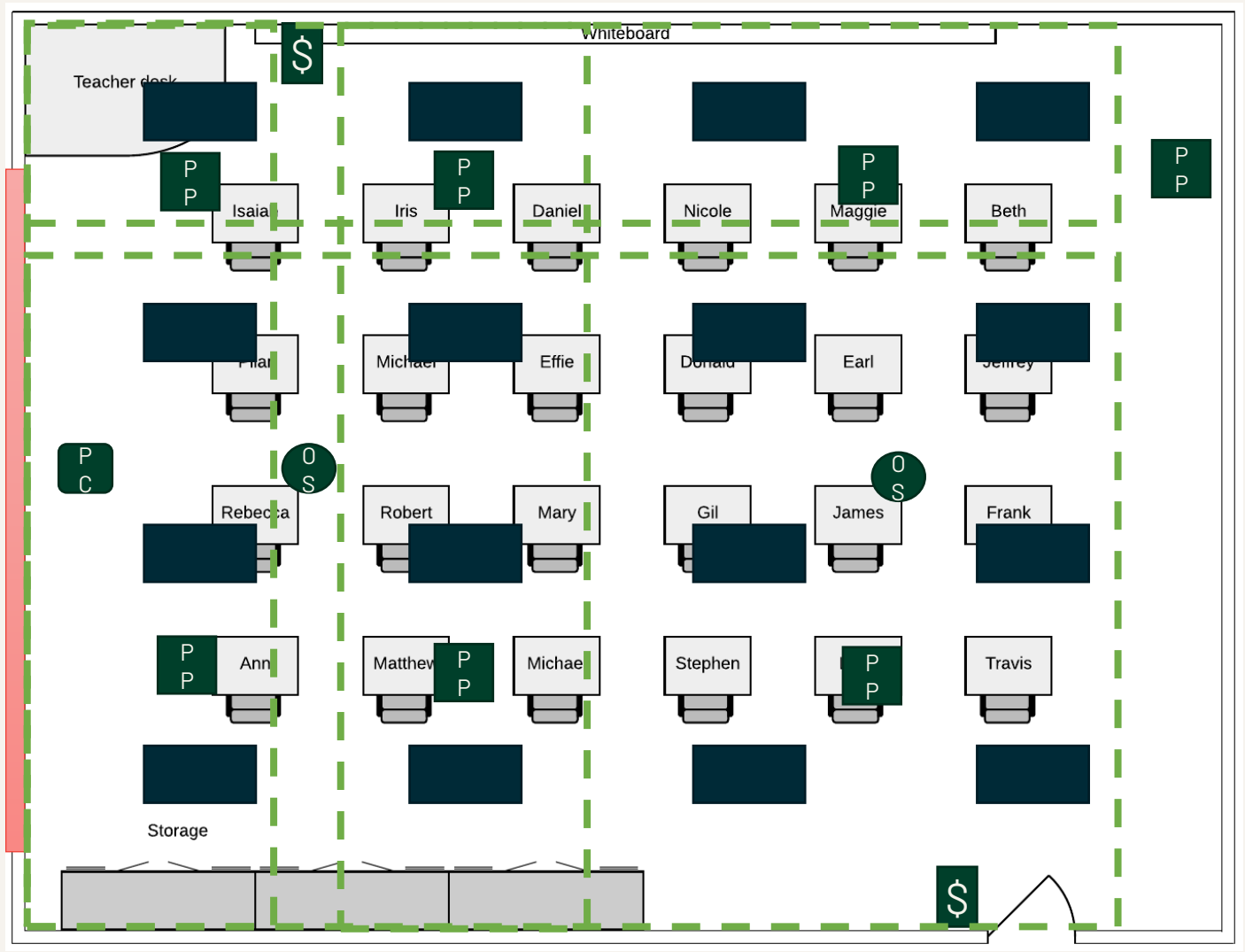
Project Considerations

Traditional vs Enabled vs Embedded Control System

Traditional Lighting Control System

- Switches on the wall
  - On/off at entrance and scene selector at teacher station
- Occupancy sensors
- Photocell
- Power packs (relays) for each zone of lighting and plug load

- (16) fixtures to install
- (12) control devices to install
- (6) pairs of 0-10V wires to install
- CAT5 cabling between devices



Source: Acuity

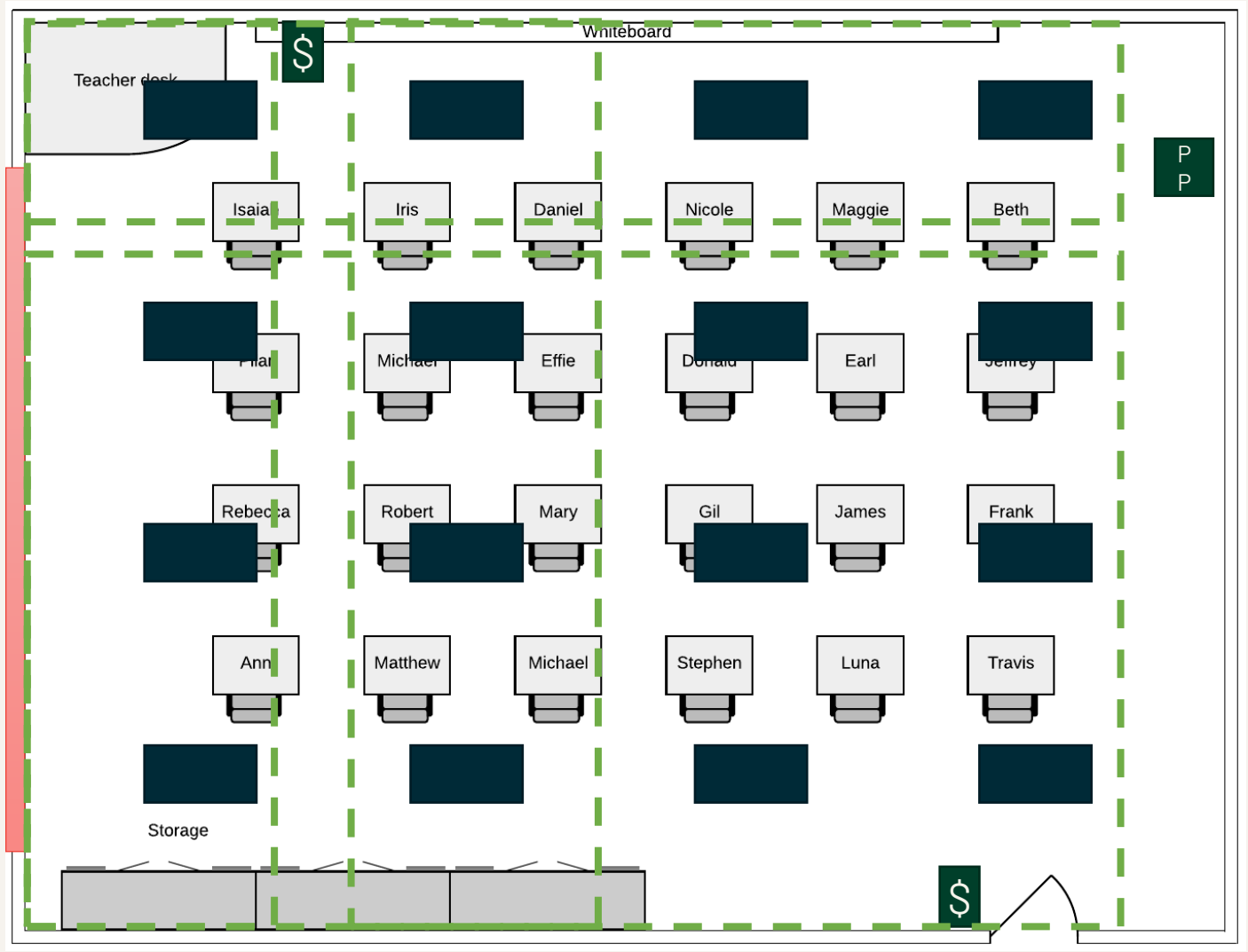
Traditional vs Embedded Control System

Embedded Lighting Control System

- Switches on the wall
  - On/off at entrance and scene selector at teacher station
- No occupancy sensors required
- No photocell required
- (1) Plug Load power pack required. All other zoning created through programming

- (16) LLLC fixtures to install (wireless)
- (2) control devices to install
- (0) pairs of 0-10V wires to install
- CAT5 cabling between devices and fixtures, or use line voltage for power

Code Compliance through configuration!



Source: Acuity

Office Lighting And Lighting Control

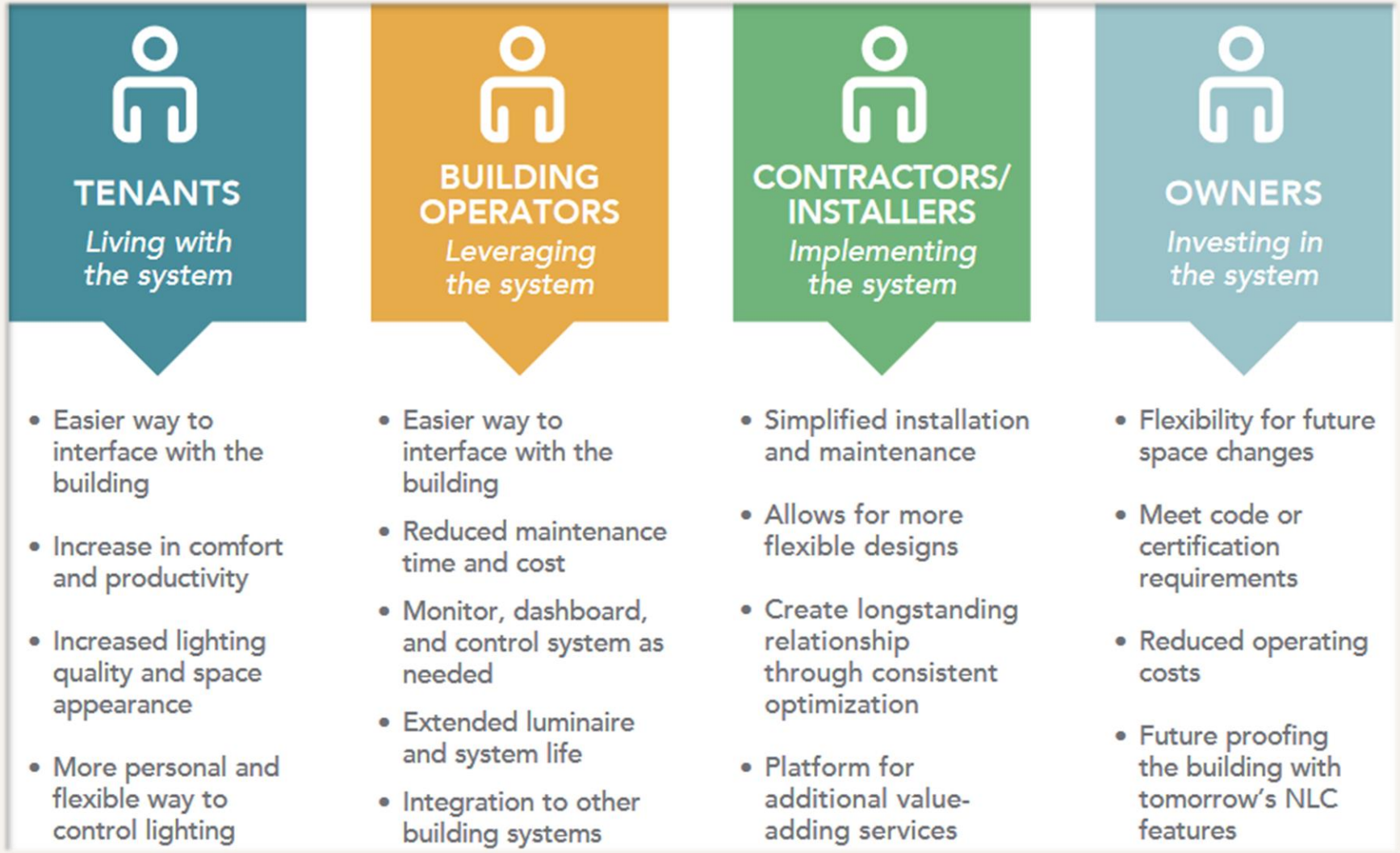
Source: Acuity

Scheduling Success: Sequence of Operation Plans

- What are the overall project goals?
- What is the need in each space?
- How can we utilize control strategies to meet these needs?
- Are there any modifications needed?

SPACE TYPE	ROOM NUMBER	MANUAL ON	MANUAL OFF	DIMMING SWITCH	OVERRIDE SWITCH	MULTI ZONE SWITCH	KEY SWITCH	TIME CLOCK ON	
Open Offices	1001, 1002, 2001, 2002	X			X				
Private Offices	505, 506, 507	X							
Meeting Rooms	etc.	X	X	X		X			
Break Rooms	etc.	X							
Kitchen	etc.	X			X				
Pantry	etc.	X							
Cafeteria	etc.	X							
Corridors	etc.					X	X	X	
Restrooms	etc.						X		
Storage Rooms	etc.								
Ground Floor Lobby/Reception Area	etc.	X	X			X	X	X	
Main Floor Lobbies/Reception Areas	etc.	X	X			X	X	X	
Electrical/Mechanical Room	etc.	X	X						
Exterior Parking Lot Lighting	etc.					X		X	
Exterior Grounds Lighting	etc.					X		X	
Exterior Security Lighting	etc.								

Value for Everyone



Summary

LLLC can be the most cost-effective option and easier to purchase and install.

LLLC can provide a future-proofed building for owners and occupants.

The systems can be simple to design and commission.

There are resources available to help you with every project type.

Resources

Resources: Design to Installation

- Simplified Systems
- Factory Commissioning Tools
- Remote Access
- Owner/Occupant Education

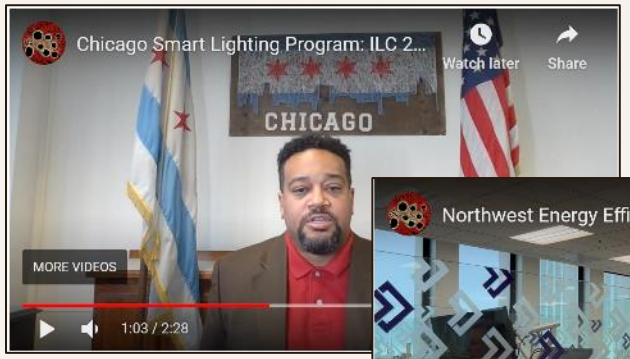
Utilize Local Resources

"With LLLC, not only do we offer load shedding capabilities, but we also provide monthly reports. This gives them insights into lighting as well as other systems, for example, their HVAC system. It's a transformative conversation that needs to happen at the decision-maker level."

Recorded Webinars

Case Studies

Infographics



Participant Videos

Journal Publications

Source: Integrated Lighting Campaign

Website:
www.integratedlightingcampaign.energy.gov

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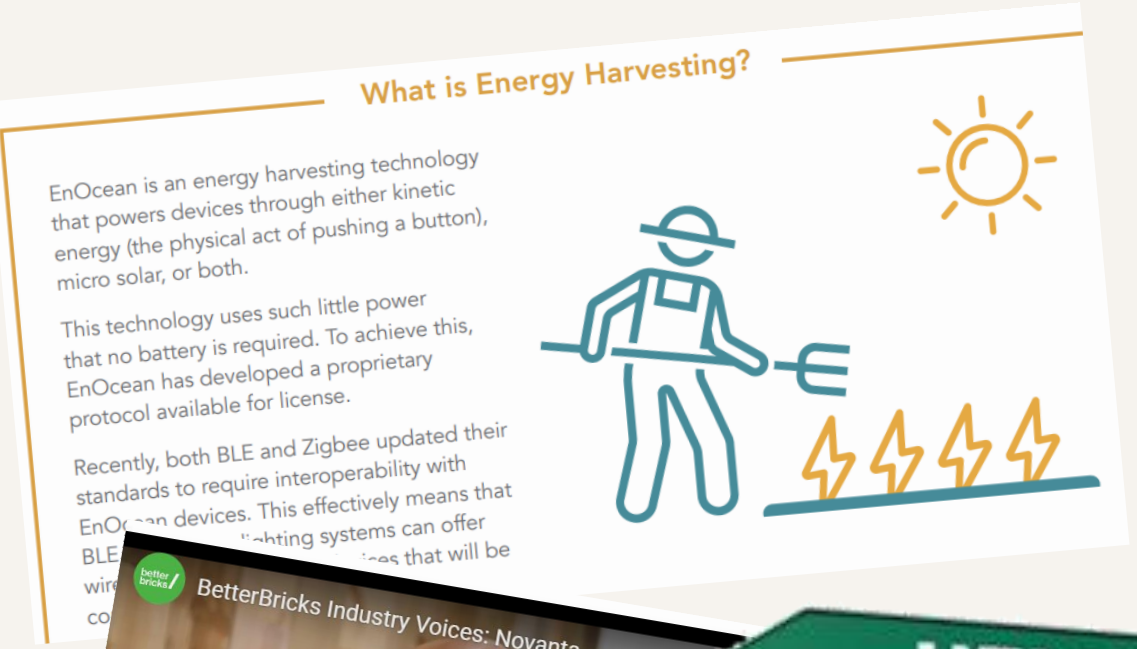

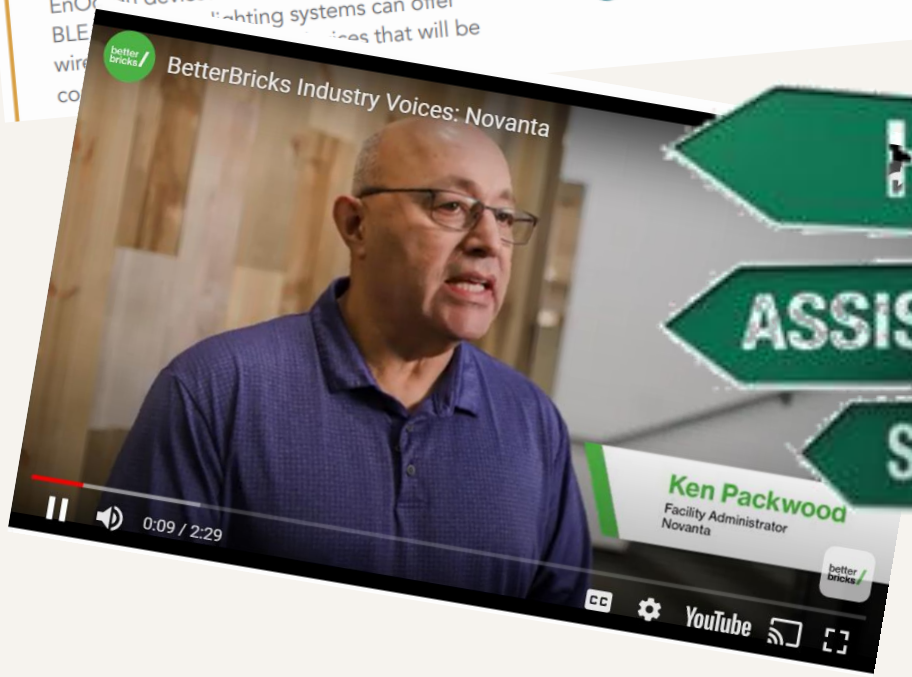

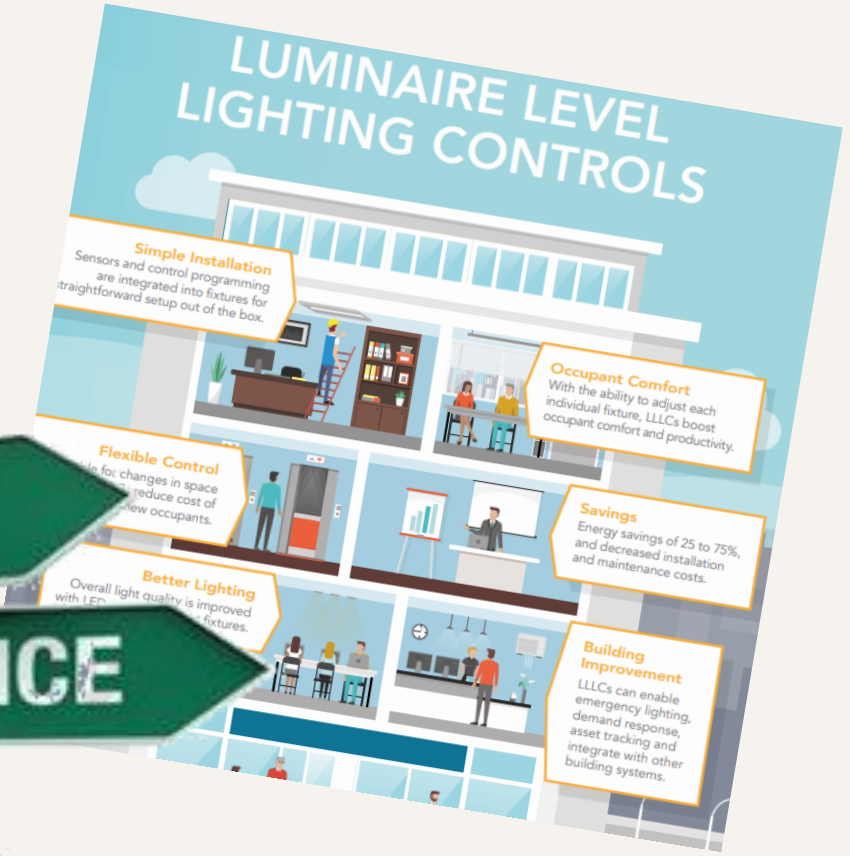

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Q&A

Thank You!

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