What is the New Paradigm?

Presented by:

Dane Sanders, PE, LEED AP

Principal

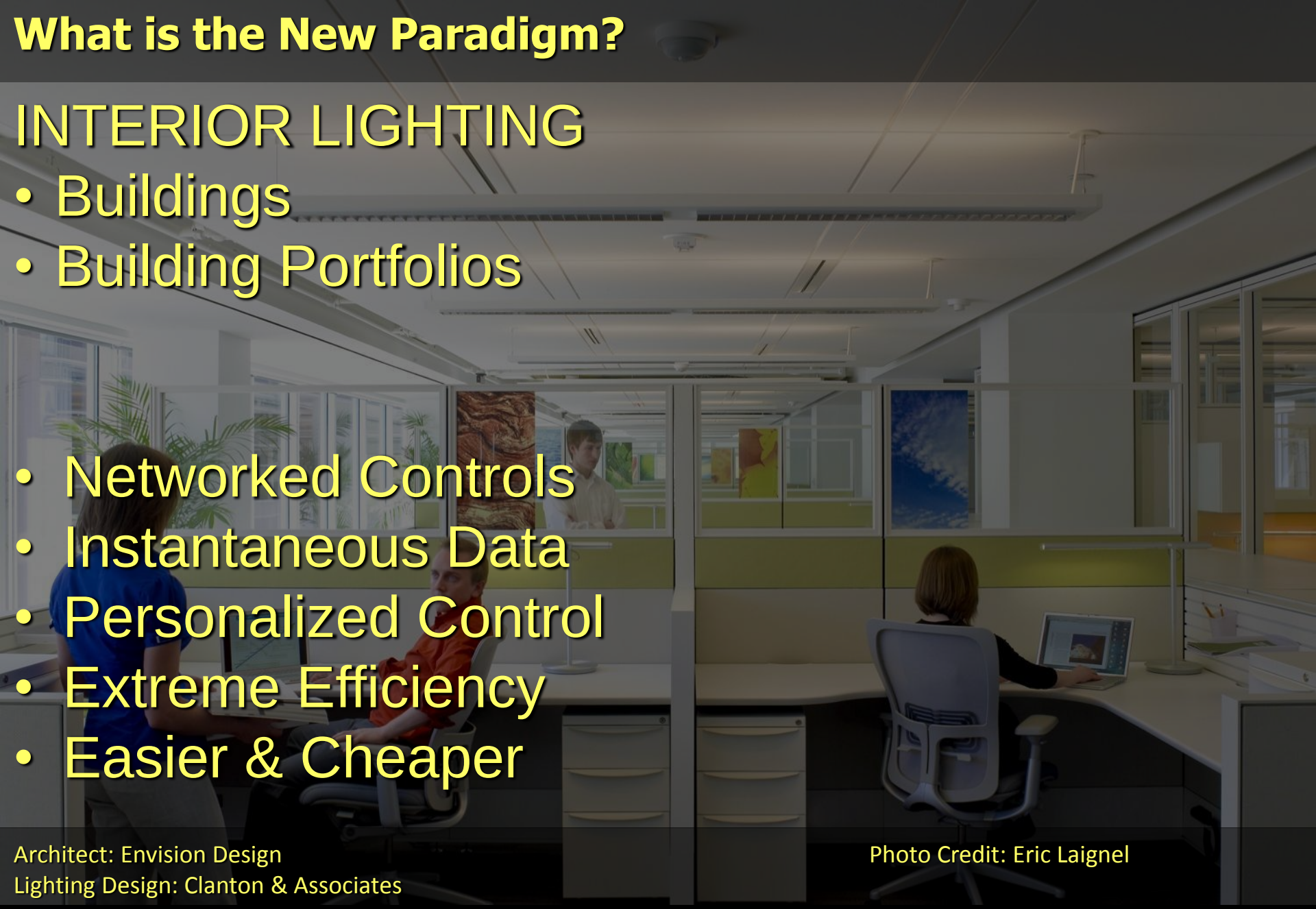
CLANTON & ASSOCIATES

LIGHTING DESIGN AND ENGINEERING

Architect: Envision Design
Lighting Design: Clanton & Associates

Photo Credit: Eric Laignel

What is the New Paradigm?



INTERIOR LIGHTING

- Buildings
- Building Portfolios

- Networked Controls
- Instantaneous Data
- Personalized Control
- Extreme Efficiency
- Easier & Cheaper

Architect: Envision Design
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INTERIOR LIGHTING

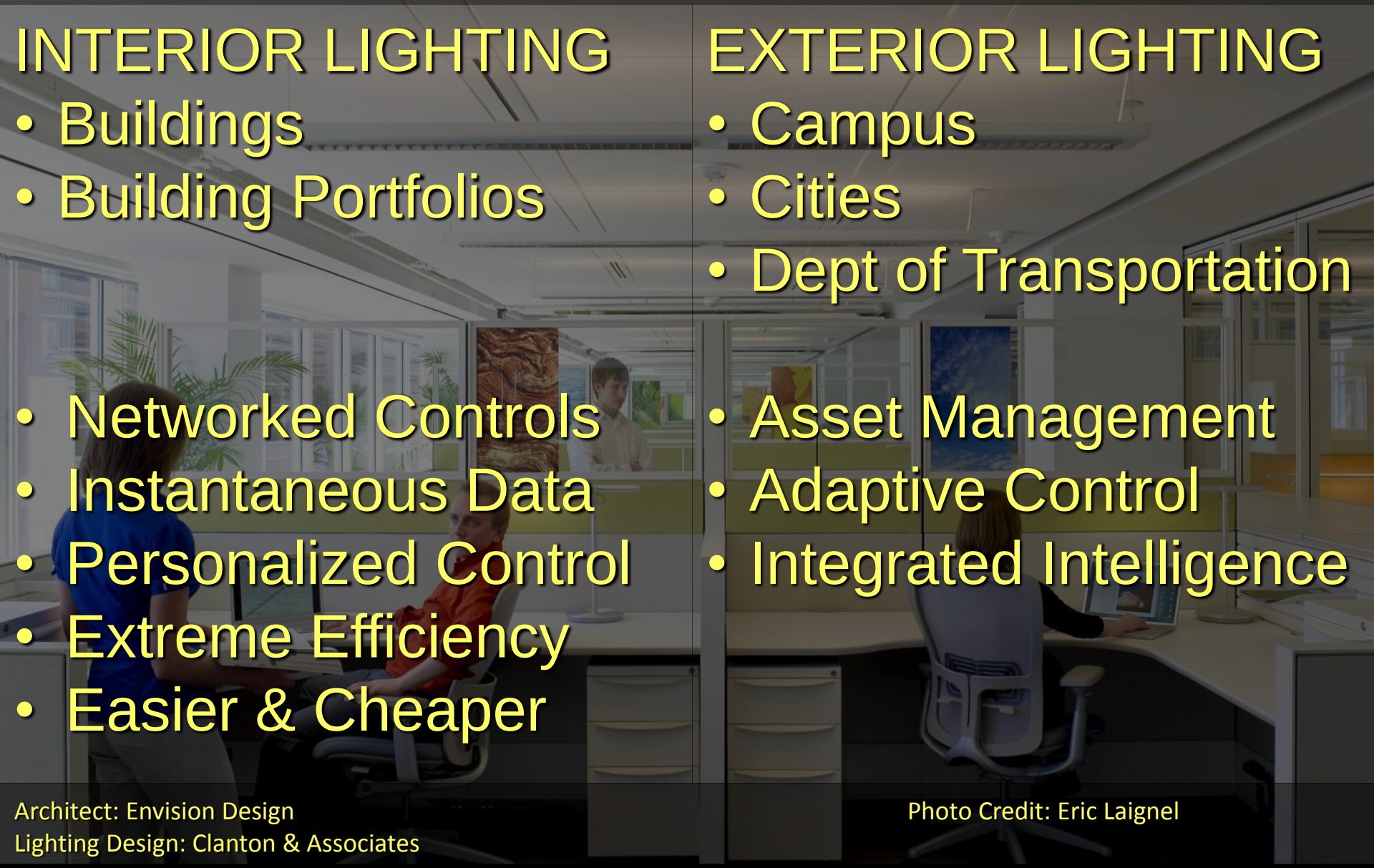
- Buildings
- Building Portfolios

- Networked Controls
- Instantaneous Data
- Personalized Control
- Extreme Efficiency
- Easier & Cheaper

EXTERIOR LIGHTING

- Campus
- Cities
- Dept of Transportation

- Asset Management
- Adaptive Control
- Integrated Intelligence



Architect: Envision Design
Lighting Design: Clanton & Associates

Photo Credit: Eric Laignel

US Green Building Council Headquarters – Washington D.C.

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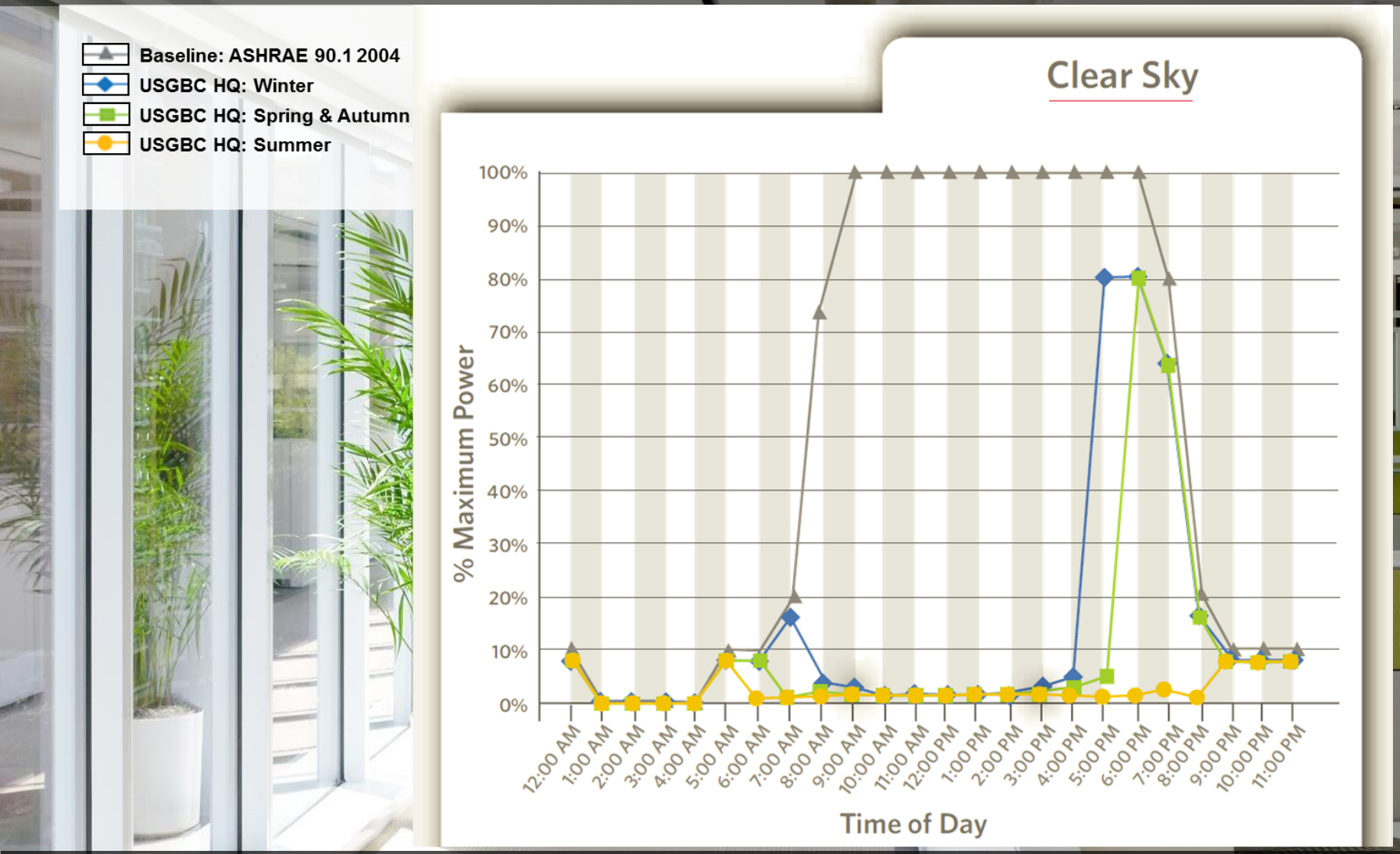

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US Green Building Council Headquarters – Washington D.C.

Open Offices

Lighting Power Density
ASHRAE 90.1 2007: 1.10 W/SF
Installed Lighting: 0.62 W/SF (**44% Below ASHRAE 90.1 2007**)

Annual Energy Use
ASHRAE 90.1 2007: 83,400 kWh/yr
Installed Lighting: 14,800 kWh/yr (**82% Below ASHRAE 90.1 2007**)

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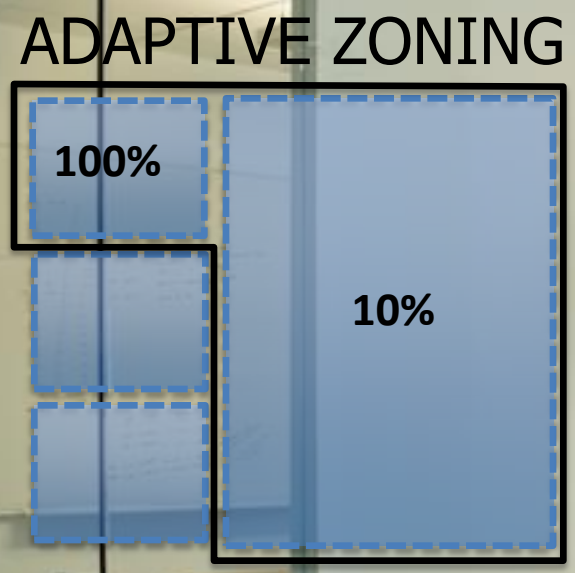
US Green Building Council Headquarters – Washington D.C.



Architect: Envision Design
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US Green Building Council Headquarters – Washington D.C.

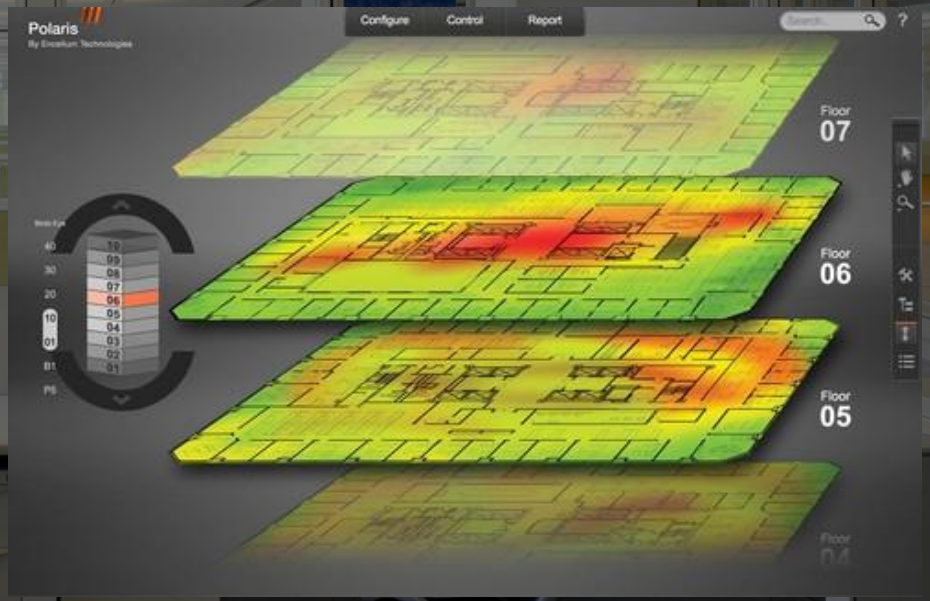
Drivers for the New Paradigm?

Architect: Envision Design
Lighting Design: Clanton & Associates

Photo Credit: Eric Laignel

Increased Expectations

- Disruptive Technology
- Client Expectation
- Public Awareness & Expectation
- Dashboard Visualization (Education)



Architect: Envision Design
Lighting Design: Clanton & Associates

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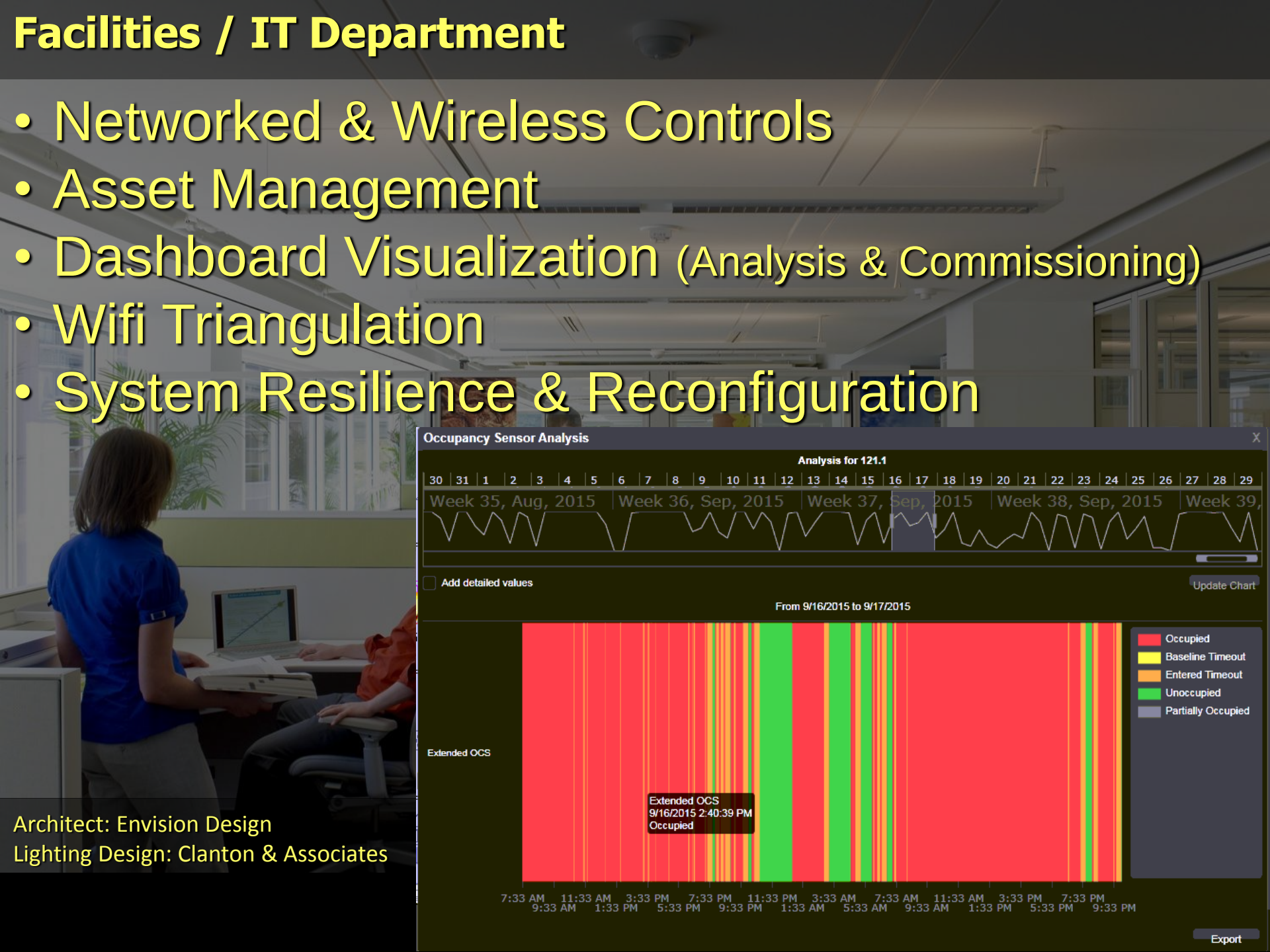
Facilities / IT Department

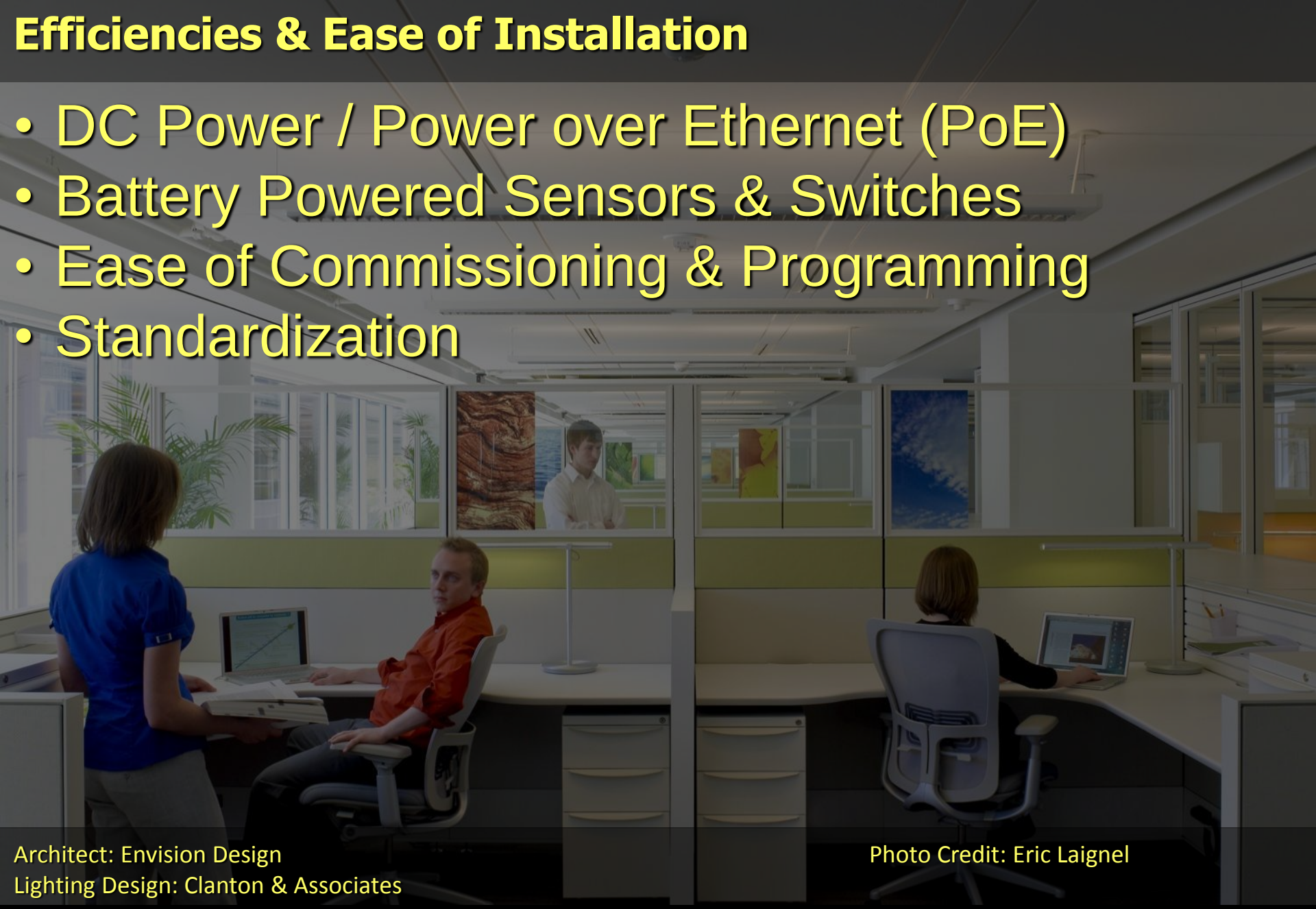
- Networked & Wireless Controls
- Asset Management
- Dashboard Visualization (Analysis & Commissioning)
- Wifi Triangulation
- System Resilience & Reconfiguration



Architect: Envision Design
Lighting Design: Clanton & Associates

Efficiencies & Ease of Installation

- DC Power / Power over Ethernet (PoE)
- Battery Powered Sensors & Switches
- Ease of Commissioning & Programming
- Standardization



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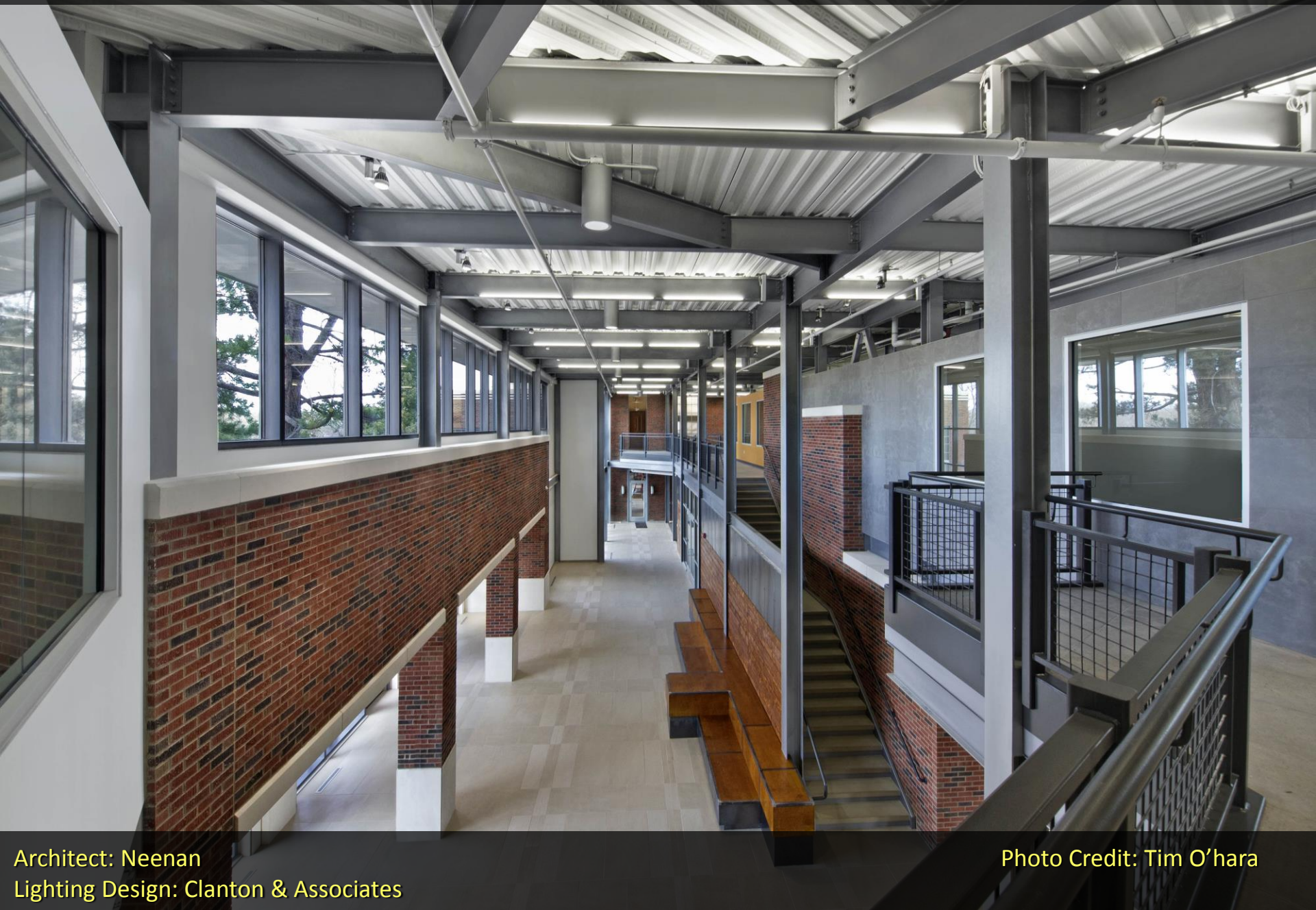
Experience, Hurdles & Lessons Learned?

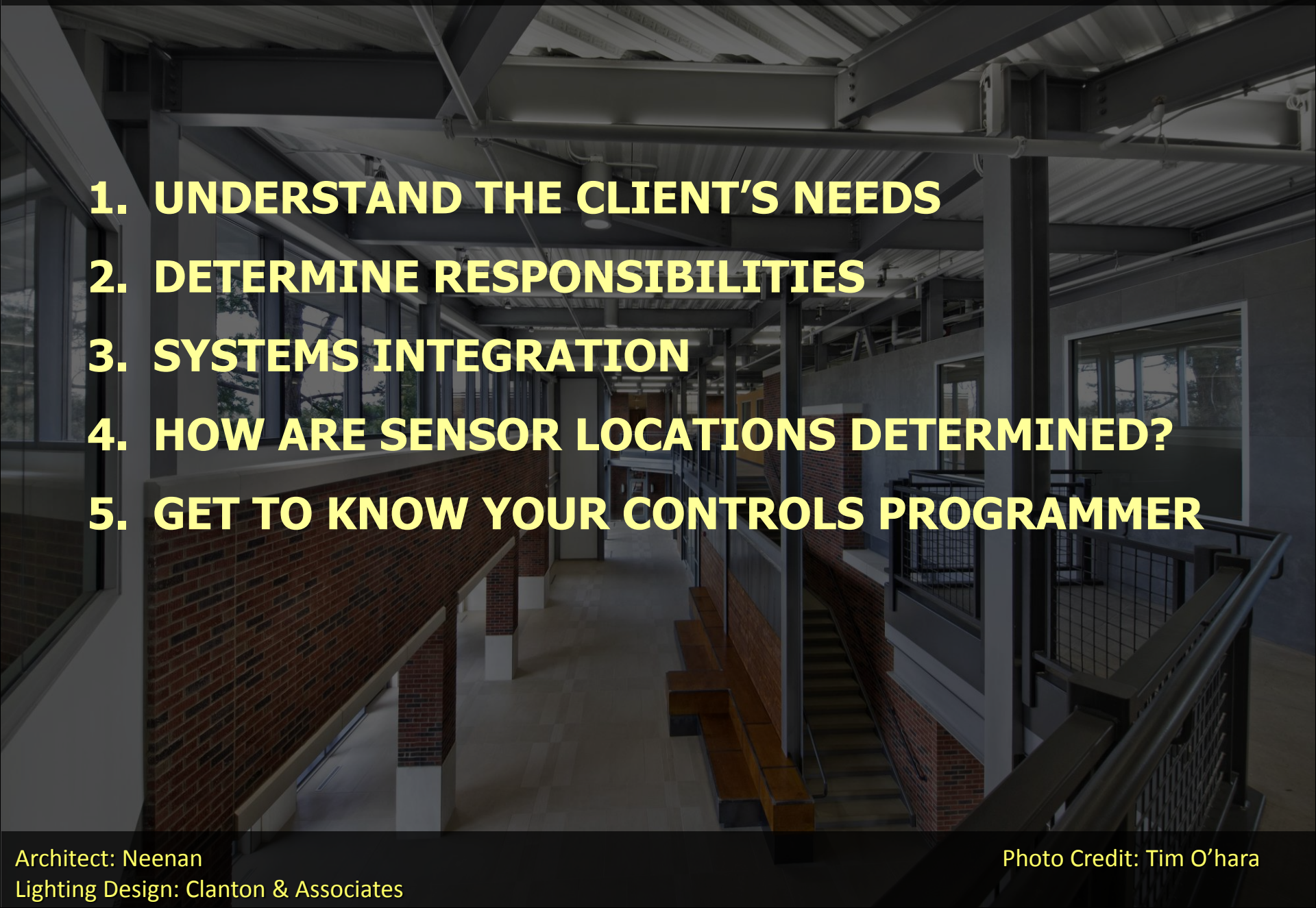
Colorado State University – Powerhouse Energy Center



Architect: Neenan
Lighting Design: Clanton & Associates

Photo Credit: Tim O'hara

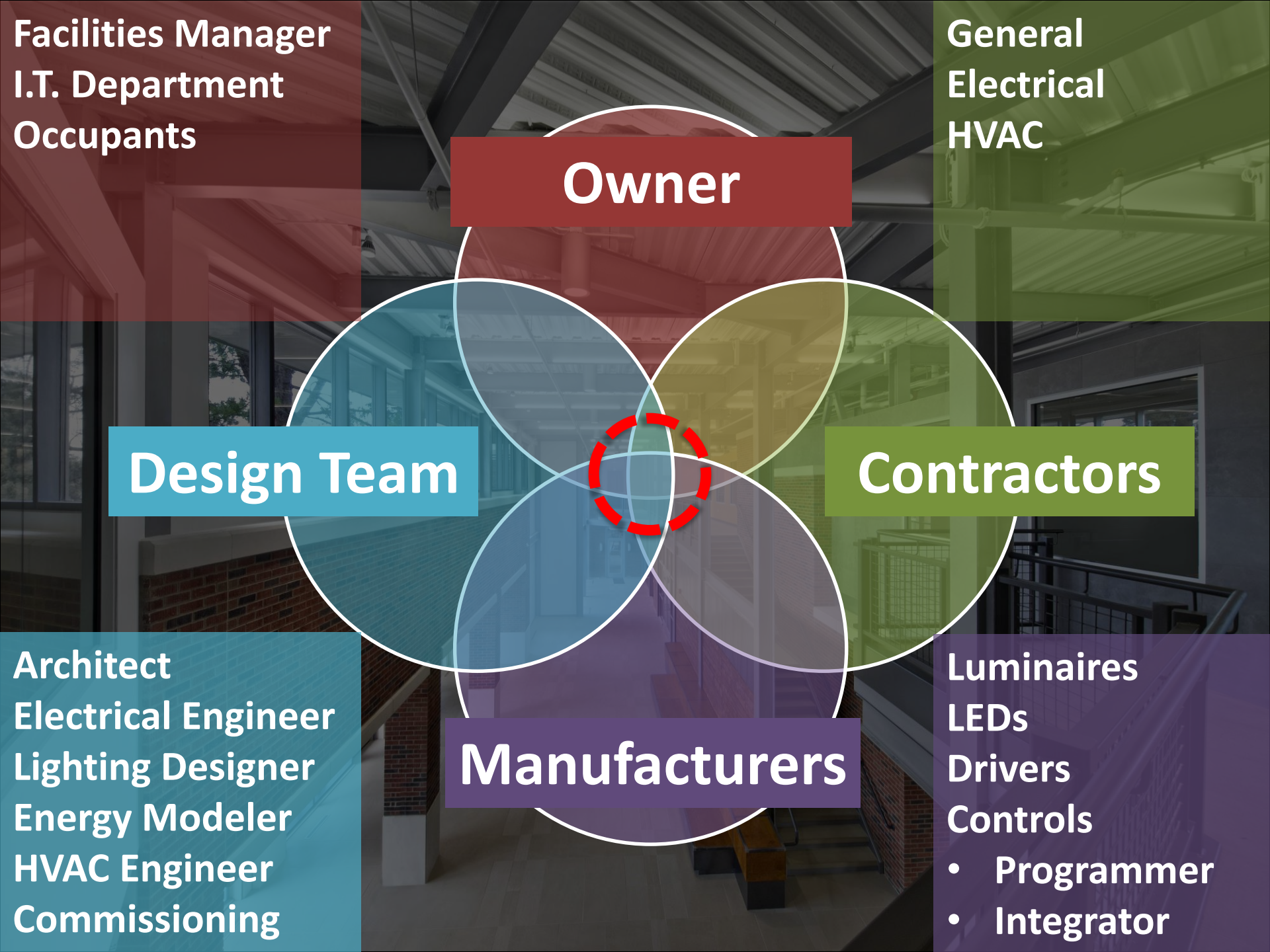
Colorado State University – Powerhouse Energy Center



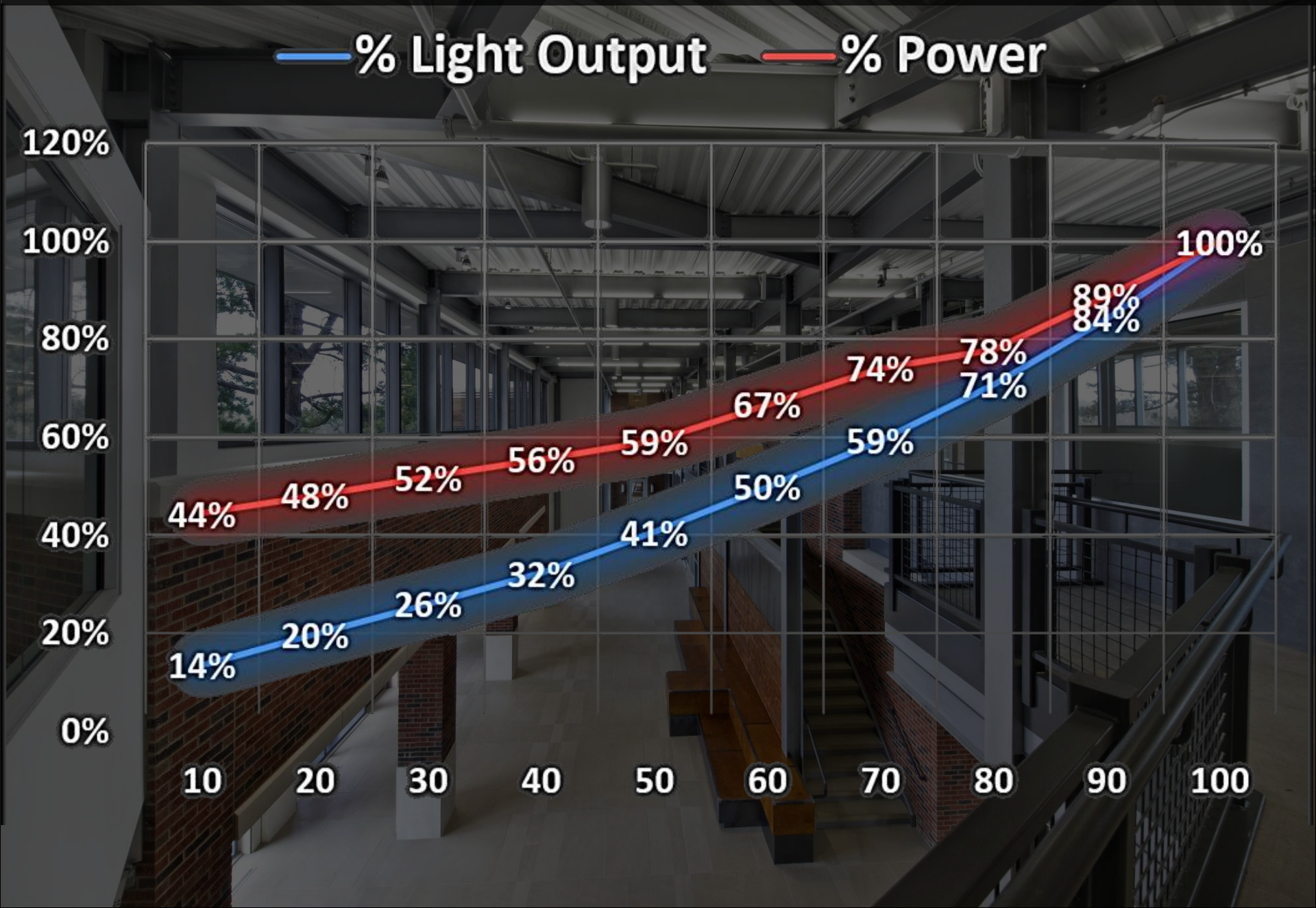
1. UNDERSTAND THE CLIENT'S NEEDS
2. DETERMINE RESPONSIBILITIES
3. SYSTEMS INTEGRATION
4. HOW ARE SENSOR LOCATIONS DETERMINED?
5. GET TO KNOW YOUR CONTROLS PROGRAMMER

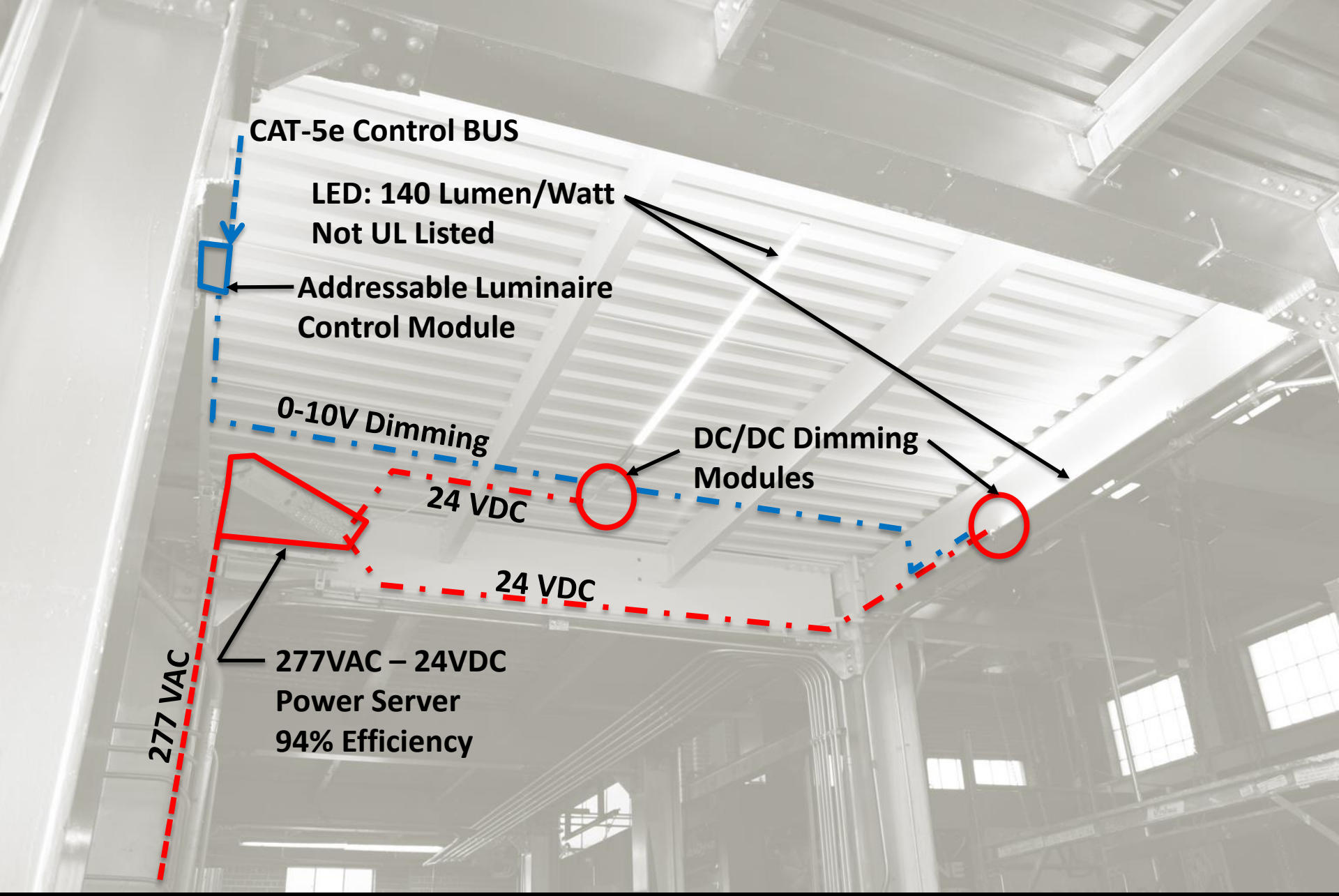
Architect: Neenan
Lighting Design: Clanton & Associates

Photo Credit: Tim O'hara


Facilities Manager
I.T. Department
Occupants
Owner
General
Electrical
HVAC
Design Team
Contractors
Architect
Electrical Engineer
Lighting Designer
Energy Modeler
HVAC Engineer
Commissioning
Manufacturers
Luminaires
LEDs
Drivers
Controls
• Programmer
• Integrator

Colorado State University – Powerhouse Energy Center



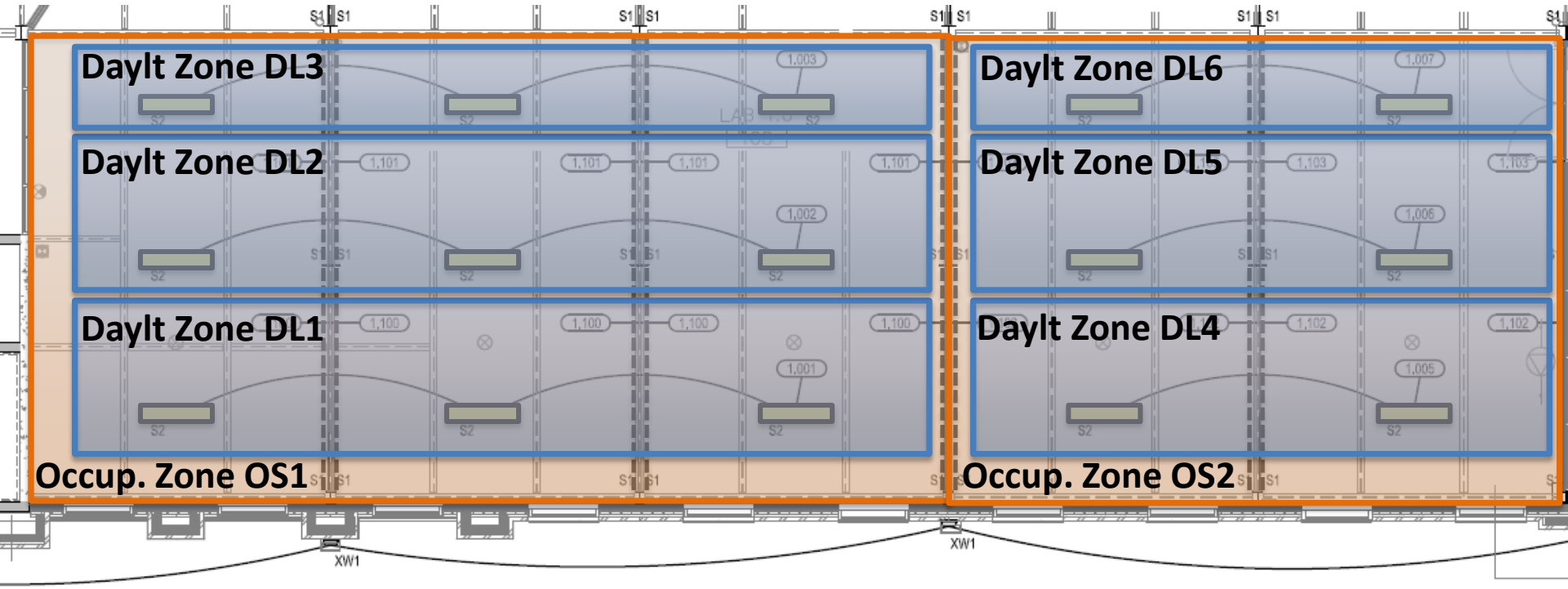

CAT-5e Control BUS
LED: 140 Lumen/Watt
Not UL Listed
Addressable Luminaire
Control Module
0-10V Dimming
DC/DC Dimming
Modules
24 VDC
24 VDC
277 VAC
277VAC – 24VDC
Power Server
94% Efficiency

Control Plans

Sequence of Operations

&

Specification



Control Plans

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Specification

LUMINAIRE INFORMATION

DAYLIGHT

OCCUPANCY

MANUAL

Lighting Control Address	Description	Type	Quantity	Lamp Type (T8, T5HO, CFL, LED, MH)	Voltage	Control Type Dimming 0-10V, Switch	Daylight Group Address	Sensor Type (Open Loop, Closed Loop)	Target FC (Day/Night)	Shade Control (Manual Chain, Manual Motorized, Solar Tracking)	Occupancy Group Address	Sensor Mounting (Ceiling Mounted, Wall Mounte Wall Box, Furniture Mounted)	Technology (Infrared, Ultrasonic, Dual Techology)	Time Delay (Day/Night [minutes], Over-Ride	Occupancy or Vacancy (O, V) (Day/Night)	Associated Control Addresses (Evening and Night Only) For Design Intent Only. Addition associations may be required fo emergency egress	HVAC Interface (Network Interface, Auxiliary Relay Interface)	Plug Load (Yes, No)	Manual Control Type (Local Switch, Wall Switch, Wall Dimmer, Scene Station)	# Scenes	Scene 1:	Scene 2:	Scene 3:	Scene 4:	Raise/Lower (Yes, No)	AV Interface (Yes, No)
Level 1: Lab 1.0 (Room #: 108)																									
1.001	Linear downlight	S2	3	LED	24VDC	D0-10V	DL1.10	CL	25/10	MC	OS1.04	CM	DT	Day(20) Eve(20) Night(5)	Day(V) Eve(O) Night(O)	1.102(10%) 1.103(10%) 1.104(10%) 1.110(10%) 1.111(10%) 1.112(10%) 1.021(50%)	-	Y Task Lts	Rocker Switch wall station	-	-	-	-	-	Y	N
1.002	Linear downlight	S2	3	LED	24VDC	D0-10V	DL1.11	CL	25/10																
1.003	Linear downlight	S2	3	LED	24VDC	D0-10V	DL1.12	CL	25/10																
1.004	Linear downlight	S2	3	LED	24VDC	D0-10V	DL1.12A	CL	25/10																
1.100	Cove light	S1	5 runs	LED	24VDC	D0-10V	DL1.10	CL	25/10											Rocker Switch wall station					
1.101	Cove light	S1	5 runs	LED	24VDC	D0-10V	DL1.12	CL	25/10																
1.005	Linear downlight	S2	2	LED	24VDC	D0-10V	DL1.13	CL	25/10	MC	OS1.05	CM	DT	Day(20) Eve(20) Night(5)	Day(V) Eve(O) Night(O)	1.100(10%) 1.101(10%) 1.110(10%) 1.111(10%) 1.112(10%) 1.021(50%)	-	Y Task Lts	Rocker Switch wall station	-	-	-	-	-	Y	N
1.006	Linear downlight	S2	2	LED	24VDC	D0-10V	DL1.14	CL	25/10																
1.007	Linear downlight	S2	2	LED	24VDC	D0-10V	DL1.15	CL	25/10																
1.008	Linear downlight	S2	2	LED	24VDC	D0-10V	DL1.15A	CL	25/10																
1.009	Linear downlight	S2	2	LED	24VDC	D0-10V	DL1.15B	CL	25/10																
1.102	Cove light	S1	4 runs	LED	24VDC	D0-10V	DL1.13	CL	25/10											Rocker Switch wall station					
1.103	Cove light	S1	4 runs	LED	24VDC	D0-10V	DL1.15	CL	25/10																
1.104	Cove light	S1	8 runs	LED	24VDC	D0-10V	DL1.15A	CL	25/10																
1.017	Linear downlight	S2	2	LED	24VDC	D0-10V	-	-	-	-	OS1.03	CM	DT	Day(20) Eve(20) Night(5)	Day(V) Eve(O) Night(O)	1.100(10%) 1.101(10%) 1.102(10%) 1.103(10%) 1.104(10%) 1.111(10%) 1.112(10%)	-	N	Rocker Switch wall station	-	-	-	-	-	Y	N
1.019	Linear downlight	S2	2	LED	24VDC	D0-10V	-	-	-																
1.020	Linear downlight	S2	1	LED	24VDC	D0-10V	-	-	-																
1.021	Wall wash	S6C	7	LED	277V	D0-10V	-	-	-											Rocker Switch wall station					
1.110	Cove light	S1	12 runs	LED	24VDC	D0-10V	-	-	-											Rocker Switch wall station					

Control Plans

Sequence of Operations

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Specification

LUMINAIRE INFORMATION			OCCUPANCY								
Lighting Control Address	**Description**		**Occupancy Group Address**	**Sensor Mounting** (Ceiling Mounted, Wall Mounted, Wall Box, Furniture Mounted)	**Technology** (Infrared, Ultrasonic, Dual Techology)	**Time Delay** (Day/Night [minutes], Over-Ride)	**Occupancy or Vacancy** (O, V) (Day/Night)	**Associated Control Addresses** (Evening and Night Only) For Design Intent Only. Additional associations may be required for emergency egress	**HVAC Interface** (Network Interface, Auxiliary Relay Interface)	**Plug Load** (Yes, No)
Level 1: Lab 1.0 (Room #: 108)										
1.001	Linear downlight		OS1.04	CM	DT	Day(20) Eve(20) Night(5)	Day(V) Eve(O) Night(O)	1.102(10%) 1.103(10%) 1.104(10%) 1.110(10%) 1.111(10%) 1.112(10%) 1.021(50%)	-	Y Task Lts
1.002	Linear downlight									
1.003	Linear downlight									
1.004	Linear downlight									
1.100	Cove light									
1.101	Cove light									

Control Plans

Sequence of Operations

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Specification

Manufacturer Survey

Interview

&

Selection

Manufacturer Design

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Shop Drawings

Control System Capabilities	MFR #1	MFR #2	MFR #3
Associated Occupancy Zoning? Describe.	✗	✓	✓
Lumen Maintenance Dimming? Describe.	✓	✓	✗
Local Memory Operation When Server Fails?	✓	✓	✓
Emergency Egress Controls Bypass? Describe.	✓	✗	✓
Plug Load Control?	✗	✓	✓

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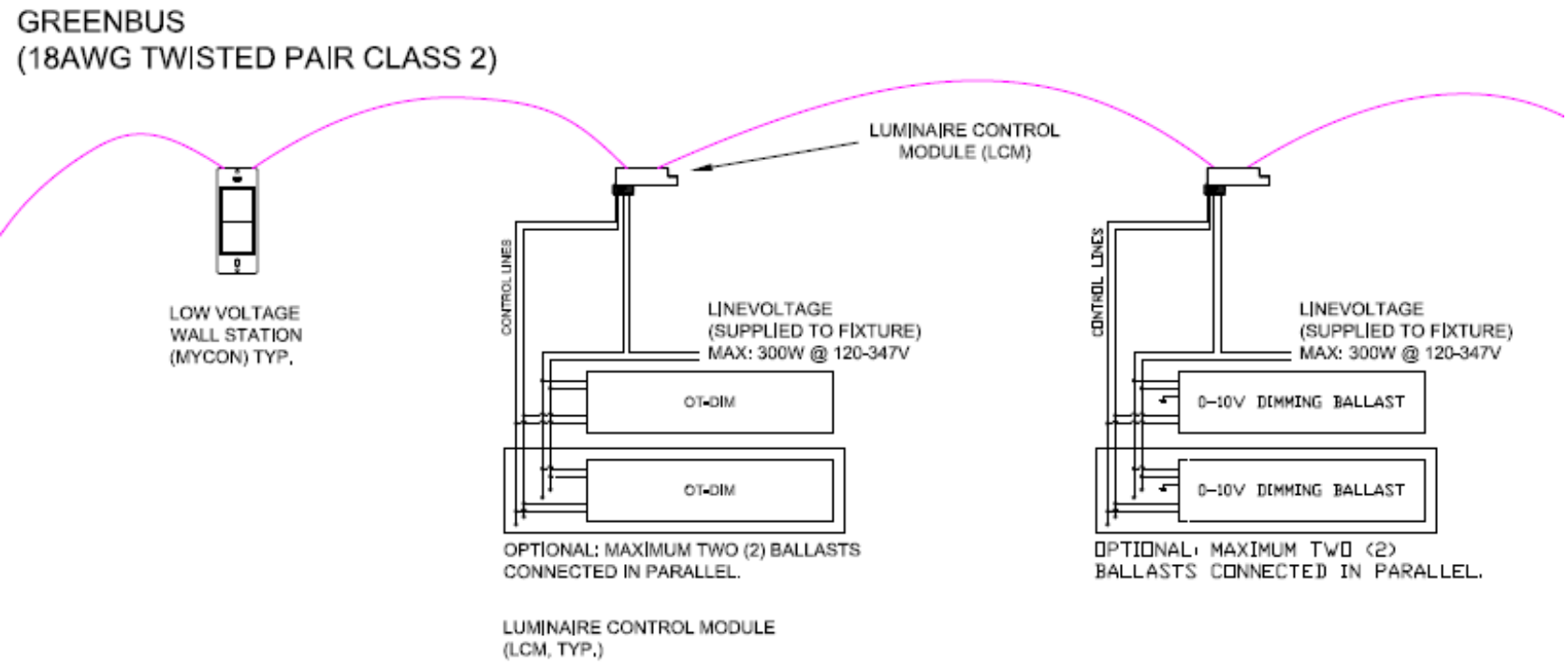

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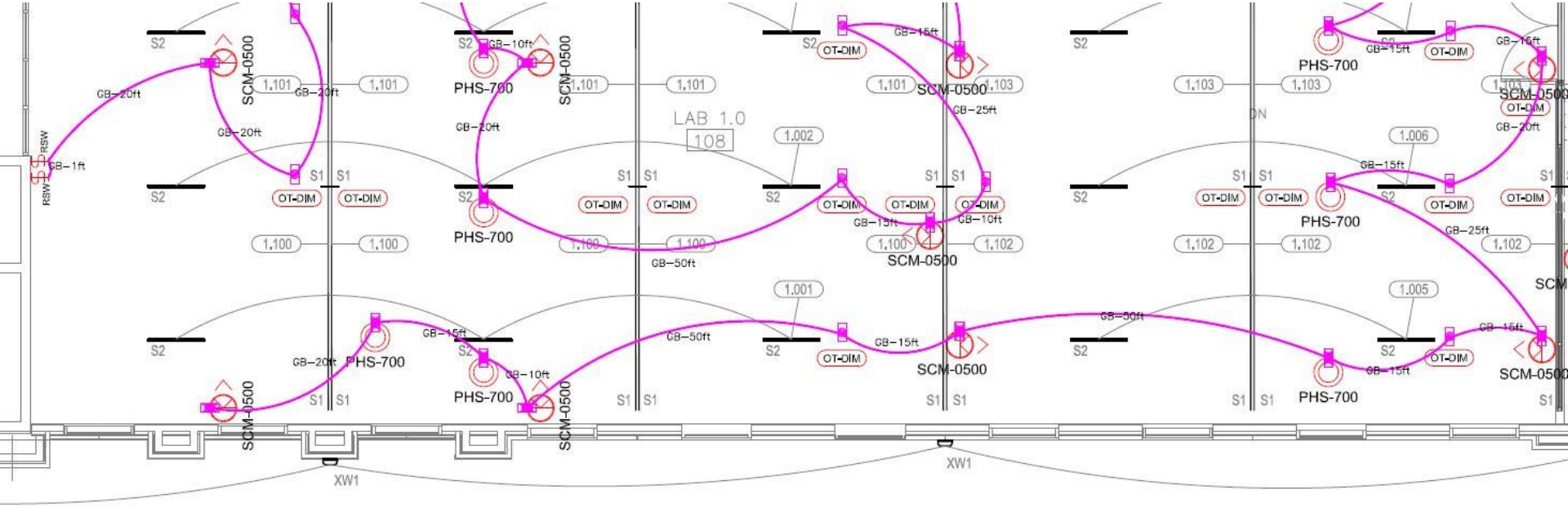

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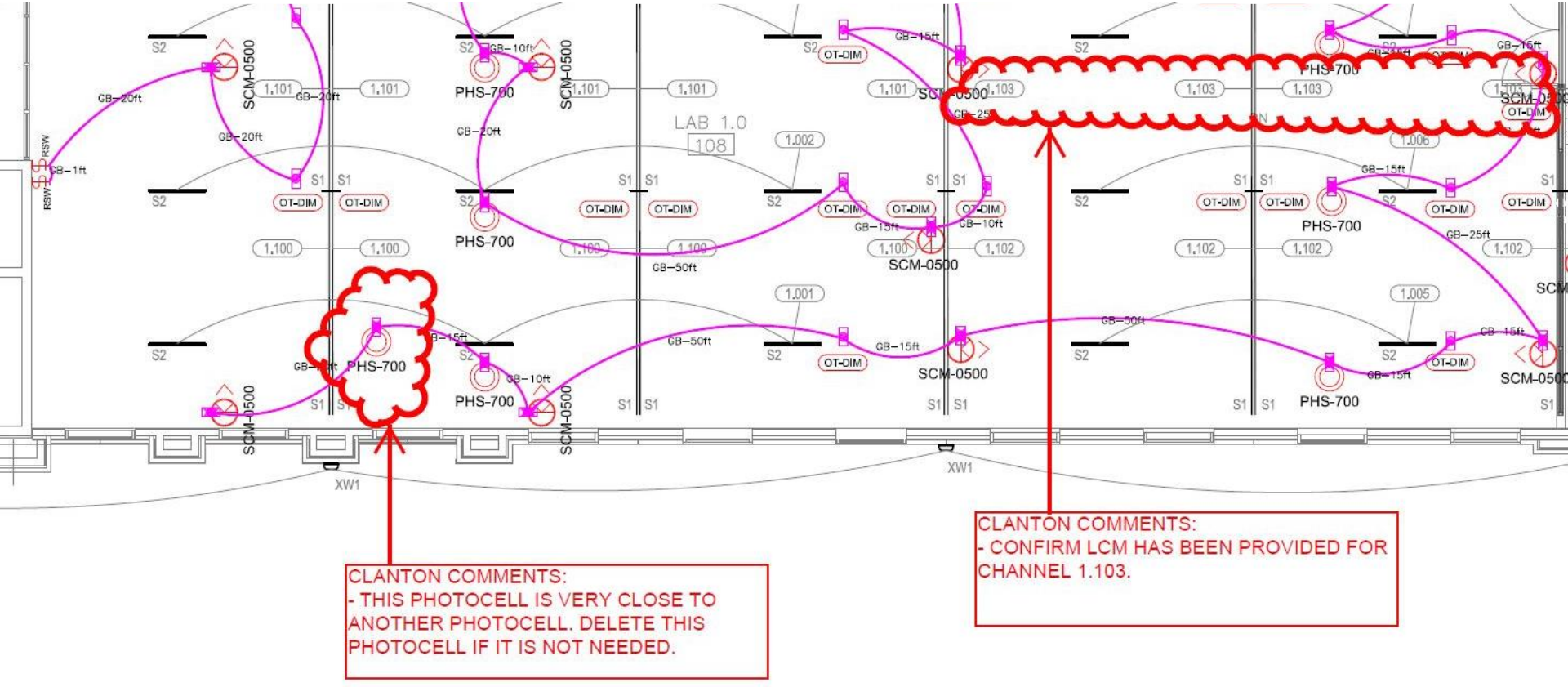


EXIT


Fixture Measurements
Supply V
Controller V
Current
Fixture V
30
25
20
15
10
5
0
-5
-0.030
-0.020
-0.010
0.000
0.010
0.020
0.030


LESSONS LEARNED:
1. MANUFACTURERS SUPPORT & WARRANTY
2. CONTROLS PROGRAMMER ON-SITE
3. REDUCE COMPLEXITY
4. IMPROVE COMPONENT INTEGRATION

Lighting System Optimization: The New Technology Paradigm

Lighting System Optimization: The New Technology Paradigm

- Streamlining Process
- Preset Sequence of Operations for “Typical” Spaces
- Ease of Commissioning & Programming
- Integrating Indoor & Outdoor
- Standardize Utility Rebates