Lighting and Controls Supplier Summit
Commercial Lighting Solutions

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CLS Delivers Additional Efficiency

1. Traditional lighting efficiency approaches are component based, e.g., lamps and ballasts.

2. CLS includes luminaires (fixtures) …

3. … and controls

4. … and expert design strategies

5. CLS includes ALL aspects of lighting energy efficiency (except for interior conditions) into a series of integrated designs, leaving nothing on the table.

Lighting Controls
- Daylight Harvesting
- Scheduling
- Scene Control
- Vacancy Sensors
- Personal Control
- Demand Response

Design
- Neighborhoods of Light
- Pendant Suspension
- On-Center Spacing
- Ballast Factor Tuning
- Room Surface Brightness

Equipment
- High Performance Lamp
- High Performance Ballast
- High Performance Luminaire

Interior Conditions
- Reflectances
- Space Geometry
- Workstation Height and Size
- Window Wall

Lighting Energy Efficiency Opportunities

CLS (Commercial Lighting Systems) includes:

1. Traditional lighting efficiency approaches are component based, e.g., lamps and ballasts.
2. CLS includes luminaires (fixtures) …
3. … and controls
4. … and expert design strategies
5. CLS includes ALL aspects of lighting energy efficiency (except for interior conditions) into a series of integrated designs, leaving nothing on the table.
1. CLS offers a diversity of best practice options, deployed through an interactive Webtool, effectively making expertise scalable, and increasing penetration of high-performance technologies.

2. Once the best practices have been adapted to a project, the resulting design is captured in the Energy Estimator, which provides all the relevant information needed for an application to next generation kWh-based incentive programs.

3. CLS harnesses the power of the utilities and energy-efficiency programs to get costs reduced for high-performance lighting technologies.

4. Deployment to market done through Regional Energy Efficiency Programs, member utilities, and the Commercial Building Energy Alliances.

5. Solutions apply to both existing building stock and new construction, so savings are near-term and widescale.

Energy Efficient, High Value, Best Practices for Lighting delivered to the mainstream

Large-scale, near-term impact, and lasting market transformation

Project data is captured to calculate deemed savings in both kWh and kW

Incentives reduce costs for high-performance equipment and increase market penetration

Large-scale deployment: Standard practice decreases, best practice increases

CLS Impact — Causal Diagram
Power density to kilowatt hours

- Lighting power density (LPD) focuses on power (kW), not time, and cannot account for savings from controls
  - Limited to installed equipment
  - Does not address building actually operating
- Path forward must include combination of controls as well as reduced LPD
  - Reduce operating power (e.g., dimming)
  - Curtail operation (e.g., occupancy sensors, time clocks, etc.)
- CLS has a role in increasing usage of kWh-based utility and energy-efficiency program rebates
Webtool tracks energy savings

- Energy savings are shown against user-chosen baseline as they make selections
- Real-time tracking shows savings from daylighting and controls
- Uses various baselines to show energy savings against goals
- Current baselines include Std. 90.1, IECC, Title 24
Limits of the Lighting Solutions

• Does not cover all spaces; we have picked spaces that are typical and applicable

• This tool does not replace professional services, it just moves the needle to provide a very efficient strawman as a starting point to help leapfrog the learning curve

• We can only analyze what has been measured
  – Reliable data measuring energy savings from lighting control systems is not easy to come by, and we won’t make promises that can’t be verified from solid data and reliable sources

• We are (always) seeking more data on lighting controls installations
Pathway to Incentives

- New Energy Estimator allows user to add actual project data
- End-user provides luminaire schedule with controls data, and tool will calculate projected savings
- Allows for design flexibility, accuracy
- Similar to documentation provided for custom programs
- Working with numerous utilities to determine their requirements for using CLS within their programs
- Goal is to break free of the component-based approach into supporting integrated systems, with a reliable process, tool, measurement, and evaluation
- kWh-based rebates, with a “how-to” that mitigates risk to the consumer and promotes best practices
GSA’s Recovery Act relighting approach

- GSA is using CLS best practices as the basis for their relighting approach for Recovery Act projects
- Committed to deep energy efficiency, lighting quality, and improvement to the infrastructure of government buildings
- CLS team prepared language for GSA Recovery Act relighting, including performance criteria, input to scope and task descriptions, and the following specifications:
  - Specifications for interior lighting
  - Interior lighting control system
  - Bi-level stairwell
  - LED parking lot lighting
  - Parking garage lighting
- Issued by GSA to the regions in June 2009
Process Overview — Vignette Development

Lighting Design Charrette

- Process and Parameters
- Design Criteria
- Conceptual Design Approaches

Vignette Design Development

- Typical Room Backgrounds
- Equipment & AGI32 Calcs
- Watts per Square Foot
- Vignette Details Text & Drawings

Implementation Guidance & Luminaire Schedule

- Vignette Summaries
- Assumptions & Quicktips
- Installation & Maintenance
- Luminaire Schedule
Lighting Design Charrette

Luminaire Systems Selected

- Recessed high performance
- Direct/indirect
- “Workstation-specific”
## Establish quantity and quality criteria

### IESNA Lighting Design Guide

| Design Issues | Appearance of Space and Luminaires | Color Appearance (and Color Contast) | Direct Glare | Glare (and Shine) | Light Distribution on Surfaces | Light Distribution on Task Plane (Uniformly) | Luminance of Room Surfaces | Modeling of Focal Points | Reflected Glare | Shadows | Source/Task/Field Geometry | Shadows | Spark/Chiaroscuro | Reflected Highlights | Surface Characteristics | System Control and Flexibility | Special Considerations | Notes on Special Considerations | Category or Value (lx) | Category or Value (lx) | Notes on illuminance - use of section | Reference Chapter(s) |
|---------------|----------------------------------|----------------------------------|-------------|----------------|-------------------------------|---------------------------------|-----------------------------|-------------------------|------------------|-----------|------------------------|-----------|----------------|----------------|-------------------|-----------------|-------------------|----------------|----------------|--------------------------|----------------|
| Offices (13)  |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Filing (see Reading) |                                    |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| General and private offices (see Reading) |                                    |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Open plan office |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Intensive VDT use |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Open plan office |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Intermittent VDT use |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Private office |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Libraries (see Libraries) |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Lobbies, lounges, and reception areas |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Mail sorting |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Copy rooms |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Parking Facilities (see Section III, Outdoor) |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Post Offices |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Lobby |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Customer service counter |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
| Mail processing, general |                                  |                                  |             |                |                               |                                 |                             |                         |                 |           |                        |           |                |                |                   |                 |                   |               |               |                          |                |
Vignette Design Development

Space types

- Open plan
- Open plan perimeter (wall washing)
- Private offices
- Conference rooms
- Corridors
- Reception
Vignette Design Development

Typical Room Selection (CAD Backgrounds)

- Prototypical — not too perfect, not too odd
- Perimeter or interior
- Cubicle density = total sf of room / # of workstations

[High density diagram]

[Medium density diagram]
Open plan partitions

- Partition heights: 48”, 56”, 64”
Design Process

- Iterative process of design and calculation
- Selected for efficiency, quality, cost, controls
Luminaire Selection Procedure

• Looked at 6–8 products in each category
• Chose top 3 (T8) luminaires for energy and quality
• Used third best for calculations
• Wrote performance specifications
Open plan — Three conceptual approaches

1. Recessed high performance
2. Pendant direct/indirect
3. Workstation specific

➡️ Others may follow
Vignette Design Development

Vignette details: Screen text and drawings

- Perspective
- Plan view
- Watts/square foot
- Approach
- Strategies
- Controls
- Luminaire details

Suspended 8' Multi-Lamp Direct/Indirect Luminaires (Office)

**Perspective Diagram**

**Overhead Plan**

**Luminaires**

- 12'-0" Two-lamp Profile Suspended Direct-Indirect Linear T8 Fluorescent Luminaire.
- Minimum Luminare Efficiency: 0.85.
- # lamps in cross section: .
- Lamps: F392/835/XPS/ECO.
- Light Source CCT: 3500K.
- Light Source CRI: 85.0.
- Ballast Type: Premium Efficiency (NEMA) Instant-Start.
- Ballast Factor: 0.68.
- Input Watts: 185.0.
- Luminaire Power Factor: 0.90.
- Ballast Power: 4.0W.
- Lamp Power: 120W.
- Luminaire Power: 176W.
- CRI @ 20°F: 85.
- CRI @ 70°F: 85.
- CRI @ 100°F: 85.
- CRI @ 130°F: 85.
- CRI @ 160°F: 85.
- CRI @ 190°F: 85.
- CRI @ 220°F: 85.
- CRI @ 250°F: 85.
- CRI @ 280°F: 85.
- CRI @ 300°F: 85.

**Concept**

Lighting Concepts for suspended direct/indirect luminaires in open-plan offices with high ceilings and high furniture partitions:
- Suspended bi-directional luminaires distribute some indirect illumination on the ceilings, which provides greater uniformity by filling in light between luminaires.
Implementation Guidance and Schedule

Implementation guidance report

- Vignette summary details
- Vignette implementation
- Control guidance
### Luminaire Schedule

- **Performance spec language**

<table>
<thead>
<tr>
<th>Fixture Label</th>
<th>Description</th>
<th># lamps in cross section</th>
<th>Lamps</th>
<th>Light Source CCT</th>
<th>Light Source CRI</th>
<th>Initial Lamp Lumens</th>
<th>Ballast Type</th>
<th>Ballast Factor</th>
<th>Input Watts</th>
<th>Lamp/Balast MLPW</th>
<th>Minimum Luminaire Efficiency</th>
<th>Footnote</th>
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<tbody>
<tr>
<td>F11</td>
<td>Recessed 2’ x 4’ with Non-Planar Lenses.</td>
<td>2</td>
<td>F032/835/XP S/ECO</td>
<td>3500K</td>
<td>85.0</td>
<td>3100</td>
<td>Premium Efficiency (NEMA) Instant-Start</td>
<td>0.88</td>
<td>55</td>
<td>107.090909091</td>
<td>0.88</td>
<td>3, 4, 8</td>
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<td>L40</td>
<td>8’-0” Two-lamp Profile Suspended Direct-Indirect Linear T8 Fluorescent Luminaire.</td>
<td>2</td>
<td>F032/835/XP S/ECO</td>
<td>3500K</td>
<td>85.0</td>
<td>3100</td>
<td>Premium Efficiency (NEMA) Instant-Start</td>
<td>0.88</td>
<td>110</td>
<td>53.5454545454545</td>
<td>0.85</td>
<td>3, 4, 8</td>
</tr>
<tr>
<td>L42</td>
<td>12’-0” Two-lamp Profile Suspended Direct-Indirect Linear T8 Fluorescent Luminaire.</td>
<td>2</td>
<td>F032/835/XP S/ECO</td>
<td>3500K</td>
<td>85.0</td>
<td>3100</td>
<td>Premium Efficiency (NEMA) Instant-Start</td>
<td>0.88</td>
<td>165</td>
<td>35.69696969696969</td>
<td>0.85</td>
<td>3, 4, 8</td>
</tr>
</tbody>
</table>
Lighting Controls Charrette

Basic criteria

- Practical and implementable for typical office spaces

- Generic enough to be inclusive?
- Specific enough to be useful?
- Advanced to save energy beyond code?
- Cost effective and widely available?
- Puts designer interests first?
- Industry buy in?
Add Conference Rooms Space

Now choose the control strategies you plan to apply to this space. Each template has been designed to avoid conflicts between the different strategies.

- **Template 1**: Multilevel switching, Vacancy Sensor
  - **Template Details**

- **Template 2**: Vacancy Sensor, Manual Dimming
  - **Template Details**

- **Template 3**: Vacancy Sensor, Manual Dimming
  - **Template Details**

- No controls strategies above those required by code will be used.
Templates: Concept drawing

- Vacancy sensor(s) turn lights off when the space is unoccupied
- Wall and AV lighting separately zoned and controlled using manual switches
- General lighting controlled using manual dimmer
Controls Templates Development

Templates: Zonal drawing

<table>
<thead>
<tr>
<th>Control</th>
<th>Zone</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$</td>
<td></td>
<td>AV wall zone controlled by manual switch</td>
</tr>
<tr>
<td>DIM</td>
<td></td>
<td>General lighting zone controlled by dimmer switch</td>
</tr>
<tr>
<td>$</td>
<td></td>
<td>Wall lighting zone controlled by manual switch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All lighting controlled by corner-mounted vacancy sensors</td>
</tr>
</tbody>
</table>
Guidance and implementation elements

- Concept drawing
- Control zone map
- Performance specifications
- Notes on wiring, installation, and commissioning
- Energy savings assumptions
Webtool Demonstration

Office Lighting Solutions key plan