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Rethink It A new approach to selecting lighting control systems

Talk to many involved in the design, installation and configuration of lighting controls and you will hear concerns about the proprietary and non-standardized character of most systems. In short, manufacturers create their own system architectures, use their own terminology and follow their own configuration routines. The result can be pain for everyone downstream.

Proprietary systems and their exclusive language can create hardship at each step. Designers can find it difficult to assess and specify comparable systems. Implementation and facilities teams take the system handoff and receive an unpleasant surprise when nothing's intuitive. And the unique system with its own language greatly complicates training throughout the industry. Further, the minimal interoperability of different systems leads designers to choose one manufacturer's system that might be *close* to what's needed, but not optimal. The alternative can be a mixture of untried and potentially incompatible components.

Then there's another, separate issue: how do designers know how well a system's architecture—scale, components and communication—really supports the claimed capabilities for the control system?

An obvious solution to these challenges would seem to be the development of standards, which, historically, have served to simplify products, lower costs and increase adoption. The most effective standards reflect market preferences and practices. Have we arrived at a place where lighting control systems are sufficiently mature for the industry to develop standards? Are manufacturers and specifiers ready to accept the inevitable limitations that accompany such standards?

Good questions! Unfortunately, standards can take a long time to develop. Meanwhile, what should we do?

Here's a suggestion: when it comes to lighting controls, act differently and think differently. Begin with a non-proprietary perspective. The Next General Lighting Systems (NGLS) program has been working to make controls less complicated. We think selecting lighting controls using a non-proprietary process, working in concert with standard terminology, can help. Here are highlights from our recent publication *Selecting Lighting Control Systems*.

> "Begin with a non-proprietary perspective

Before looking at a specific system, think about controls in a four-step process independent of any manufacturer's technology or architecture, as shown in **Figure 1:**

1. *Establish objectives for the control systems based on the owner's project requirements*. This approach begins the Controls Intent Narrative or CIN, a concept now receiving much warranted and increased attention. Common objectives might include code compliance, enhanced lighting performance, additional energy conservation or increased facility productivity.
2. *Identify the controls capabilities based on your objectives.* A system with multiple capabilities tends to be more costly and complicated. Selecting capabilities by the objectives they serve, rather than by what a specific system offers, helps to limit system cost and complexity. Capabilities can then be documented in the CIN. **Figure 2** illustrates the connection between objectives and capabilities.
3. *Consider the system architecture: do you want central vs. distributed processing? Wired vs. wireless communication?* Product literature doesn't always reveal how system architecture affects system capabilities and performance. Nevertheless, you can learn to recognize system attributes that limit, complicate or fail to support the desired capabilities.
4. *Document the desired system characteristics.* IES-LP-16-22 serves as a handy reference and guide to creating a practical CIN and Sequence of Operations.

Thinking through this process facilitates the evaluation of available control systems and help determine the final selection.

High cost and low operational effectiveness pop up in most discussions of lighting control systems. Incorporating these concerns into the decision process, rather than addressing them late in design or facility operation, clearly makes sense. Here are two promising approaches: focus on key capabilities and assess risk.

1. *As mentioned, limit systems capabilities to directly support controls objectives.* While the incremental cost of additional capabilities may seem low in high-performance systems, more configuration, troubleshooting and training are usually entailed, along with higher cost. Each additional system capability adds risk in the form of mistakes in design, configuration and usage. It's more practical and cost effective to focus on the "gotta haves" while staying away from the "nice to haves." Some capabilities, such as tunable color, involve more risk of problems than others and without direct experience, it's often hard to tell.
2. *Focus on two risk metrics that might provide an objective assessment, as seen in **Figure 3***. The Technology Factor considers maturity and widespread availability, both of which suggest the degree to which problems have been successfully resolved. The Communications Factor focuses on connections to external systems or components, considered a major contributor to system distress due to issues of compatibility and familiarity.

In general, the more a system relies on external connections, the greater the risk that something will go awry. That is not to imply that newer technologies and external connections are problems themselves, but that designers should recognize the risks and invest the effort to understand details, especially those not explicit in product literature.

When you read product literature, how well do you understand the language and what it means for system performance, risk and cost? NGLS and many others in the lighting community have called out confusing terminology as an obstacle to success with controls. Standardized terminology should—and can—be used in controls specifications and literature. Designers can help move this process along by favoring generic language and avoiding proprietary or manufacturer-specific terms, even (or

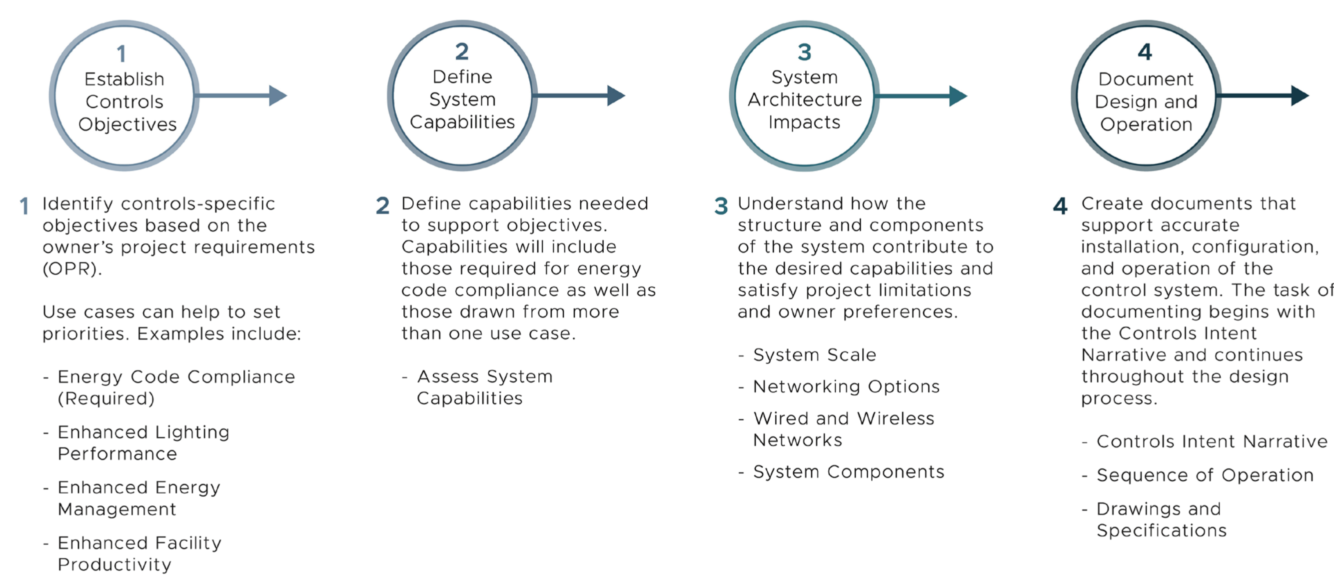

Figure 1: Selecting lighting control systems begins with four basic steps.

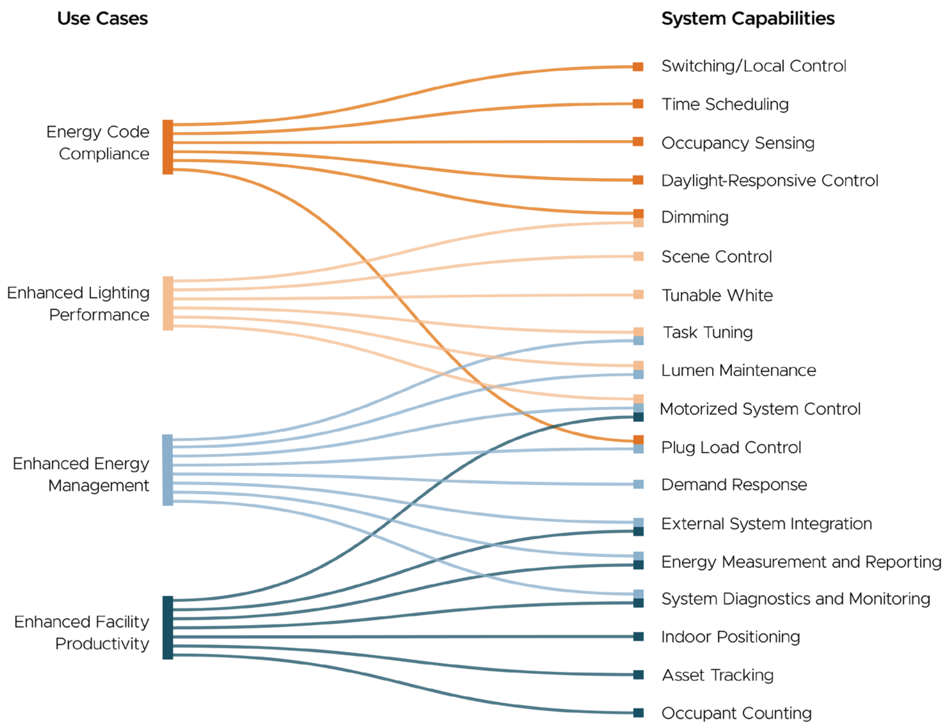

Figure 2: Use cases and related system capabilities.

Legend

Risk Factors

Technology Availability (TA)

- ○ Capability is ubiquitous in lighting controls systems.
- ◐ Capability is offered in an upgraded tier of most controls systems.
- ● Availability in current market is limited to specialized or advanced systems.

Communication Requirements (CR)

- ○ Basic communication or does not require an exchange of data.
- ◐ Capability may require communication between devices within the lighting controls system. Standardized methods for data exchange may be required.
- ● Capability requires communication between devices or networks outside of the lighting controls system.

System Capabilities	Risk Factors TA	CR
Time Scheduling	○	○
Occupancy Sensing	○	○
Daylight-Responsive Control	○	○
Dimming	○	○
Scene Control	○	○
Tunable White	◐	◐
Task Tuning	◐	◐
Lumen Maintenance	○	○
Motorized System Control	○	○
Plug Load Control	◐	○
Demand Response	◐	●
External System Integration	◐	●
Energy Measurement and Reporting	◐	◐
System Diagnostics and Monitoring	◐	◐
Indoor Positioning	●	●
Asset Tracking	●	●
Occupant Counting	●	●

Figure 3: Understanding risk factors can help to anticipate the problems that might arise from the system capabilities in a lighting control system.

especially) when a specific system is the basis of design.

This should be an easy win. After all, lighting designs often use performance specifications rather than named products. There are challenges, of course: which manufacturer or product name becomes the basis of design? Is one device really the same as another? Nevertheless, once the lighting community starts to use consistent terminology, barriers will fall. The IES, the Design Lights Consortium (DLC), and the Lighting Controls Alliance (LCA) are each making efforts on this front with glossaries, data files and search engines as well as with industry-wide training and education.

We can start to think differently now—and we have a variety of tools to help you take action:

- Download PNNL's *Selecting Lighting Control Systems*, on which this article is based.
- Consult IES LP-16-22 which also takes a non-proprietary approach.
- Attend our interactive workshop at LightFair in May, "Modeling a New Approach to the Design of Lighting Controls."

Most importantly, we would like to hear from you! We can make a difference together—feel free to share your thoughts with me at ruth.taylor@pnnl.gov.

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