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Evaluating the Non-Energy Benefits of Advanced Networked Lighting Controls

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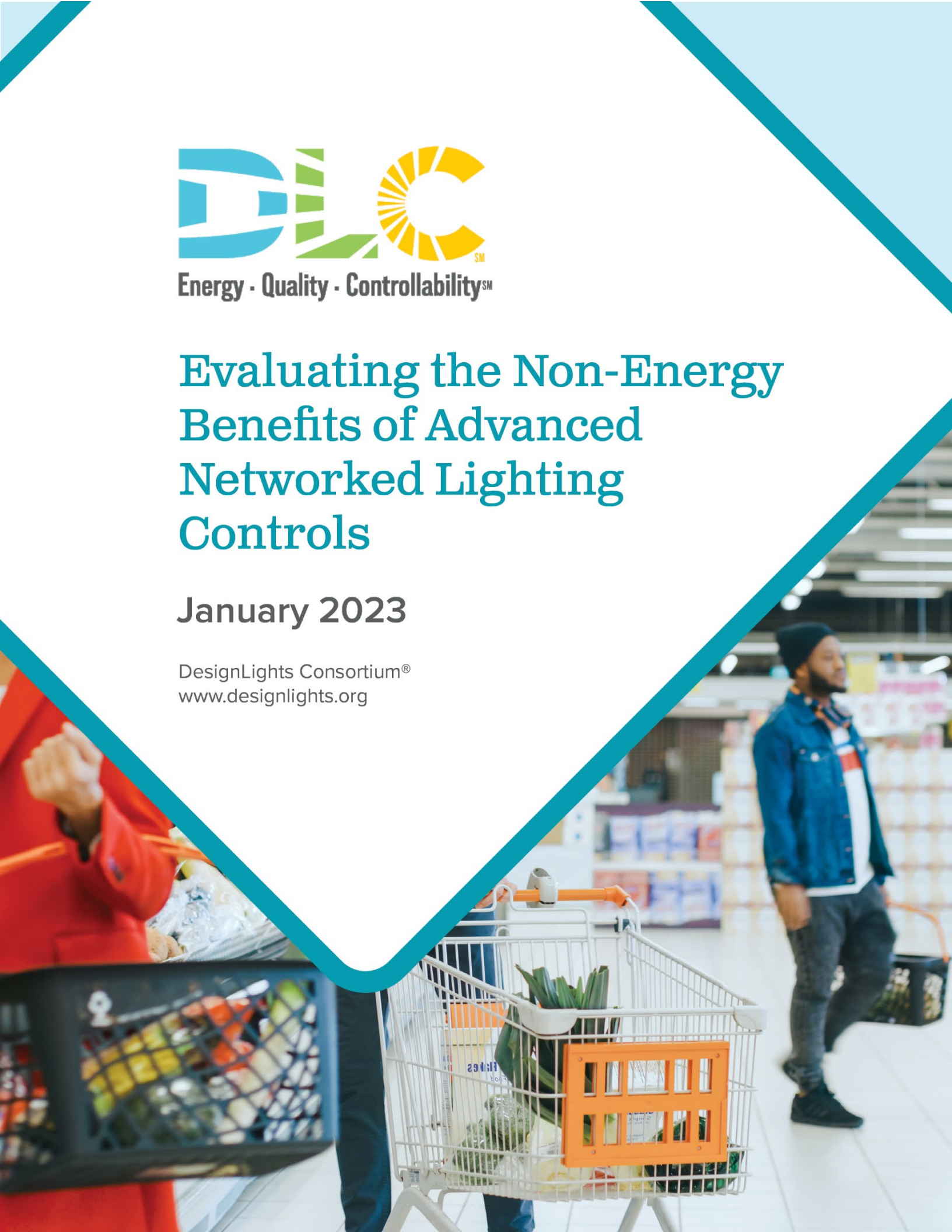

Introduction

As energy efficient LED technology has become mainstream, the quantifiable benefits from controlling smaller lighting loads may appear to have diminished at first glance. The truth is, while direct energy savings from controls alone represents a smaller portion of savings compared to the savings from LEDs, the use of networked lighting controls (NLC) continues to provide substantial benefits. Some of these, characterized as "non-energy benefits" or "non-energy impacts" (NEBs and NEIs, respectively), can provide adopters greater value than energy savings alone.

It has always been challenging to identify these benefits and assign them value – but this information is critical to the lighting decision-making process. Up until now, lighting cost-benefit analyses have only assessed the initial cost of investment against the anticipated energy savings. Quantifiable NEBs will enable building professionals to include anticipated savings from productivity gains, safety and security enhancements, extended equipment lifecycles, and more in their calculations. In addition, these NEBs will allow utility incentive program staff and others working to transform the market to incorporate an expanded set of metrics for measuring the cost-effectiveness of NLC implementation.

Definitions

What are NLCs?
The DLC defines networked lighting controls (NLCs) as the combination of sensors, network interfaces, and controllers that effect lighting changes to luminaires, but do not include the luminaires themselves.

Often, these control devices may be embedded in luminaires during the manufacturing process.

NLCs may be wireless (radios embedded in each network device that wirelessly connect with each other) or wired (physical wires connect the network control components).

A good example is a platform containing occupancy sensors, switches, photosensors, and control modules that all work together across an application to provide interrelated and coordinated control.

What are NEBS/NEIs?
Non-energy benefits (NEBs) and non-energy impacts (NEIs) are specific, identifiable benefits that accrue beyond the energy savings realized from the implementation of the energy efficiency measure. These can be positive or negative. This paper refers to NEBs with the intent of including both NEBs and NEIs.

This research, commissioned by the DesignLights Consortium (DLC) and conducted by Skumatz Economic Research Associates, Inc. (SERA), identifies NEBs specific to NLC usage and develops a methodology for assigning them quantitative values. This summary provides an overview of the research and instructions to obtain more detail about the findings.

Key Results

For decisionmakers that participated in utility energy efficiency programs: Including the net value of NEBs in cost-benefit analyses produced a return on investment (ROI) 2.3 times higher than when only considering energy savings.

For building operations staff: Net energy savings from NEBs were valued at approximately 11% of a full-time maintenance staff member's time to provide similar impacts.

For building occupants: A net increase in self-reported productivity of almost 8% was estimated for each employee in workplaces where NLCs were operating.

Methodology

To identify and rank the value of NEBs, the research team performed a review of the extensive body of existing NEBs research spanning 20+ years and conducted interviews and surveys with three key stakeholder groups. Several subject matter experts, including distributors, contractors, and manufacturers, were also interviewed to provide background on NLCs and explore relevant NEBs.

Outreach and Interviews

It was determined that three key stakeholder groups were the most relevant to interview:

- **Decisionmakers that participated in utility energy efficiency programs:**
  End users that were referred by efficiency program administrators typically have firsthand knowledge about NLC technologies and experience evaluating NEBs in relation to conventional energy savings valuations.
- **Building operations staff:**
  Building owners, operators, or managers typically make purchasing decisions regarding NLCs and reap the benefits of energy efficiency incentive programs. These respondents recognize or experience both the positive and negative effects of NLCs in the workplace.
- **Building occupants from key business sectors:**
  Occupants of commercial offices, healthcare facilities, schools, and warehouses provide perspective on NEBs value based on their personal experiences in work environments with and without NLCs.

The team then developed unique lists of NEBs for each of the three stakeholder groups to evaluate. The project sample size exceeded the team's initial goal and was sufficient to satisfy statistical thresholds and develop defensible estimates.

Interviewees were initially asked to rank the relative importance of each NEB, and then asked detailed questions about the value of each of the top four NEBs they identified. The utility-referred decisionmaker group was asked to assign value relative to energy savings, while the building operations and building occupant groups were asked to assign value in terms of minutes of time spent daily. Each group was also instructed to assign a general value to the remainder of the list of NEBs. **Table 1** illustrates the most important NEBs identified by each group.

Table 1. Most Important NEBs to Key Stakeholder Groups

Decisionmakers referred by utility	Building operations	Building occupants
Extending the life of lighting equipment	Internal building safety and security	Feeling of safety/security within the building
Look and ambiance of the space	Productivity from the automation of the lighting and equipment	Feeling of safety/security outside the building
Control over energy use	Quality of lighting in the space	Improvement of quality of light in the workspace
Maintenance and associated labor costs	Ability to perform work more efficiently and effectively	Ability to do their job more efficiently and effectively

Quantifying the Results

To communicate the results of their research, the team quantified the responses of each stakeholder group as follows:

- **Decisionmakers referred by utility energy efficiency programs:** NEBs value was quantified as a percentage greater than the monetary value of the energy savings from the NLC.
- **Building operations**: NEBs value was quantified as a percentage of a facility maintenance full time staff member's wage or salary.
- **Building occupants:** NEBs value was quantified as a percentage of a full time building occupant's wage or salary.

Results: A NEBs Value Spectrum

The research team determined the following values for NEBs based on the outreach to the three stakeholder groups:

For **decisionmakers that participated in utility energy efficiency programs,** including the net value of NEBs in cost-benefit analyses produced a return on investment (ROI) 2.3 times higher than when only considering energy savings. (In other words, NEBs added 30% more value to an NLC installation).

Building operators reported that the net value of NEBs was approximately equal to **11% of a full-time maintenance staff member's time**.

The building occupant group identified a nearly **8% average increase in self-reported productive time** attributable to the operation of the NLCs. This number applied to every employee in a workplace with NLC systems implemented.

By using methods with more than 20 years of application in energy efficiency programs and that have extensive support in the literature, readers can be assured that the findings of this research are well-documented the conclusions are conservative enough to be relied upon by decisionmakers.

Conclusion

The study demonstrated that value estimates for NEBs/NEIs can be developed for NLC technologies and monetizable values can be provided for both decisionmakers and building occupants. These values would be appropriate to add to cost-benefit assessments, payback analyses, or ROI computations to provide a more complete assessment of benefits compared to costs. This information may improve cost-benefit ratios, increase participation in utility incentive programs, and will offer additional insight into the broader value of NLC implementation in the commercial sector.

By identifying the NEBs most valued by the study respondents, the research also provided an important roadmap for communicating the importance of NLC implementation to the marketplace. Rather than using generalized or vague value propositions, solution providers can now offer a greater degree of

precision in educating prospective decision makers about the benefits they can realize from an NLC investment.

Future research could explore additional factors, such as building type, sophistication of the installed controls, size of the business, and northern versus southern latitudes. This study offered some preliminary findings regarding NLC implementation in commercial offices, healthcare facilities, schools, and warehouses, but lacked the sample sizes to identify detailed results or differences.

The project team completed a comprehensive report that includes detailed discussions of the study design and development, the survey instruments used in the research, results tables, and the literature review, available exclusively to DLC utility and energy efficiency program Members.