

# CT X1931-4 Advanced Lighting Controls - PSD New Measures

Final Results Presentation  
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## Agenda

**01** Phase 2 Objectives

**02** Study Findings

**04** Study Recommendations

**05** Study Methods



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## Phase 2 Objectives

- **Provide additional detail to the Phase 1 residential and commercial Advanced Lighting Controls measures that were incorporated into the PSD; adjust measure parameters if needed.**
- Confirm or update Phase 1 controls' savings factors through empirical data and interviews
- Investigate topics identified through Phase 1 that may impact savings factors, such as:
  - Savings factor differentiation between NLC and LLLC
  - Application of savings factors for combinations of controls beyond dual occupancy and daylight sensors
- Explore appropriate coincidence factors and measure lifetimes per control technology through expert and market actor interviews

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## Overall findings

- Advanced lighting controls (ALCs), as a term, was used to focus on luminaire level lighting controls (LLLC), networked lighting controls (NLC), and connected LED lighting.
- DNV advises one change to the measures identified and selected through phase 1 of this project, a reconsideration of LLLCs and how they are broken out
  - All other measures were either confirmed or insufficient information could be gathered to recommend changes
- For the sake of this project,
  - DNV has defined basic controls as occupancy sensors, daylight dimming, or high-end trim
  - DNV has defined hybrid controls as any combination of basic controls.
- These basic and hybrid controls measure factors, though less emphasized than ALCs, were found to be reasonable when proposed to the market actors and industry experts.

# Savings Factors

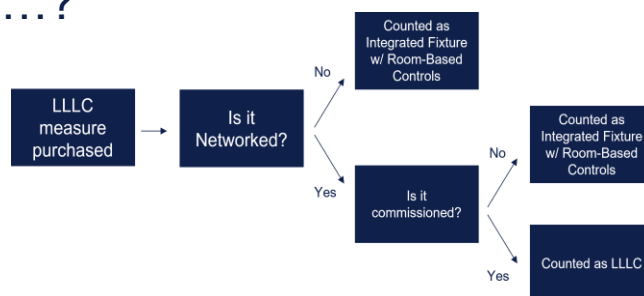
Measure	Control Technology	Phase 1 Savings Factor - Existing	Phase 2 Savings Factor - Recommended
Commercial and Industrial Lighting Controls	Luminaire Level Lighting Controls (LLLC)	49%	49%
	Networked Lighting Controls (NLC)	49%	49%
	Integrated Fixture w/ Room-Based Controls	N/A	38%
Residential Lighting Controls	Connected LED Lighting	29%	29%

- Due to the variations in responses from both market actors (4) and experts (5), as well as the custom files gathered from the utilities, it is our recommendation to leave the savings factors unchanged, except the breakout of non-networked/non-commissioned LLLCs (to be elaborated further).
- Industry Experts and Market Actors had little input to the Residential Connected LED Lighting value.
- “NLCs likely offer far greater potential for energy savings. However, it is harder to quantify savings from LLLCs so not enough data to really know.”

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## LLLCs or...?



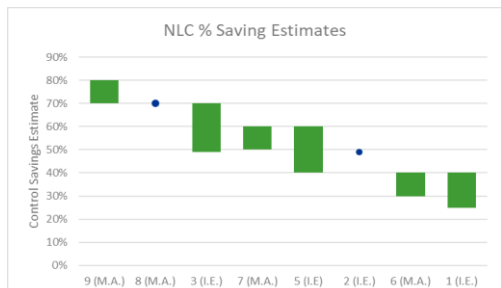
- All experts and market actors reported high potential for LLLCs, though estimations had high variance.
- One theme that emerged is without proper commissioning, LLLCs are unlikely to realize full potential. Also, definition of LLLC requires networking.
- The added savings potential of being an LLLC comes from proper installation, commissioning, and networking.

Hybrid Combination	Savings Factor
High end trim & occupancy	33%
High end trim & daylight dimming	35%
Occupancy & daylight dimming	38%

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# Savings Factors: IDI estimates and DLC study findings

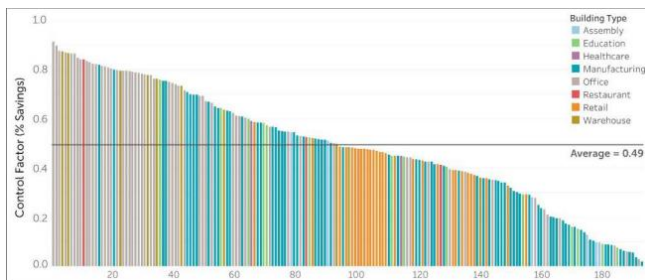


**IDI Savings Factor Estimations**

Displaying NLC estimates

M.A. – Market Actor Estimate

I.E. – Industry Expert Estimate



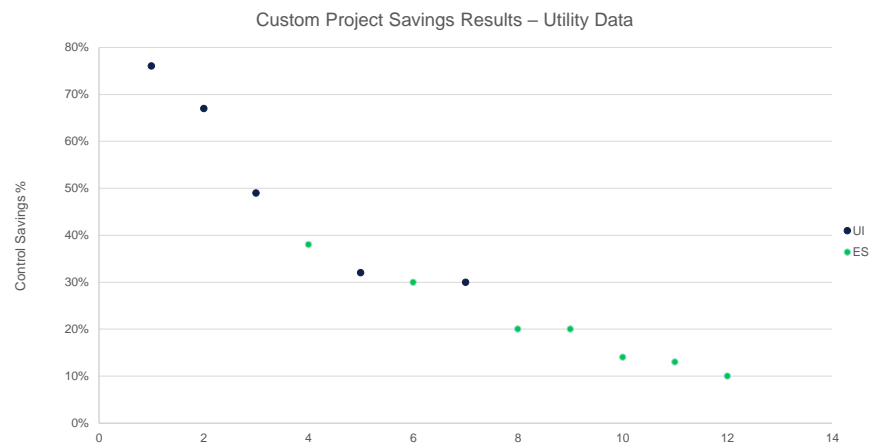
**Savings Factors from DLC Study<sup>1</sup>**

Distribution shows spread from 80+% to <10% savings due to NLCs.

Study reviewed just shy of 200 projects to inform

1. DLC and Northwest Energy Efficiency Alliance (NEEA), "Energy Savings from Networked Lighting Control (NLC) Systems with and without LLLC", Energy Solutions, Sept 24 2020.

## Savings Factors



	Utility	Control Savings (%)
1	UI	76%
2	UI	67%
3	UI	49%
4	ES	38%
5	UI	32%
6	ES	30%
7	UI	30%
8	ES	20%
9	ES	20%
10	ES	14%
11	ES	13%
12	ES	10%
	ES AVG	21%
	UI AVG	51%

## Measure Lives – Phase 2

- Respondents indicated the measure lives for ALCs are determined by the life of the fixture.
  - DNV asked market actors and experts if the controls last as long, less, or the same as the bulb/fixture being controlled and if ALCs are typically replaced when bulbs/fixtures burn out or are replaced on schedule
  - Respondents typically felt ALCs last the same or long but noted that generally ALCs are replaced when the bulb/fixture is replaced.
- Due to this, DNV recommends maintaining the MLs chosen in phase 1, as it is set to the life of the fixture being controlled.

Measure	Control Technology	Phase 1 ML*	Phase 2 ML – Recommended*
Commercial and Industrial Lighting Controls	Luminaire Level Lighting Controls (LLLC)	L.O. – 12.2 Retro - 7	L.O. – 12.2 Retro - 7
	Networked Lighting Controls (NLC)	L.O. – 12.2 Retro - 7	L.O. – 12.2 Retro - 7
Residential Lighting Controls	Connected LED Lighting	10	10

## Measure Lives – Phase 1

- For C&I, phase 1 selected a ML of 12.2 years for lost opportunity and 7 years for retrofit, aligning with the measure life for fixtures (LED) based on a 2021 study conducted in CT regarding measure lives.
- For Residential controls, phase 1 selected a measure lifetime of 10 years based on the CT PSD lifetime for conventional commercial lighting controls. The AMLs determined for residential bulbs would not be applicable to the residential measures because they are adjusted based on the CT lighting market, which would not apply to controls measures.

\* L.O – Lost Opportunity; Retro - Retrofit

## Coincidence Factors – Sample question (C&I)

Question	Answers
<p>From your experience, do C&amp;I facilities typically have unique control settings for a typical summer and a typical winter?</p>	<p><i>Would say no, the same year round, other than times of coming on depending on daylight hours</i></p>
	<p><i>Yes, definitely pick up additional energy savings based on longer daylight hours, also pick up summer – people on vacations etc, offices are darker, longer schedules built into the system design, have a calendar programmed in as part of the system</i></p>
	<p><i>Yes, depends on level of light entering space, if have skylights or large windows or have sawtooth story windows in the roof, however time scheduling when we have a networked system allows us to adjust A) to astronomical time clock differences between DST and Standard time and also allows us to schedule different events – ex cleaning crews, also allows us to dim on demand when company requires it, so advantages to having NLC hooked into utility Demand response systems</i></p>

## Coincidence Factors – Sample question (Residential)

Question	Answers
<p>From your experience, do residences typically have unique control settings for a typical summer and a typical winter?</p>	<p><i>No, same thing, just lights coming on</i></p>
	<p><i>Depends on if someone is home, if someone works from home a lot get greater savings year-round, someone who doesn't work at home is harder to determine/pinpoint</i></p>
	<p><i>No, it doesn't seem that disciplined</i></p>

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## Recommendations for Future Research

1) More detailed review of LLLC sales and commissioning to better understand realized savings coming from technology.

- To truly understand the savings of a product with such a high variance, metering would be most beneficial. This would allow for better measurement of coincidence factors as well.

2) LLLCs savings potential is due more to commissioning and (required) networking than the measure. We recommend the 49% savings factor be applied to those LLLCs with confirmed commissioning/networking, while those simply reported as an LLLC purchase be given a 38% SF.

3) The low quantity of custom projects to review underscores the need for future research as the measure gain more market traction.

4) Consider learning from Massachusetts' C&I Lighting Controls Impact Evaluation study starting Q3 2022



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## Phase 2 Methods

- Expert Interviews (5 Complete)
  - Interviews with experts (designers, installers, manufacturers, suppliers, or other industry contacts) sourced from the implementation staff and/or tracking data.
- Market Actor Interviews (4 Complete)
  - Interviews with market actors to identify available data and provide context for the current market.
- Empirical Data Review / Analysis
  - C1635 Impact Evaluation of PY 2016 & 2017 Energy Opportunities (EO) Program (August 2020)
    - *This provided only 2 relevant projects*
  - Custom lighting project files for NLCs from UI and Eversource.

# Primary Research Data Sources

## Empirical Data Studies

- C1635 Impact Evaluation of PY 2016 & 2017 Energy Opportunities (EO) Program (August 2020)
- *Part of C1635*: CT Upstream Lighting Study investigating PY2018

## Utility Data

- Custom lighting project files for NLCs from UI and Eversource.
  - 5 Custom files from UI
  - 7 Custom files from Eversource for 2020 and 2021