**The Lighting Energy Alliance (LEA)** at Rensselaer Polytechnic Institute’s Lighting Research Center is a collaboration of members who pool their funds to advance lighting research and education that is of common interest.

### Program of Work

Since launching in 2014, LEA projects have supported lighting efficiency incentive and regulatory programs, primarily involving commercial lighting applications. LEA has focused on projects that:

- **identify** effective new products and technologies to reduce lighting energy,
- **quantify** energy savings, and
- **support** its members in implementation through education.

### Benefits of Joining

- Shaping LEA’s agenda.
- Leveraging of sponsorship with funding from other LEA members and with other research at the LRC.
- Priority access to LEA and other relevant LRC research results before publication.
- Visit to your facility by LRC lead researchers each year with a customized agenda.
- Invitation to exclusive annual LRC Partner-Alliance Event to learn the latest in lighting research and network with other lighting professionals.
- Immediate launch of in-house research for timely results.
- Logo placement on LRC website.
- Assistance in answering the most pressing lighting questions.
- Option to perform additional research and education activities at a discounted cost.
- Option to recruit staff at LRC networking event for LRC students and alumni and by hosting an externship for MS in Lighting graduates.

### Membership

LEA membership is available to utilities, efficiency agencies, energy service companies (ESCOs), and not-for-profits.

The membership cost for LEA is:

- $30,000 per year.
- $25,000 per year with a three-year commitment.
- $15,000 per year for LRC Partners.

Funds are pooled to conduct research and operations.
**Completed and Current LEA Projects**

**Horticultural luminaires** represent a fast-growing load for many utilities. LEA created a recommended testing and evaluation framework based on equal-PPFD (photosynthetic photon flux density) and provided energy and economic results from testing LED and HID horticulture luminaires. LEA found that although eight of the 10 tested LED luminaires had a higher luminaire efficacy than the tested HPS luminaires, when meeting the design requirements for a typical greenhouse application, half of the LED luminaires had a higher lighting power density and seven out of 10 had a higher life cycle cost.

**Lighting for health and well-being** is increasingly being recognized as a non-visual benefit of lighting and is increasingly being adopted into practice. Unfortunately, the lighting needed to entraining occupants’ circadian rhythms often leads to increased energy use. LEA is teaming with the LRC’s Light & Health Alliance to identify techniques to provide health benefits while also minimizing energy use.

**Parking lot lighting** and parking garage lighting uses almost half as much energy as all commercial buildings combined. Lighting power densities in parking applications can be reduced by optimizing the lighting for safety and energy. In this ongoing laboratory-based study, LEA will create an understanding of how illuminance level, uniformity, and spectrum affect occupants’ perceptions of brightness and safety, which will pave the way for energy optimization.

**Luminaire-level lighting controls** (LLLCs) offer significant savings in open offices due to the spatial granularity of the motion sensing. LEA examined the effect of four LLLC parameters—group size, sensor field of view, delay period, and dim state—on energy savings. LEA found that the scenario leading to the most energy use uses twice as much lighting energy as the scenario leading to the least energy use, showing that LLLC parameters play an important role in energy savings and should be considered by installers and efficiency programs.

LEA co-sponsored a study with Bonneville Power Administration to characterize performance under field conditions. The results showed that the products were easy to install and significant energy savings were realized, but initialization and occupant satisfaction were challenging for some products.

**Pin-base LED lamps** offer an opportunity for power reduction in commercial downlight applications. LEA found that the tested LED products had sufficient light output to replace most 26W CFLs and some 32W CFLs, but was not sufficient to replace 42W CFLs, and the payback period was about two years. LEA produced a short guide for specifiers to help specifiers select appropriate products.

**LED troffers** often replace fluorescent troffers in commercial energy retrofit projects. LEA produced a short guidance document and webinar for specifiers to help identify products that will balance energy savings with occupant satisfaction.
Potential Future LEA Projects

**Connected lighting** can reduce HVAC energy use through variable ventilation and predictive heating/cooling. This study will identify commercially available products and technologies, pilot projects, and documented energy savings.

A separate potential project will determine how to adjust group size, sensor field of view, delay period, and dim state to both save energy and maintain office occupants' satisfaction with the lighting. This project builds on the completed LLLC parameter study, which identified how adjusting these parameters affect energy use. This project will result in recommendations for specifiers and installers, and will quantify the maximum savings that can be achieved without disturbing occupants.

**Parking lot lighting** optimization will determine how to reduce energy use while meeting occupants' safety and security needs. This project will build on the current laboratory-based project, which is identifying how illuminance level, spectrum, and uniformity affect an occupant's sense of safety. This project will validate the laboratory work in actual parking lots, optimize the lighting design for energy and occupant safety, and produce guidance on how lighting specifiers can use these techniques.

**Brightness-based lighting design** guidance will create recommendations on how to design lighting for interior commercial spaces based on providing adequate visual performance and brightness perception where needed. There is a potential for significant energy savings due to LEDs providing more energy at short wavelengths than traditional light sources, which leads to increased brightness perception. This work will build upon a task-vertical-ambient lighting concept, lighting researcher Kit Cuttle's surface exitance design concept, and and the brightness metric $B_2(\lambda)$ developed at the LRC. This project will include a human factors study to optimize office occupant satisfaction and energy savings.

**Advanced lighting design** guidance will identify techniques and technologies that can be used to achieve high quality and energy efficient lighting in commercial spaces including offices, retail, classrooms, and parking lots. The resulting guidance will assist in the implementation of custom lighting efficiency programs.

**Horticulture luminaires** are difficult to compare with one another based on efficacy in a grow facility. This project will create an online calculator to allow efficiency programs, manufacturers, and other stakeholders to compare horticulture luminaire performance on an equal-PPFD (photosynthetic photon flux density) basis in a grow facility. It will build off the completed horticulture luminaire study and will allow additional luminaires to be evaluated by uploading product data online and receiving a specification sheet from the calculator.

A second project will examine the impact of LED horticulture luminaires on HVAC energy use in grow facilities to determine how switching to LED luminaires will impact a grower's total energy use. The project will investigate several types of grow facilities and climate regions.