The LRC recently conducted an evaluation of the energy and economic performance of light-emitting diode (LED) horticultural lighting systems compared with high-pressure sodium (HPS) and metal halide (MH) horticultural lighting systems.

Based on the findings from a literature review and survey conducted by the LRC, the project team developed a framework for evaluating and comparing horticultural lighting systems. The framework includes recommended testing, evaluation, and reporting methods. It allows lighting systems to be compared based on equal photosynthetic photon flux density (PPFD), which is analogous to photopic illuminance on a work surface in an architectural application. The framework includes the analysis of 11 luminaire-specific metrics and 5 application-specific metrics, which provide growers with the most accurate information regarding the performance of any given horticultural lighting system.

The LRC then used this framework to test and evaluate 13 horticultural lighting systems, including ten LED, two HPS, and one MH product. First, the lighting systems were photometrically tested. Then the LRC determined the number of luminaires and the lighting system energy requirements necessary to reach minimum PPFD and uniformity criteria in a simulated greenhouse.

The results show that intensity distribution plays an important role, illustrated by the fact that two of the tested LED lighting systems had higher luminaire power demand in the greenhouse application to meet the PPFD criterion.

The LRC found an increase in shading from the LED lighting systems compared with HPS due to the size of the luminaires and the fact that more are needed to provide the same PPFD in a greenhouse. The shading from LED lighting systems reduces daylight from HPS, thus more electric energy could be needed for lighting with the LED systems, depending upon the available daylight.

The LRC also found that three of the tested LED lighting systems had lower life-cycle costs, while the remaining seven had higher life-cycle costs than either of the two 1000-watt HPS lighting systems that were tested.

The results of the evaluation show that stakeholders can be misled by considering luminaire efficacy alone. Rather, the intensity distribution and layout to reach a criterion PPFD are necessary for an accurate life-cycle cost analysis. The LRC report provides a framework that stakeholders can use to evaluate horticultural lighting systems.