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# L-Prize Concept Phase winners propose next-generation SSL designs

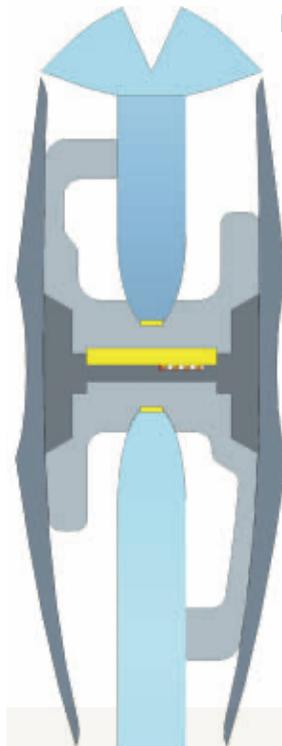
PNNL's **KATE HICKCOX** notes common themes of modularity and interoperability that could ease the integration of 2022 L-Prize Concept Design winners.

**D**uring the Department of Energy (DOE) Solid-State Lighting R&D Workshop on Feb. 3, U.S. Secretary of Energy Jennifer Granholm announced the winners of the Concept Phase of DOE's latest L-Prize competition. The program aims to spark innovation with interoperable LED lighting systems in commercial building applications. These systems can include LED luminaires, sensors, control devices, and interfaces.

I helped design this iteration of the L-Prize competition, which was last held a decade ago. In the Concept Phase, we encouraged competitors to submit designs that go beyond current constraints in lighting innovation, such as cost, form factor, materials, and controls. Entrants were invited to imagine and design concept systems that attain energy efficiency, lighting quality, connectivity, and life cycle requirements beyond those of current commercially available products and consider environmental sustainability and diversity, equity, and inclusion (DEI). The announcement by Secretary Granholm culminated an exciting first round of design and engineering for the entrants.

The competition's first phase also invited participation from all interested teams or inventors. We encouraged the submission of concepts from known and nontraditional manufacturers, including garage inventors and academics. Seeing submissions from individuals, small teams, and experts within and outside the lighting industry that introduced new perspectives to this challenge was exciting. Our expert reviewer panel (ERP) examined and scored all eligible submissions and selected four as winners for this phase. Each winner received \$20,000 in prize money. Below are the features and innovations that the ERP scored highly, as well as information on the four winners.

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 KATE HICKCOX is a lighting research scientist at Pacific Northwest National Laboratory (PNNL), which administers the L-Prize along with the U.S. Department of Energy's National Renewable Energy Laboratory.



**QuarkStar's Project Tango concept offers high optical efficiency and tunability in a networked luminaire.**

QuarkStar

## Project Tango

QuarkStar, an international group of lighting thought leaders working in partnership with Nichia, submitted a networked white-tunable luminaire concept for retrofit projects. The concept, dubbed "Project Tango," leverages innovations in optics, LED construction, and power conversion technology. The ERP was impressed by its novel optical design and potential to simultaneously deliver extremely high optical efficiency and precisely controlled light distribution.

QuarkStar's proposed concept uses OpenThread, an open-source networking protocol developed by Google. To date, open-source protocols have not gained much traction in commercial lighting, but they have potential to enable greater interoperability among building systems, including lighting. Other notable highlights include top-to-bottom design decisions geared toward sustainability and waste reduction, such as predictive maintenance and modular replacement and upgrades that can be serviced in-field. Based in Las Vegas, QuarkStar has a long track record of workforce diversity in its innovation and IP teams, which earned the company bonus points in the DEI category. (*Editor's note:* Learn more about QuarkStar on p. 17.)

## Sustainable and connected troffer retrofit

Orion Energy Systems of Manitowoc, WI, took on the fluorescent-to-LED retrofit with its entry. The concept included a high-efficacy, networked LED luminaire with advanced controls that could be swapped in place of an existing fluorescent luminaire in less than 2 minutes.

The ERP liked Orion's application of advanced capabilities to retrofit situations, which represent an estimated 90% of the overall lighting market. The concept's quick installation of an advanced controls platform would also address a current barrier in the market. The ERP also praised the luminaire's high efficacy (184 lm/W), excellent color quality, and use of plug-and-play standards-based controls, which can decrease costs and increase adoption. A modular light engine is designed for upgrading in the field to improve or change the performance.

The modular approach not only allows for potential efficacy maintenance or increases but also enables better end-of-life outcomes, such as recycling or proper disposal of e-waste. Finally, diversity among design and engineering team members and the inclusion of diverse STEM (science, technology, engineering, and mathematics) students via internships earned bonus points.

### Laterally symmetrical Level 3 engine for 3D printing

Startup Smash the Bulb of Mountain View, CA, teamed with Bridgelux of Fremont, CA, on a 3D-printed, semi-indirect luminaire concept that uses a high-performance light engine that requires no secondary optics to deliver high efficacy and quality of light. The ERP liked the luminaire's innovative optical design, which addresses glare and reduces losses. Reviewers found the 3D-printed luminaire housing intriguing for its ability to be produced at a job site to mitigate supply-chain challenges and to reduce the environmental impact of packaging and shipping luminaires from afar. From a networking perspective, the ERP liked the multiprotocol compatibility (DALI, 0–10V, Bluetooth), which would help support interoperability with other systems.

### Papaya Modular Lighting Ecosystem

Papaya of Evanston, IL, was a unique winner in that the team comes entirely from outside the lighting industry. Its Modular Lighting Ecosystem concept proposes an open-source, community-based approach in which innovators of all disciplines can participate in evolving this lighting solution over time. Some reviewers were excited about this model while others questioned its viability in the fast-paced, competitive lighting market. Seeing whether this concept can be brought forward as a working prototype and ultimately a commercially available product will be interesting.

Beyond the open-source model, reviewers were intrigued by the concept's highly modular design and use of advanced technology, including a light module that has potential neural network and machine-learning capabilities.



**Orion's retrofit troffer is designed to reduce installation time and simplify connected lighting management with standardized controls.**

Orion Energy Systems



**Together, Smash the Bulb and Bridgelux submitted a 3D-printed luminaire concept with multiple controls-systems compatibility.**

Smash the Bulb



**Papaya's Modular Lighting Ecosystem may advance lighting design with an open-source approach to development over time.**

Papaya

### Next up: L-Prize Prototype Phase

The Concept Phase of the L-Prize called for out-of-the-box thinking and novel approaches from innovators across the nation. The upcoming Prototype Phase opens this summer and seeks working lighting-system prototypes that meet the rigorous L-Prize energy efficacy, light quality, connectivity, and product life cycle requirements — the combination of which should exceed the capabilities of currently available products. This phase is open to anyone, regardless of whether they participated in the Concept Phase. Entrants are welcome and encouraged to build and submit prototypes, which the ERP will evaluate and score. Winners in the Prototype Phase will share a \$2 million prize pool.

When we open the Prototype Phase, we will also issue a request for information (RFI) aimed at connecting parties interested in possible teaming arrangements for production, installation, evaluation, demonstration, and/or deployment of systems. This partner RFI will be kept open throughout the L-Prize duration and posted on the L-Prize website.

In the meantime, those seeking partnerships can check the L-Prize website, which currently lists 29 teams and 193 innovators that have already signed up.

Congratulations to the Concept Phase winners, and good luck to everyone participating in the Prototype Phase. We are closer than ever to revolutionizing the lighting industry and excited to see what happens next.

### FURTHER READING

For more context on the DOE L-Prize program and its evolution with the onset of LEDification 2.0, we recommend:

[DOE testing of L Prize LED lamp passes 40,000 hours](https://edsmagazine.com/16696631)

[edsmagazine.com/16696631](https://edsmagazine.com/16696631)

[DOE reprises L-Prize seeking to accelerate SSL evolution in commercial buildings](https://edsmagazine.com/14208781)

[edsmagazine.com/14208781](https://edsmagazine.com/14208781)

[L-Prize concept phase offers rare opportunity for innovators](https://edsmagazine.com/14210065)

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