L•PRIZE®

U.S. Department of Energy

Lighting Prize (L-Prize)

OFFICIAL RULES

The L-Prize® will advance the state of the art in light-emitting diode (LED) lighting, encouraging technology developers and researchers to engage in advanced lighting system development leading to groundbreaking designs, products, and impact.

OFFICIAL RULES: MODIFICATIONS SUMMARY

Modifications made to the rules are summarized below and highlighted in the text.

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I. PROGRAM SUMMARY

1. INTRODUCTION

The L-Prize ("Prize") targets commercial sector lighting, which accounts for 37% of national lighting energy use.[1] The L-Prize competition encourages lighting innovators to design lighting systems with breakthrough lighting energy efficiency, quality, functionality, and sustainability. A full realization of solid-state lighting (SSL) technology potential envisions LED lighting products manufactured with significant U.S. content and demonstrating exceptional energy efficiency, data connectivity, seamless lighting control, excellent visual quality, and design for recycling and remanufacturing. The L-Prize will reward innovations that move rapidly to improve lighting performance, resulting in energy, carbon, and cost savings for American businesses and consumers.

The L-Prize will award a total of up to $12.2 million in cash prizes. In the Concept Phase, the U.S. Department of Energy (DOE) anticipates up to 10 awards of $20,000 each. In the Prototype Phase, DOE plans up to three winners to split a total prize pool of $2 million. In the final Manufacturing and Installation Phase, up to two winners will split a $10 million prize pool.

Contest	Winners	Prizes
Concept Phase	Up to 10	$20,000 per winner
Prototype Phase	Up to 3	$2 million pool
Manufacturing and Installation Phase	Up to 2	$10 million pool

Table 1: Contest Phases and Prize Information

2. BACKGROUND

The first Lighting Prize was awarded by DOE in 2011, recognizing a high-efficiency LED replacement for the traditional 60-watt A19 incandescent bulb. Since that time, SSL technology has continued to advance and LEDs are now the predominant light source technology for new lighting installations, from streetlights to retail lighting to homes. While commercially available LED lights are now competitive with all other lighting technologies, the full technical and application potential of SSL still far exceeds today's products. Advanced interoperable lighting systems have the potential to better manage lighting energy use, integrate with other building systems, streamline maintenance and operations, and even respond to electric grid signals, increasing value and resiliency of buildings. The L-Prize, a successor to the first Lighting Prize, seeks to unlock that additional potential to combine high luminaire efficacy with exceptional lighting quality, data-driven control and functionality, innovative design, construction, and grid flexibility for the future of illumination in commercial and institutional buildings. The L-Prize will target connected lighting technologies for commercial building applications where there is significant opportunity for innovation, energy savings, and impact. DOE's Building Technologies Office invites lighting innovators to participate in this new competition to bring tomorrow's lighting into today.

[1] DOE. 2015 U.S. Lighting Market Characterization. November 2017.

The goal of this L-Prize is to advance the U.S. clean energy economy for next-generation LED lighting, encouraging technology developers and researchers to engage in advanced lighting system development leading to transformative designs, products, and impact. The challenging technical requirements are intended to stimulate creative approaches that raise the bar for efficiency, quality of light, connectivity, and environmental footprint. Currently available technologies and systems may excel in one performance area, but often at the expense of others (e.g., some excel at efficacy but at the expense of color rendition, flicker, or glare that can have negative impacts on worker safety, productivity, or well-being). A key innovation of this L-Prize is that a winning system must demonstrate exceptional achievement in all areas. In addition to this technical innovation, the L-Prize also invites innovation for diversity, equity, and inclusion (DEI) in how systems are designed, produced, deployed, or installed.

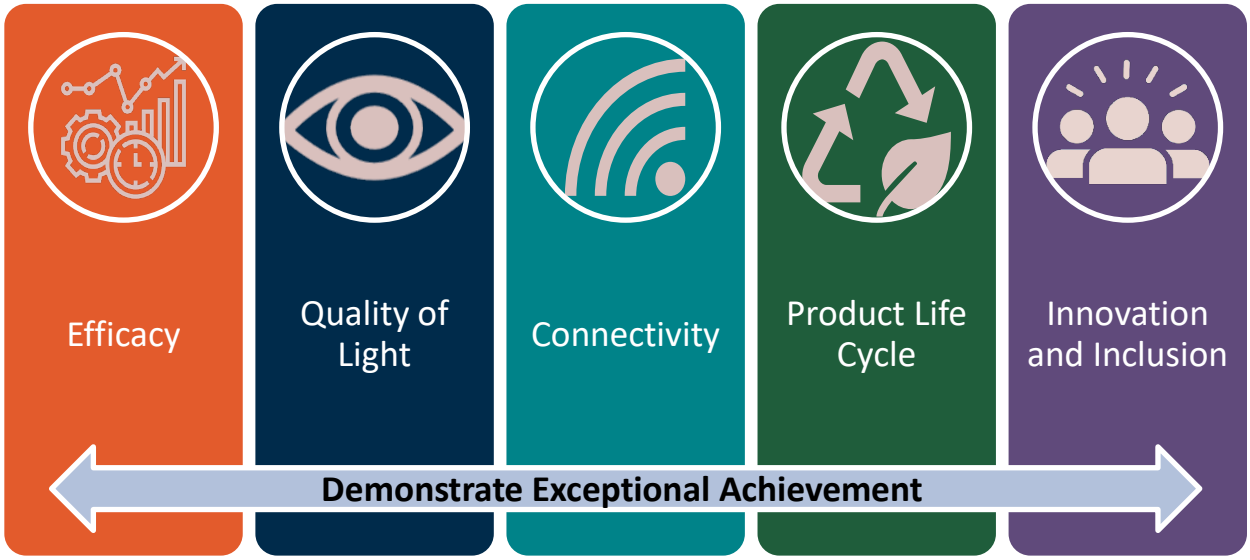

Figure 1: Winning systems must innovate and demonstrate exceptional achievement across all areas.

DOE estimates that LED luminaires could achieve approximately twice their current average luminaire efficacy through additional improvements in LED materials, light extraction, optics, luminaire design, and electronic configuration.[2] Further, tapping the potential of LED lighting to deliver the necessary spectrum and intensity with appropriate distribution and control could further decrease lighting energy use while meeting human physiological needs and improving the occupant experience in the built environment. Additional gains can be realized through systemic improvements to connected lighting technologies that integrate building systems, delivering both energy and non-energy benefits. Finally, approaches that support product life cycle improvements, such as replaceable components and safe end-of-life strategies, have the potential to decrease negative life cycle impacts from lighting products and systems.

3. TARGETED APPLICATIONS, SYSTEMS, AND LUMINAIRE TYPES

The L-Prize scope includes the luminaires, sensors, control devices, and interfaces that comprise a connected lighting system. Winning entries will include all system components necessary to meet the L-Prize technical requirements. The competition targets commercial sector applications where significant energy savings and occupant benefits will be realized. Luminaires must be appropriate for ambient lighting in commercial and institutional building interiors such as offices, healthcare facilities, educational facilities, and other settings where linear lighting is predominant. Luminaires specifically designed or intended for task, accent, display,

[2] DOE. 2019 Lighting R&D Opportunities. January 2020.

outdoor, and industrial applications including low/high-bay luminaires are not eligible.

4. CONTEST PHASES

The L-Prize has three distinct phases. DOE encourages participation in all three phases; however, there is no requirement for competitors to do so. A competitor may choose to participate in only the first phase, or the second, or the third, or any combination thereof. Each phase's competitor entries will be independently evaluated, and any prizes awarded will be made without consideration for whether that competitor or entry participated in any other phase.

1. The **Concept Phase** invites innovative concept proposals from potential competitors. Competitors will imagine and document a concept luminaire and lighting system of the future, thinking beyond the current constraints on lighting innovation such as cost, form factor, materials, and integration. This phase will provide competitors with an opportunity to receive feedback on their concept proposal and potential to receive a cash award. Concept proposals will be scored for innovation, feasibility, and ability to meet the L-Prize technical requirements. A cash award of $20,000 each will be awarded to up to 10 of the highest-scoring complete concept entries meeting the technical requirements and received within the eligibility period (see Table 2).

2. The **Prototype Phase** invites physical prototype systems, emphasizing technological innovation and presenting the opportunity and the challenge to think outside the standard forms, materials, and price points of commercially available products. An award of $2 million will be divided among up to three competitors earning the most points for innovation exceeding minimum performance requirements in four areas: efficacy, quality of light, connectivity, and product life cycle, with additional points possible for DEI innovation. The Prototype Phase will also initiate a teaming opportunities process described in the section TEAMING REQUEST FOR INFORMATION.

3. The **Manufacturing and Installation Phase** will reward production and installation of real products meeting the L-Prize technical requirements. An award of $10 million will be divided among up to two competitors earning the most points based on production volume, U.S. content, and U.S. installations, in addition to technical and DEI innovation points.

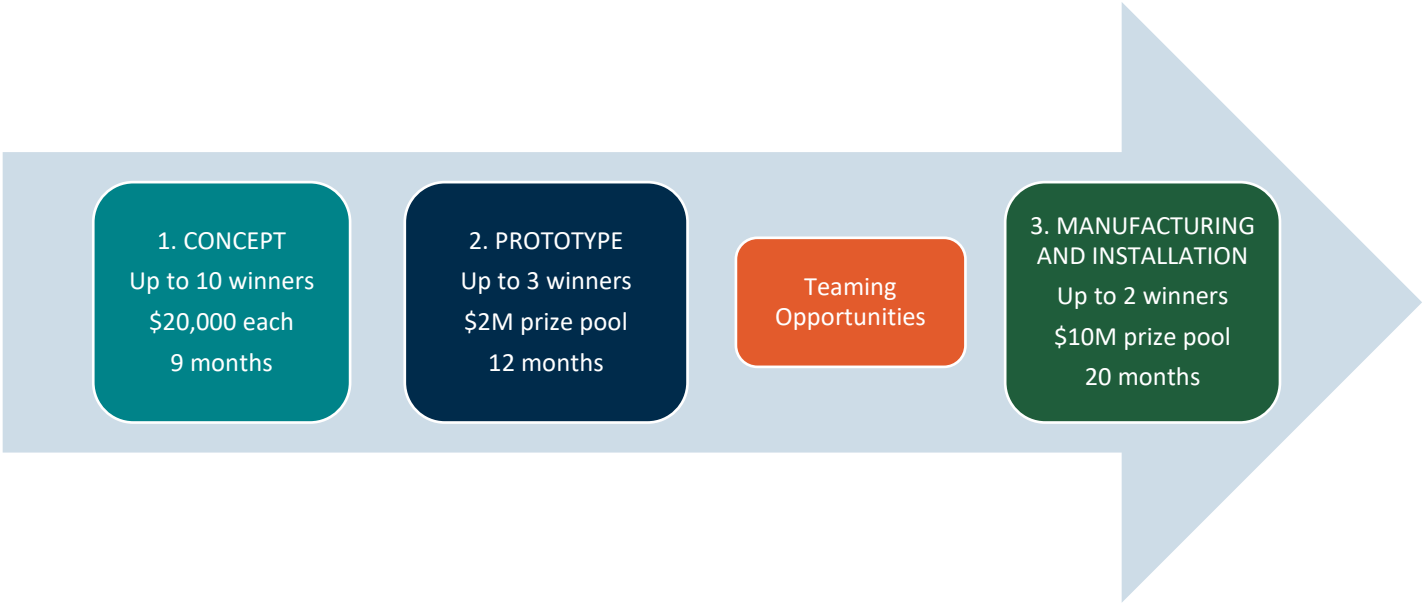

Figure 2: L-Prize phases. Participation in any phase is not required to participate in any previous or subsequent phase(s).

5. COMMENTS ON RULES

DOE aims for a contest that realizes the L-Prize innovation goals while encouraging participation from a wide range of competitors. To support this objective, DOE invites comments on the L-Prize requirements and timelines. DOE will accept comments at the beginning of the Concept Phase on the subsequent Prototype and Manufacturing and Installation phases. DOE reserves the right to revise subsequent phase requirements and timelines based on the input received. Any changes to requirements or timelines of subsequent phases will be announced with the opening of the subsequent phase (see Figure 3 for process and Table 2 for timing). Comments will be accepted via email to lprize@nrel.gov and must be submitted using the provided Comment Form available at https://www.herox.com/lprize.

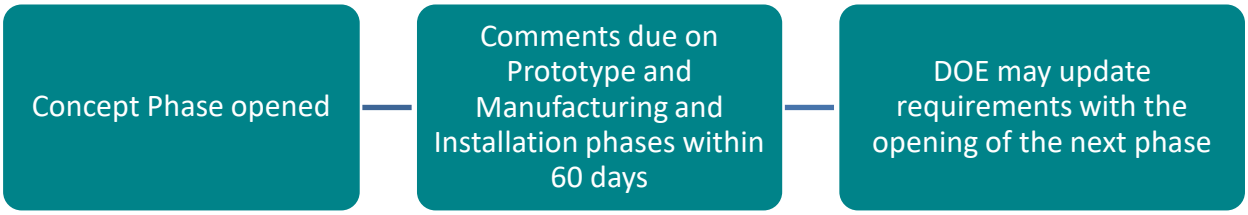

Figure 3: Comment process. See Table 2 for timing.

6. TEAMING REQUEST FOR INFORMATION

A Request for Information (RFI) will be issued simultaneously with the opening of the Prototype Phase. The purpose of the RFI is to seek parties interested in possible teaming arrangements for production and installation of systems capable of meeting the L-Prize technical requirements. These parties may include utilities, energy service companies (ESCOs), installation contractors, academic institutions, manufacturing partners, and any other parties with interest to support the manufacture, deployment, and/or installation of lighting systems meeting the L-Prize requirements. A teaming partner list will be created as a resource that competitors may use to identify any partners they wish to team with in the Manufacturing and Installation Phase. The teaming partner RFI will be kept open throughout the duration of the L-Prize. The teaming partner list will be posted publicly at https://www.herox.com/LPrize/resources and regularly updated.

7. IMPORTANT DATES

Opening Date	Deadline or Closing Date	Event
May 17, 2021		L-Prize launches Concept Phase opens for submissions (open for 6 months) Comment period opens for feedback on requirements and timelines of subsequent (Prototype and Manufacturing and Installation) phases (open for 60 days)
	July 16, 2021	Comment period for subsequent phases closes
	Nov. 19, 2021, 5 p.m. ET	Concept Phase submissions due
	Jan. 19, 2022	Concept Phase winners announced
Feb. 15, 2022		Prototype Phase opens for submissions (open for 10 months) Teaming RFI opens (open until end of L-Prize competition)
	March 15, 2022	First list of RFI teaming partners posted; updated monthly until end of L-Prize competition
	May 15, 2022	Intent to Submit forms due
	Dec. 15, 2022	Prototype Phase submissions due
	Feb. 2023	Prototype Phase winners announced
March 2023		Manufacturing and Installation Phase opens for submissions (open for 15 months)
	Oct. 2023	Intent to Submit forms due
	July 2024	Manufacturing and Installation Phase submissions due
	Dec. 2024	Manufacturing and Installation Phase winners announced

Table 2: L-Prize Competition Timeline

All dates are subject to change including contest openings, deadlines, and announcements. Sign up for updates at https://www.herox.com/lprize.

8. CONTEST RULES

The L-Prize seeks to incentivize the creation of lighting systems that demonstrate exceptional performance in four technical areas: efficacy, quality of light, connectivity features, and product life cycle. In all three phases, or contests, additional points will be awarded for technical and DEI innovation. Lighting systems must also meet or exceed U.S. content, production, and installation requirements in the Manufacturing and Installation Phase. There are technology and performance trade-offs across each of the technical areas. For example, maximizing luminous efficacy typically has a negative impact on lighting color quality, and vice versa. The L-Prize aims to drive technology innovations to overcome these technical trade-offs and realize exceptional performance in all areas. Winners of the Prototype Phase as well as the Manufacturing and Installation Phase must meet minimum technical performance requirements for all mandatory items listed in Figure 4. Detailed requirements and available points can be found in Appendices A and B.

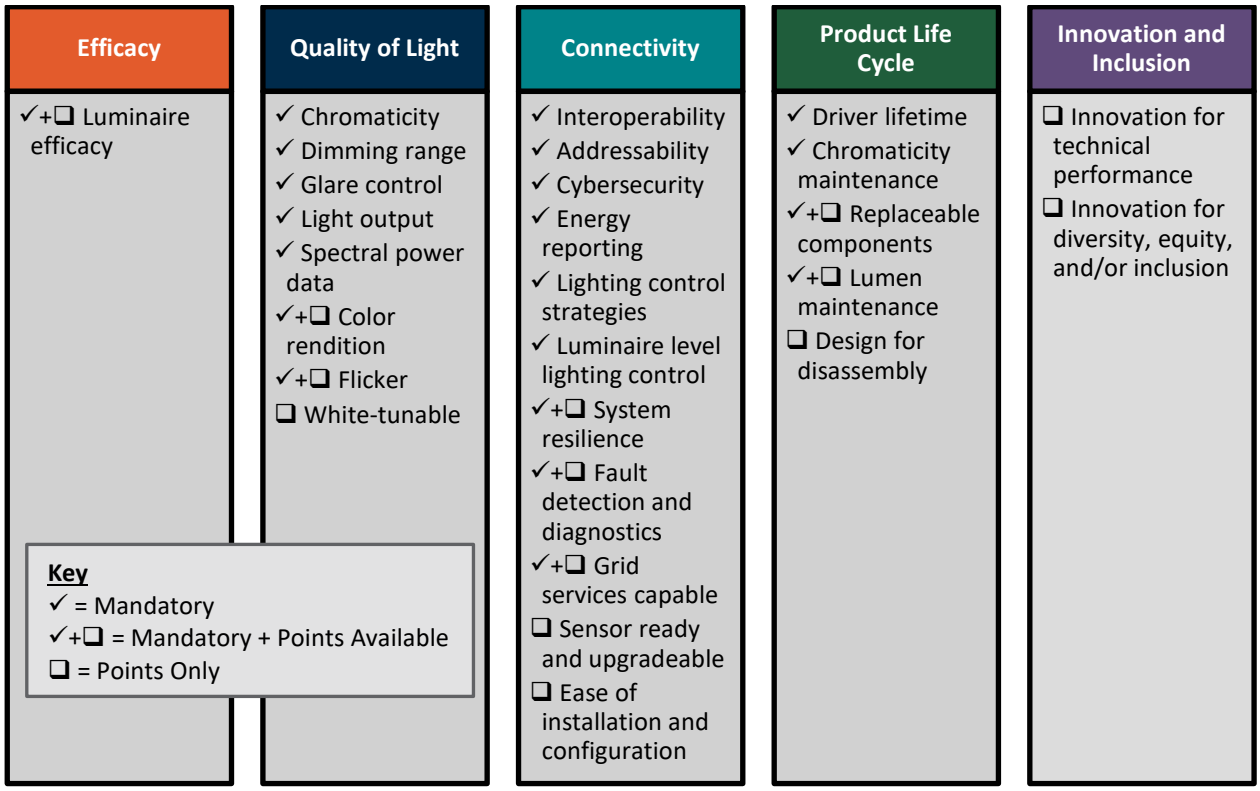

Figure 4: L-Prize topics and requirements

9. L-PRIZE ROLES

The following roles are referenced throughout this document.

Prize Administrator – Prize administration will be carried out by the National Renewable Energy Laboratory (NREL), which hosts the American Made Challenges website, and the Pacific Northwest National Laboratory (PNNL), which is responsible for the technical requirements and evaluation process.

Expert Reviewer Panel – A panel composed of non-federal officers will review and score entries submitted under this competition to determine whether the submitted system meets the L-Prize requirements detailed in this document, and then recommend winners to DOE. The Expert Reviewer Panel is composed of individuals who collectively are knowledgeable about lighting science, SSL technologies, engineering, energy efficiency, connected/networked lighting, product life cycle considerations, and lighting manufacturing.

Judge –The director of the Building Technologies Office within the DOE Office of Energy Efficiency and Renewable Energy will select the winners for each phase of the L-Prize, based on the evaluation criteria set out in these rules.

II. CONCEPT PHASE

Any eligible competitor can participate in and enter a submission package to compete in the L-Prize Concept Phase. Competitors must register at https://www.herox.com/lprize and submit entries by the deadline. Participation in the Concept Phase is not required to enter any subsequent phases. The following rules are for competitors participating in the Concept Phase.

Concept Phase Prizes

- Up to 10 winners
- $20,000 per winner (up to $200,000 total)

1. SUMMARY

In the Concept Phase, competitors design concept systems that meet energy efficiency, lighting quality, connectivity, and product life cycle requirements exceeding those of currently available products, while considering innovations for diversity, equity, and inclusion. Competitors will think beyond current constraints on lighting innovation, such as cost, form factor, materials, and system integration. In the Concept Phase, competitors will submit documentation of their concept systems, which will reference the L-Prize technical requirements listed in Appendix A. Competitors may participate only in the Concept Phase if desired—participation in subsequent phases is not required. Concepts submitted before the deadline will be scored by the Expert Reviewer Panel based on the requirements outlined below. The Judge will select up to 10 winning concepts, each of which will qualify for a $20,000 cash award.

2. PROCESS

The Concept Phase comprises four important steps:

1. **Registration:** Eligible competitors must register to participate at https://www.herox.com/lprize.

2. **Submission:** Competitors submit entries through HeroX before the Concept Phase deadline (see Table 2).

3. **Evaluation:** Each entry will be reviewed and scored by the Expert Reviewer Panel using the judging criteria described in Subsection 6: SUBMISSION EVALUATION.

4. **Announcement:** The Prize Administrator will notify winners and request the necessary information (IRS W-9 form, ACH form, and Prize Acceptance Form) to distribute cash prizes. The Prize Administrator will then publicly announce winners.

The process for the Concept Phase is outlined in Figure 5 below. See Table 2 for details.

Figure 5: Process and timeline for the Concept Phase.

3. PRIZES

The Concept Phase offers up to 10 cash prizes of $20,000 each. DOE reserves the right to select fewer than 10 winners.

4. HOW TO ENTER

Interested teams must register at https://www.herox.com/lprize. To enter a submission package, you must create an account on HeroX and register for the L-Prize competition. Early registration is strongly encouraged to receive important L-Prize updates and event invitations.

5. WHAT TO SUBMIT

A complete submission package for the Concept Phase should include the following:

- Cover page, which may be released to the public by DOE
- PowerPoint summary slide, which may be released to the public by DOE
- Completed Concept Phase Technical Performance and Scoring Form
- Description of key innovations and features
- Concept drawings
- System one-line diagram
- Projected cost estimate and bill of materials for the concept luminaire (optional)

Descriptions of each submission element are provided below.

Cover Page (to be made public)

Competitors must create a one-page PDF cover page with the following basic information:

- Project title
- Short description
- Key project members (names, contact information, and links to LinkedIn profiles, if possible)
- Keywords that best describe your team's solution (e.g., troffer, connected, sustainable)
- City, state, and 9-digit zip code for the lead team member
- Other partners, if any

Competitors should not include any trade secrets or commercial information that is privileged or confidential on the cover page.

PowerPoint Summary Slide (to be made public)

Competitors must create a single-slide summary in PowerPoint that contains technically specific details about your submission that also can be understood by a nontechnical audience. No specific template is required, but text should be readable on a standard printout and conference-room projection. Competitors should not include any trade secrets or commercial information that is privileged or confidential on their summary slide.

Completed Concept Phase Technical Performance and Scoring Form (not public)

Competitors must complete the provided Concept Phase Technical Performance Scoring Form (available at https://www.herox.com/lprize) to document the expected technical performance of their concept, the number of expected points that would be earned by the concept, and technical justifications for the performance and points estimates claimed by the competitor.

Description of Key Innovations and Features (not public)

Competitors must provide a one-page PDF describing key innovations and features of their concept for consideration by the Expert Reviewer Panel. This document should include technical innovations and any innovations that address diversity, equity, and inclusion.

Concept Drawing(s) (not public)

Competitors must provide a PDF of up to five detailed drawings at one drawing per page showing luminaire dimensions, construction, concept material choices, and components. Drawings of control system components external to the luminaire are not required. DOE will not accept scanned handwritten drawings and will not review any drawings beyond five pages.

System One-Line Diagram (not public)
Competitors must provide a one-page PDF of a system one-line diagram conceptualizing how a typical system would be laid out for a one-story small office building, including required connected lighting system components.

Projected Cost Estimate and Bill of Materials (optional) (not public)
Competitors may submit an optional projected cost estimate and bill of materials (BOM) in PDF format to support the feasibility of their concept. The cost estimate and BOM is not required and cannot exceed five pages.

6. SUBMISSION EVALUATION

Each Concept Phase submission will be reviewed and scored by the Expert Reviewer Panel, and responses will be issued to competitors after the Concept Phase winners are announced (see Table 2 for timing). Only entries that provide all the required information and are received before the deadline will be eligible to win the Concept Phase monetary awards. Evaluation of each submission will be based on the following criteria:

- **Feasibility** – Entries will be reviewed and scored by the Expert Reviewer Panel for feasibility to develop the concept as a real product. This will include an assessment of the market relevance, materials, manufacturability, and installability of the solution based on each competitor's submitted documentation and technical approach.
- **Technical Performance** – Entries will be assessed and scored by the Expert Reviewer Panel on whether the minimum technical requirements have been met, how many points have been earned, and the competitor's technical approach and justifications for achieving the points. See Table 3 for a summary of the technical requirements and available points. See Table 4 for information about how the Expert Reviewer Panel will evaluate each competitor's points estimates in their scoring evaluation.
- **Innovation and Inclusion** – Entries will be evaluated and scored by the Expert Reviewer Panel on two criteria: 1) innovative concepts, features, or approaches to achieve or go beyond the technical requirements in the areas of efficacy, quality of light, connectivity, life cycle impacts, and/or supply chain innovation; and 2) innovation or means of addressing diversity, equity, and/or inclusion. Examples of technical innovation areas of interest to DOE include but are not limited to innovations that achieve excellent optical control and distribution of light while achieving high efficacy; innovations that improve ease of installation, commissioning, and use of the system; and use of recycled, bioderived, or low-toxicity materials. Examples of innovation for diversity, equity, and inclusion include but are not limited to teams led by minority-owned businesses, teams from Minority-Serving Institutions (MSIs) including Historically Black Colleges and Universities (HBCUs)/Other Minority Institutions (OMIs),[3] and teams from Opportunity Zones.[4] Innovations in these areas and others that

[3] MSIs including HBCUs/OMIs are educational entities recognized by the Office of Civil Rights (OCR), U.S. Department of Education, and identified on the OCR's Department of Education U.S. accredited postsecondary minorities' institution list. See: https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html.

[4] Opportunity Zones were added to the Internal Revenue Code by section 13823 of the Tax Cuts and Jobs Act of 2017, codified at 26 U.S.C. 1400Z-1. The list of designated Qualified Opportunity Zones can be found in IRS Notices 2018-48 (PDF) and 2019-42 (PDF). Further, a visual map of the census tracts designated as Qualified Opportunity Zones may also be found at Opportunity Zones Resources. Also see frequently asked questions about Qualified Opportunity Zones.

contribute to the L-Prize goals are encouraged.

Up to 10 of the highest-scoring complete entries, as scored by the Expert Reviewer Panel according to Table 4 and selected by the Judge, will be awarded $20,000 each.

Feedback will be provided for all complete Concept Phase entries regardless of whether the competitor has won the monetary prize. The Prize Administrator intends to provide feedback to competitors after the winners of the Concept Phase are announced. This feedback is intended to help competitors who may wish to improve and iterate their submissions. The feedback provided will be the opinions of the Expert Review Panel and will not necessarily represent the opinions of DOE.

Interviews: The Prize Administrator, at its sole discretion, may decide to interview some of the Concept Phase competitors. The interviews would be held before the winners are announced and would serve to help clarify questions DOE may have. Participating in interviews is not required, and being contacted for an interview is not an indication of winning.

Final Determination: DOE's final determination of Concept Phase winners will take into account Expert Reviewer Panel scores, interview findings (if applicable), and program policy factors listed in the section ADDITIONAL TERMS AND CONDITIONS: PROGRAM POLICY FACTORS.

Concept Phase – Minimum Technical Requirements and Points Summary See Appendix A for details of each 'Minimum Requirement' and 'Possible Points'				
Category	**Topic**	**Minimum Requirement(s)**	**Possible Points**	**Total Possible Points**
Efficacy	Luminaire Efficacy	150 lm/W	Up to 10 pts. for higher efficacy performance above 150 lm/W	Up to 10 pts. possible
Quality of Light	Light Output	> 2,000 lm	n/a	Up to 8 pts. possible
	Color Rendition	Preference rating of P2, fidelity rating of F3	2 pts. for improved preference rating of P1	
	Chromaticity	4000 K, Duv between -0.006 and 0.000, chromaticity consistency within 0.0015 radius	n/a	
	White-Tunable	n/a – optional	4 pts. for white-tunable capability	
	Glare Control	UGR ≤ 19	n/a	
	Temporal Light Modulation (Flicker)	Fundamental frequency > 90 Hz, SVM ≤ 0.9	2 pts. for improved flicker performance SVM ≤ 0.4	
	Dimming Range	Dims to 5% or lower	n/a	
	Spectral Power Data (SPD)	SPD data in 5-nm increments	n/a	
Connectivity	Technical Interoperability	Complies with industry standard specification for basic network connectivity	n/a	Up to 11 pts. possible
	Application Interoperability	API required with access to zone, occupancy, faults, energy data	n/a	
	Addressability	All luminaires and devices are addressable	n/a	
	Cybersecurity	n/a – not required for Concept Phase	n/a	
	Energy Reporting	Energy reporting capability required	n/a	
	Lighting Control Strategies	Task, schedule, occupancy, daylight control required	n/a	
	System Resilience	Maintains control after temporary loss of connection to network or power	1 pt. for maintaining control after loss of connection to gateway, or next higher element in topology	
	Fault Detection and Diagnostics (FDD)	Reports basic system faults	Up to 3 pts. for advanced, predictive FDD capabilities	
	Luminaire Level Lighting Control (LLLC)	Sensor per luminaire capability required	n/a	
	Grid Services Capable	OpenADR 2.0a demand response required	Up to 4 pts. for advanced grid services capabilities using OpenADR 2.0b	
	Sensor Ready and Upgradeable	n/a – optional	1 pt. for standards-based upgradeability for advanced sensors	
	Ease of Installation and Configuration	n/a – optional	2 pts. for plug-and-play Class 2 power and data connections	
Product Life Cycle	Lumen Maintenance	L_{70} ≥ 50,000 hrs	1 pt. for L_{90} ≥ 36,000 hrs	Up to 7 pts. possible
	Chromaticity Maintenance	≤ 0.002 after 6,000 hrs	n/a	
	Driver Lifetime	≥ 50,000 hrs	n/a	
	Replaceable Components	Replaceable driver or light engine	2 pts. for replaceable LED arrays or modules, if applicable	
	Design for Disassembly (DfD)	n/a – optional	Up to 4 pts. for DfD documentation and time calculation	

Table 3: Concept Phase Minimum Technical Requirements and Points Summary

Criteria	Statements – Expert Reviewer Panel will score each statement	Scoring Approach
Technical Feasibility	The proposed concept represents a technically valid concept that is manufacturable and installable and based on reasonable technical assumptions.	Scored 0 to 3 0 = strongly disagree 1 = slightly disagree 2 = slightly agree 3 = strongly agree
	The proposed concept is relevant to commercial ambient lighting applications and meets a clear and significant market need with potential for significant market adoption.	Scored 0 to 3 0 = strongly disagree 1 = slightly disagree 2 = slightly agree 3 = strongly agree
Technical Performance	The proposed concept meets the minimum technical requirements and has well-supported technical justifications for the proposed performance.	Scored 0 to 5 0 = strongly disagree 1 = disagree 2 = slightly disagree 3 = slightly agree 4 = agree 5 = strongly agree
	The proposed concept earns points from Table 3 with well-supported technical justifications for those points. Expert Reviewers may reduce scores if they find the credibility of the technical justifications provided by competitors to be lacking.	Scored 0 to 5 0 = 0 points earned 1 = 1-5 points earned 2 = 6-10 points earned 3 = 11-15 points earned 4 = 16-20 points earned 5 = 21+ points earned
Innovation on Technical Performance and Innovation on Diversity, Equity, and Inclusion	The proposed concept includes innovative concepts, features, or approaches that achieve and go beyond the technical requirements in the areas of efficacy, quality of light, connectivity, life cycle impacts, and/or supply chain innovation.	Scored 0 to 5 0 = strongly disagree 1 = disagree 2 = slightly disagree 3 = slightly agree 4 = agree 5 = strongly agree
	The proposed concept and/or team includes aspects or innovations that address diversity, equity, and/or inclusion.	Scored 0 to 5 0 = strongly disagree 1 = disagree 2 = slightly disagree 3 = slightly agree 4 = agree 5 = strongly agree
	Highest Score Possible	**26**

Table 4: Expert Reviewer Panel Concept Phase Scoring Approach

This concludes the official rules for the L-Prize Concept Phase. The following rules for the Prototype Phase and Manufacturing and Installation Phase of this prize program are draft rules and subject to change. If you would like to make comments on the draft rules for the Prototype and Manufacturing and Installation phases, please do so in accordance with the instructions contained in the COMMENTS ON RULES section.

III. PROTOTYPE PHASE

The Prototype Phase is the second phase of the L-Prize competition. In this phase, competitors will submit working prototype lighting systems that push the boundaries of energy efficiency, quality, functionality, and sustainability.

Prototype Phase Prizes

- Up to 3 winners
- $2 million prize pool

1. SUMMARY

In the Prototype Phase, competitors create prototype systems that meet energy efficiency, lighting quality, connectivity, and product life cycle requirements exceeding those of currently available products, while considering innovations for diversity, equity, and inclusion. Competitors will submit complete prototype systems consisting of 10 luminaires and all system components and controls, allowing hands-on evaluation of all technical requirements.

2. PROCESS

The Prototype Phase comprises six steps:

1. **Registration:** Eligible competitors must register to participate at https://www.herox.com/lprize.
2. **Request for Information:** An RFI will be issued to seek parties interested in possible teaming arrangements for production and installation of systems capable of meeting the L-Prize technical requirements. See the TEAMING REQUEST FOR INFORMATION section for more information.
3. **Intent to Submit:** The Prototype Phase requires competitors to provide a completed Intent to Submit form through HeroX, due three months after phase opening (see Table 2 for timing).
4. **Submission:** The Prototype Phase requires both technical documentation and physical working prototypes to be submitted for evaluation. All documentation should be submitted through HeroX. An address for shipment of physical prototypes will be provided prior to phase opening.
5. **Evaluation:** Each prototype entry will be evaluated by the Expert Reviewer Panel. The panel will conduct both documentation and physical prototype evaluation to determine whether the submitted prototype meets the L-Prize requirements and the score achieved. The judging criteria will assess elements described in the
6. 6. SUBMISSION EVALUATION section.
7. **Announcement:** After the Prototype Phase submission evaluation (see Table 2 for timing), the Prize Administrator will notify winners and request the necessary information (IRS W-9 form, ACH Form, and Prize Acceptance Form) to distribute cash prizes. The Prize Administrator will then publicly announce winners.

The process for the Prototype Phase is outlined in Figure 6 below. See Table 2 for timing and details**.**

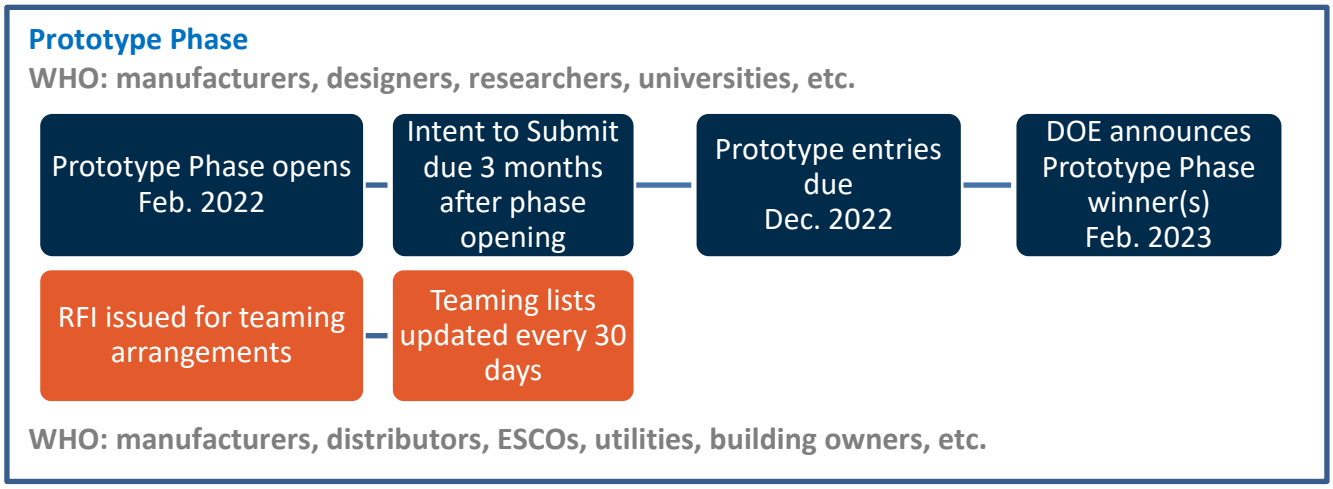

Figure 6: Process and timeline for the Prototype Phase. See Table 2 for specific timing and details.

3. PRIZES

DOE anticipates that the Prototype Phase will offer a $2 million prize pool, divided among up to three winners based on the number of points earned by each winner. The minimum prize amount for a winner of this phase is $500,000. DOE will also consider program policy factors in determining winners and prize amounts and reserves the right to select fewer than three winners. See Final Determination section below.

4. HOW TO ENTER

Interested teams must register at https://www.herox.com/lprize. To enter a submission package, you must create an account on HeroX and register for the L-Prize competition. Early registration is strongly encouraged to receive important L-Prize updates and event invitations.

5. WHAT TO SUBMIT

A complete submission package for the Prototype Phase should include the following:

- Cover page, which may be released to the public by DOE
- PowerPoint summary slide, which may be released to the public by DOE
- Technical documentation listed under “Materials to be Submitted” in Appendix A
- Completed Prototype Phase Technical Performance and Scoring Form
- Description of key innovations and features
- System one-line diagram
- Instructions for Expert Reviewer Panel
- 10 complete working physical prototype luminaires and associated connected lighting system components

Descriptions of each submission element are provided below.

Cover Page (to be made public)

Competitors must create a one-page PDF cover page with the following basic information:

- Project title
- Short description
- Key project members (names, contact information, and links to LinkedIn profiles, if possible)
- Keywords that best describe your team's solution (e.g., troffer, connected, sustainable)
- City, state, and 9-digit zip code for the lead team member
- Other partners, if any

Competitors should not include any trade secrets or commercial information that is privileged or confidential on the cover page.

PowerPoint Summary Slide (to be made public)

Competitors must create a single-slide summary in PowerPoint that contains technically specific details about your submission that also can be understood by a nontechnical audience. No specific template is required, but text should be readable on a standard printout and conference-room projection. Competitors should not include any trade secrets or commercial information that is privileged or confidential on their summary slide.

Technical Documentation Listed in Appendix A (not public)

For each technical requirement and optional point, Appendix A lists the "Materials to be submitted by competitor" for the Prototype Phase. This required information typically will be test reports based on industry standards. See Appendix A for full details. A consolidated checklist of required test reports is also provided in Appendix D for reference.

Completed Prototype Phase Technical Performance and Scoring Form (not public)

Competitors must complete the Prototype Phase Technical Performance Scoring Form (available at https://www.herox.com/lprize) to document the expected technical performance and number of points earned for their prototype submission.

Description of Key Innovations and Features (not public)
Competitors must provide a one-page PDF describing key innovations and features of their prototype for consideration by the Expert Reviewer Panel. This document should include technical innovations and any innovations that address diversity, equity, and inclusion.

System One-Line Diagram (not public)
Competitors must provide a one-page PDF of a system one-line diagram conceptualizing how a typical system would be laid out for a one-story small office building, including required connected lighting system components.

Instructions for Expert Reviewer Panel (not public)
Competitors must provide detailed instructions to the Expert Reviewer Panel for how to demonstrate or implement the required connectivity capabilities and associated points earned for the system, as applicable. If instructions are not provided or cannot be followed and the Expert Reviewer Panel is unable to verify the claimed performance, then credit and/or associated points may not be given for the claimed connectivity capability.

10 Complete Working Prototypes (not public)
Competitors must provide 10 complete working prototype luminaires and all necessary system components to physically demonstrate and implement the required system capabilities and points claimed by the competitor. This may include gateways, switches, sensors, power supplies, servers, tablets, cabling, wiring, etc., as applicable for the system being submitted. DOE will only provide basic 120V AC power wiring to assess the functionality and required capabilities of the system.

6. SUBMISSION EVALUATION

Each Prototype Phase entry will be evaluated by the Expert Reviewer Panel. The panel will conduct both documentation review and physical evaluation to determine whether the submitted prototype meets the L-Prize requirements and the score that the competitor's submission achieves. The submitted prototype system may be installed and tested in a laboratory setting to verify selected capabilities of the system and compliance with the L-Prize technical requirements shown in Table 5.

Expert Reviewer Panel Scoring Approach: Each entry will be scored by the Expert Reviewer Panel based on the number of points earned for the requirements listed in Table 5, and an additional Innovation and Inclusion score of up to 10 points for (1) innovative features or capabilities that achieve or go beyond the L-Prize technical requirements and/or (2) innovative aspects that address diversity, equity, and/or inclusion in how the solution is designed or produced. Examples of technical innovation areas of interest to DOE include but are not limited to innovations that achieve excellent optical control and distribution of light while achieving high efficacy; innovations that improve ease of installation, commissioning, and use of the system; and use of

recycled, bioderived, or low-toxicity materials. Examples of innovation for diversity, equity, and inclusion include but are not limited to teams led by minority-owned businesses, teams from MSIs including HBCUs/OMIs,[5] and teams from Opportunity Zones.[6] Innovations in these areas and others that contribute to the L-Prize goals are encouraged.

Interviews: The Prize Administrator, at its sole discretion, may decide to interview some of the Prototype Phase competitors. The interviews would be held before the winners are announced and would serve to help clarify questions DOE may have. Participating in interviews is not required, and being contacted for an interview is not an indication of winning.

Final Determination: DOE's final determination of Prototype Phase winners will take into account the highest total scores from Table 5, interview findings (if applicable), and program policy factors listed in ADDITIONAL TERMS AND CONDITIONS: PROGRAM POLICY FACTORS.

[5] Minority Serving Institutions (MSIs), including HBCUs/OMIs as educational entities recognized by the Office of Civil Rights (OCR), U.S. Department of Education, and identified on the OCR's Department of Education U.S. accredited postsecondary minorities' institution list. See: https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html.

[6] Opportunity Zones were added to the Internal Revenue Code by section 13823 of the Tax Cuts and Jobs Act of 2017, codified at 26 U.S.C. 1400Z-1. The list of designated Qualified Opportunity Zones can be found in IRS Notices 2018-48 (PDF) and 2019-42 (PDF). Further, a visual map of the census tracts designated as Qualified Opportunity Zones may also be found at Opportunity Zones Resources. Also see frequently asked questions about Qualified Opportunity Zones.

Prototype Phase – Minimum Requirements and Points Summary See Appendix A for details of each 'Minimum Requirement' and 'Possible Points'				
Category	**Topic**	**Minimum Requirement(s)**	**Possible Points**	**Total Possible Points**
Efficacy	Luminaire Efficacy	150 lm/W	Up to 10 pts. for higher efficacy performance above 150 lm/W	Up to 10 pts. possible
Quality of Light	Light Output	> 2,000 lm	n/a	Up to 8 pts. possible
	Color Rendition	Preference rating of P2, fidelity rating of F3	2 pts. for improved preference rating of P1	
	Chromaticity	4000 K, Duv between -0.006 and 0.000, chromaticity consistency within 0.0015 radius	n/a	
	White-Tunable	n/a – optional	4 pts. for white-tunable capability	
	Glare Control	UGR ≤ 19	n/a	
	Temporal Light Modulation (Flicker)	Fundamental frequency > 90 Hz, SVM ≤ 0.9	2 pts. for improved flicker performance SVM ≤ 0.4	
	Dimming Range	Dims to 5% or lower	n/a	
	Spectral Power Data (SPD)	SPD in 5-nm increments	n/a	
Connectivity	Technical Interoperability	Complies with industry standard specification for basic network connectivity	n/a	Up to 11 pts. possible
	Application Interoperability	API required with access to zone, occupancy, faults, energy data	n/a	
	Addressability	All luminaires and devices are addressable	n/a	
	Cybersecurity	n/a – not required for Prototype Phase	n/a	
	Energy Reporting	Energy reporting capability required	n/a	
	Lighting Control Strategies	Task, schedule, occupancy, daylight control required	n/a	
	System Resilience	Maintains control after temporary loss of connection to network or power	1 pt. for maintaining control after loss of connection to gateway	
	Fault Detection and Diagnostics (FDD)	Reports basic system faults	Up to 3 pts. for advanced, predictive FDD capabilities	
	Luminaire Level Lighting Control (LLLC)	Sensor per luminaire capability required	n/a	
	Grid Services Capable	OpenADR 2.0a demand response required	Up to 4 pts. for advanced grid services capabilities using OpenADR 2.0b	
	Sensor Ready and Upgradeable	n/a – optional	1 pt. for standards-based upgradeability for advanced sensors	
	Ease of Installation and Configuration	n/a – optional	2 pts. for plug-and-play Class 2 power and data connections	
Product Life Cycle	Lumen Maintenance	L_{70} ≥ 50,000 hrs	1 pt. for L_{90} ≥ 36,000 hrs	Up to 7 pts. possible
	Chromaticity Maintenance	≤ 0.002 after 6,000 hrs	n/a	
	Driver Lifetime	≥ 50,000 hrs	n/a	
	Replaceable Components	Replaceable driver or light engine	2 pts. for replaceable LED arrays or modules, if applicable	
	Design for Disassembly (DfD)	n/a – optional	Up to 4 pts. for DfD documentation and time calculation	
Innovation and Inclusion	Innovation for Technical Performance, and Innovation for Diversity, Equity, and/or Inclusion	n/a	Up to 10 pts. for submission features as scored by the Expert Reviewer Panel	Up to 10 pts. possible

Table 5: Prototype Phase Minimum Requirements and Points Summary

This section is DRAFT text. Final Manufacturing and Installation Phase rules will be published after the comment period.

IV. MANUFACTURING AND INSTALLATION PHASE

Manufacturing and Installation Phase Prizes

- Up to 2 winners
- $10 million prize pool

The Manufacturing and Installation Phase is the third and final phase of the L-Prize, which will encompass manufacturing and installation of lighting products meeting the L-Prize technical requirements. This phase of the competition recognizes U.S. manufacturing, installations, and additional life cycle and operation considerations.

1. SUMMARY

In the Manufacturing and Installation Phase, competitors earn points on the quantity of products produced and installed, weighted by U.S. content, in addition to the technical requirements and points listed in Table 6. New points opportunities are added for systems installed under a business model or contract that may include ongoing system optimization, upgrade, and/or recycling at end of life. The goal of the Manufacturing and Installation Phase is to have competitors realize the economic and energy savings benefits from the technology development fostered by the L-Prize.

2. PROCESS

The Manufacturing and Installation Phase comprises five steps:

1. **Registration:** Eligible competitors must register to participate at https://www.herox.com/lprize.

2. **Intent to Submit:** The Manufacturing and Installation Phase requires competitors to provide a completed Intent to Submit form through HeroX, due six months after phase opening (see Table 2 for timing).

3. **Submission**: The Manufacturing and Installation Phase requires both technical documentation and physical working systems to be submitted for evaluation. All documentation should be submitted through HeroX. An address for shipment of physical prototypes will be provided prior to phase opening.

4. **Evaluation:** Each entry will be evaluated by the Expert Reviewer Panel. The panel will review both documentation and physical evaluation results to determine whether the submitted system meets the L-Prize requirements and what technical score is achieved. The Expert Reviewer Panel and/or representatives of the DOE Prize Administrator will also evaluate installation site(s) and may visit the sites in person. The judging criteria will assess elements described in the 6. SUBMISSION EVALUATION section.

5. **Announcement:** After the Manufacturing and Installation Phase submission evaluation (see Table 2 for timing), the Prize Administrator will notify winners and request the necessary information (IRS W-9 form, ACH Form, and Prize Acceptance Form) to distribute cash prizes. The Prize Administrator will then publicly announce winners.

The process for the Manufacturing and Installation Phase is outlined in Figure 7 below. See Table 2 for timing and details.

This section is DRAFT text. Final Manufacturing and Installation Phase rules will be published after the comment period.

Manufacturing and Installation Phase

WHO: Individual manufacturers or teams that may include manufacturers, distributors, building owners and managers, ESCOs, as-a-service vendors, utilities, etc.

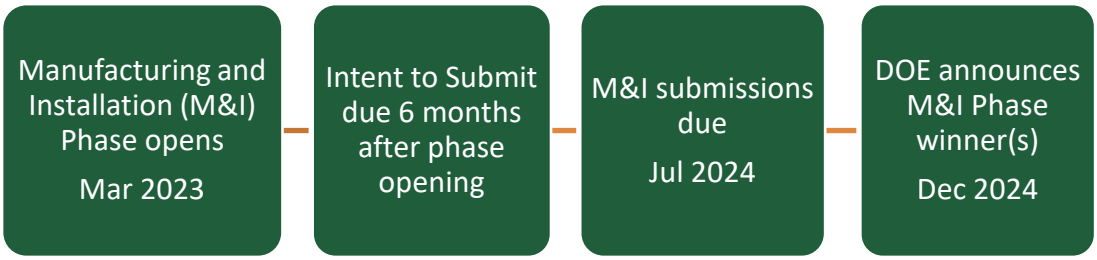

Figure 7: Process and timeline for the Manufacturing and Installation Phase. See Table 2 for specific timing and details.

3. PRIZES

DOE anticipates that the Manufacturing and Installation Phase will offer a $10 million prize pool, divided between up to two winners based on the number of points earned by each winner. The minimum prize amount for a winner of this phase is $4 million. DOE will also consider program policy factors in determining winners and prize amounts and reserves the right to select fewer than two winners. See the Final Determination section below.

4. HOW TO ENTER

Interested teams must register at https://www.herox.com/lprize. To enter a submission package, you must create an account on HeroX and register for the L-Prize competition. Early registration is strongly encouraged to receive important L-Prize updates and event invitations.

5. WHAT TO SUBMIT

A complete submission package for the Manufacturing and Installation Phase should include the following:

- Cover page, which may be released to the public by DOE
- PowerPoint summary slide, which may be released to the public by DOE
- Technical documentation listed under “Materials to be Submitted” in Appendix A
- U.S. Content, Production, and Installation and Additional Life Cycle and Operation Considerations documentation listed under ”Materials to be Submitted” in Appendix B
- Completed Manufacturing and Installation Phase Technical Performance and Scoring Form
- Description of key innovations and features
- System one-line diagram(s)
- Instructions for Expert Reviewer Panel
- 10 complete working physical luminaires and associated connected lighting system components

Descriptions of each submission element are provided below.

This section is DRAFT text. Final Manufacturing and Installation Phase rules will be published after the comment period.

Cover Page (to be made public)

Competitors must create a one-page PDF cover page with the following basic information:

- Project title
- Short description
- Key project members (names, contact information, and links to LinkedIn profiles, if possible)
- Keywords that best describe your team's solution (e.g., troffer, connected, sustainable)
- City, state, and 9-digit zip code for the lead team member
- Other partners, if any

Competitors should not include any trade secrets or commercial information that is privileged or confidential on the cover page.

PowerPoint Summary Slide (to be made public)

Competitors must create a single-slide summary in PowerPoint that contains technically specific details that also can be understood by a nontechnical audience. No specific template is required, but text should be readable on a standard printout and conference-room projection. Competitors should not include any trade secrets or commercial information that is privileged or confidential on their summary slide.

Technical Documentation Listed in Appendix A (not public)

For each technical requirement and optional point, Appendix A lists the "Materials to be submitted by competitor" for the Manufacturing and Installation Phase. This required information typically will be test reports based on industry standards. See Appendix A for full details. A consolidated checklist of required test reports is also provided in Appendix D for reference.

U.S. Content, Production, and Installation Documentation Listed in Appendix B (not public)

Appendix B lists the "Materials to be submitted by competitor" to determine the points earned by the competitor for "U.S. Content, Production, and Installations" and "Additional Life Cycle and Operation Considerations." The rules document and Appendix B will be updated with further details of this required documentation prior to the launch of the Manufacturing and Installation Phase. See Appendix B for details.

Completed Manufacturing and Installation Phase Technical Performance and Scoring Form (not public)

Competitors must complete the provided (available at https://www.herox.com/lprize) Manufacturing and Installation Phase Technical Performance Scoring Form to document the technical performance and number of points earned for their Manufacturing and Installation submission.

This section is DRAFT text. Final Manufacturing and Installation Phase rules will be published after the comment period.

Description of Key Innovations and Features (not public)
Competitors must provide a one-page PDF describing key innovations and features of their solution and installations for consideration by the Expert Reviewer Panel. This document should include technical innovations and any innovations that address diversity, equity, and inclusion.

System One-Line Diagram (not public)
Competitors must provide a one-page PDF of a system one-line diagram(s) for their installations and for a typical system that would be laid out for a three-story medium-sized office building, including required connected lighting system components.

Instructions for Expert Reviewer Panel (not public)
Competitors must provide detailed instructions to the Expert Reviewer Panel for how to demonstrate or implement the required connectivity capabilities and associated points earned for the system, as applicable. If instructions are not provided or cannot be followed and the Expert Reviewer Panel is unable to verify the claimed performance, then credit and/or associated points may not be given for the claimed connectivity capability. These instructions are in addition to the technical documentation required in Appendix A.

10 Complete Working Luminaires and Associated Connected Lighting System Components (not public)
Competitors must provide 10 complete working physical luminaires and all necessary connected lighting system components to physically demonstrate and implement the required capabilities and points claimed by the competitor. This may include gateways, switches, sensors, power supplies, servers, tablets, cabling, wiring, etc., as applicable for the system being submitted. DOE will only provide basic line-voltage 120V AC power wiring to assess the functionality and required capabilities of the system.

6. SUBMISSION EVALUATION

Each Manufacturing and Installation Phase entry will be evaluated by the Expert Reviewer Panel. The panel will conduct both documentation review and physical evaluation to determine whether the submitted system meets the L-Prize requirements and the score that the competitor's submission achieves. The submitted system may be installed and tested in a laboratory setting to verify select capabilities of the system and compliance with the L-Prize technical requirements listed in Table 6.

The U.S. content, production, and installation documentation will also be reviewed by the Expert Reviewer Panel, and in-person site visits of the installation sites may be conducted. The Expert Reviewer Panel will determine the number of U.S. content, production, and installation points earned by the competitor. The total U.S. content of the luminaire must be at least 50% and the final assembly of the luminaire (including integral subsystem components) must be in the United States. See APPENDIX B: US CONTENT, PRODUCTION, AND INSTALLATION REQUIREMENTS for further details. **Moreover, competitors must earn a minimum of 15 total**

points for the combination of "U.S. Content, Production, and Installation" and "Additional Life Cycle and Operations" as defined in Appendix B to be eligible to win the Manufacturing and Installation Phase. These minimum requirements, as well as the minimum technical specifications, must be met for a submission to be eligible.

The Expert Reviewer Panel will recommend up to two winners to the Judge that meet the L-Prize requirements and have the highest total scores.

Expert Reviewer Panel Scoring Approach: Each entry will be scored by the Expert Reviewer Panel to determine the number of points earned for the requirements listed in Table 6, which includes an innovation score of up to 10 points for (1) innovative features or capabilities that achieve or go beyond the L-Prize technical requirements and/or (2) innovative aspects that address diversity, equity, and/or inclusion in how the solution is designed, produced, deployed, and/or installed. Examples of technical innovation areas of interest to DOE include but are not limited to innovations that achieve excellent optical control and distribution of light while achieving high efficacy; innovations that improve ease of installation, commissioning, and use of the system; significant U.S. content for system components external to the luminaire; and use of recycled, bioderived, or low- toxicity materials. Examples of innovation for diversity, equity, and inclusion include but are not limited to installation in minority-owned businesses or MSIs including HBCUs/OMIs,[7] or through linkages with Opportunity Zones.[8] Innovations in these areas are encouraged. Table 5 provides a summary of available points for the Manufacturing and Installation Phase. See Appendices A and B for detailed descriptions and point requirements.

Interviews: The Prize Administrator, at its sole discretion, may decide to interview some of the Manufacturing and Installation Phase competitors. The interviews would be held before the winners are announced and would serve to help clarify questions DOE may have. Participating in interviews is not required, and being contacted for an interview is not an indication of winning.

Final Determination: DOE's final determination of L-Prize winner(s) will take into account Expert Reviewer Panel scores, interview findings (if applicable), and program policy factors listed in the ADDITIONAL TERMS AND CONDITIONS: PROGRAM POLICY FACTORS section.

[7] Minority Serving Institutions (MSIs), including HBCUs/OMIs as educational entities recognized by the Office of Civil Rights (OCR), U.S. Department of Education, and identified on the OCR's Department of Education U.S. accredited postsecondary minorities' institution list. See: https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html.

[8] Opportunity Zones were added to the Internal Revenue Code by section 13823 of the Tax Cuts and Jobs Act of 2017, codified at 26 U.S.C. 1400Z-1. The list of designated Qualified Opportunity Zones can be found in IRS Notices 2018-48 (PDF) and 2019-42 (PDF). Further, a visual map of the census tracts designated as Qualified Opportunity Zones may also be found at Opportunity Zones Resources. Also see frequently asked questions about Qualified Opportunity Zones.

This section is DRAFT text. Final Manufacturing and Installation Phase rules will be published after the comment period.

Manufacturing and Installation Phase – Minimum Requirements and Points Summary See Appendix A and B for details of each 'Minimum Requirement' and 'Possible Points'				
Category	**Topic**	**Minimum Requirement(s)**	**Possible Points**	**Total Possible Points**
Efficacy	Luminaire Efficacy	150 lm/W	Up to 10 pts. for higher efficacy performance above 150 lm/W	Up to 10 pts. possible
Quality of Light	Light Output	> 2,000 lm	n/a	Up to 8 pts. possible
	Color Rendition	Preference rating of P2, fidelity rating of F3	2 pts. for improved preference rating of P1	
	Chromaticity	4000 K, Duv between -0.006 and 0.000, chromaticity consistency within 0.0015 radius	n/a	
	White-Tunable	n/a – optional	4 pts. for white-tunable capability	
	Glare Control	UGR ≤ 19	n/a	
	Temporal Light Modulation (Flicker)	Fundamental frequency > 90 Hz, SVM ≤ 0.9	2 pts. for improved flicker performance SVM ≤ 0.4	
	Dimming Range	Dims to 5% or lower	n/a	
	Spectral Power Data (SPD)	SPD in 5-nm increments	n/a	
Connectivity	Technical Interoperability	Complies with industry standard specification for basic network connectivity	n/a	Up to 11 pts. possible
	Application Interoperability	API required with access to zone, occupancy, faults, energy data	n/a	
	Addressability	All luminaires and devices are addressable	n/a	
	Cybersecurity	3rd party certification required	n/a	
	Energy Reporting	Energy reporting capability required	n/a	
	Lighting Control Strategies	Task, schedule, occupancy, daylight control required	n/a	
	System Resilience	Maintains control after temporary loss of connection to network or power	1 pt. for maintaining control after loss of connection to gateway	
	Fault Detection and Diagnostics (FDD)	Reports basic system faults	Up to 3 pts. for advanced, predictive fault reporting capabilities	
	Luminaire Level Lighting Control (LLLC)	Sensor per luminaire capability required	n/a	
	Grid Services Capable	OpenADR 2.0a demand response required	Up to 4 pts. for advanced grid services capabilities using OpenADR 2.0b	
	Sensor Ready and Upgradeable	n/a – optional	1 pt. for standards-based upgradeability for advanced sensors	
	Ease of Installation and Configuration	n/a – optional	2 pts. for plug-and-play Class 2 power and data connections	
Product Life Cycle	Lumen Maintenance	L_{70} ≥ 50,000 hrs	1 pt. for L_{90} ≥ 36,000 hrs	Up to 7 pts. possible
	Chromaticity Maintenance	≤ 0.002 after 6,000 hrs	n/a	
	Driver Lifetime	≥ 50,000 hrs	n/a	
	Replaceable Components	Replaceable driver or light engine	2 pts. for replaceable LED arrays or modules, if applicable	
	Design for Disassembly (DfD)	n/a – optional	Up to 4 pts. for DfD documentation and time calculation	
Continues on next page				

This section is DRAFT text. Final Manufacturing and Installation Phase rules will be published after the comment period.

Continued from previous page				
Category	**Topic**	**Minimum Requirement**	**Possible Points**	**Total Possible Points**
U.S. Content, Production, and Installation	U.S. Content	Competitors must earn a minimum of 15 total points for the combination of "U.S. Content, Production, and Installation" and "Additional Life Cycle and Operations" to be eligible to win. There is an upper limit of 50 total points that can be earned for the combination of "U.S. Content, Production, and Installation" and "Additional Life Cycle and Operations." The total U.S. content of the luminaire must be at least 50% and the final assembly of the luminaire (including integral subsystem components) must be in the United States. See APPENDIX B: US CONTENT, PRODUCTION, AND INSTALLATION REQUIREMENTS for further details of these requirements.	Scaling Factor "Z" determined based on percent of U.S. content and U.S. assembly	15 pts. required, up to 50 pts. possible (upper limit)
	Production		1 pt. per 100 units produced x "Z" Scaling Factor = Total U.S. Content and Production pts.	
	U.S. Installations		1 pt. per 100 units installed in the U.S. x "Z" Scaling Factor = Total U.S. Installation pts.	
Additional Life Cycle and Operation Considerations	System Maintenance, Optimization, and Upgrade		0.25 pts. per 100 units installed under business model or contract that includes 1) ongoing system maintenance + optimization and 2) upgrade provisions	
	End-of-Life Reclaim, Recycle, or Re-use		0.25 pts. per 100 units installed under business model or contract that includes reclaim, re-use, and/or recycle provisions at end of life	
Innovation and Inclusion	Innovation for Technical Performance, and Innovation for Diversity, Equity, and/or Inclusion	n/a	Up to 10 pts. for submission features as scored by the Expert Reviewer Panel	Up to 10 pts. possible

Table 6: Manufacturing and Installation Phase Minimum Requirements and Points Summary

V. ELIGIBILITY REQUIREMENTS

1. COMPETITOR ELIGIBILITY

In addition to the minimum requirements noted for a relevant phase, all L-Prize competitors must comply with the eligibility requirements below. Eligibility is subject to verification before prizes are awarded. The registered competitor is the individual or entity that registers to compete on the HeroX website.

- Private entities must be incorporated in and maintain a primary place of business in the United States with majority domestic ownership and control.
- If a private entity seeking to compete does not have domestic ownership and control, DOE may consider issuing a waiver of that eligibility requirement where the entity submits a compelling justification; demonstrates the entity is incorporated in and maintains a primary place of business in the United States; and otherwise meets the eligibility requirements. Entities seeking a waiver should include a justification along with their submission. DOE may require additional information before making a determination on the waiver request. There are no rights to appeal DOE's decision on the waiver request. See Section VI.16 for details and instructions on seeking a waiver. Competitors can submit a waiver request at any time during any of the three phases, and DOE will make a determination independent of the submission evaluation.
- Academic and non-federal government entities must be based in the United States.
- Individuals who worked at DOE (federal employees or support service contractors) within six months prior to the submission deadline of any contest are not eligible to participate in any prize contests in this competition.
- Non-DOE federal entities and federal employees are not eligible to win any prize contests in this program.
- Employees of an organization that co-sponsors this program with DOE are not eligible to participate in any prize contests in this program.
- NREL and PNNL employees directly involved in administration of this prize are not eligible to participate in any prize contest in this program; however, NREL, PNNL, and other national laboratory employees, including laboratory researchers, may participate. They can also win a prize contest, provided they are not competing in their official capacity.
- Entities and individuals publicly banned from doing business with the U.S. government such as entities and individuals debarred, suspended, or otherwise excluded from or ineligible to participate in federal programs are not eligible to compete.
- Entities identified on a Department of Homeland Security (DHS) Binding Operational Directive (BOD) as an entity publicly banned from doing business with the United States government are not eligible to compete. See https://cyber.dhs.gov/directives.
- Entities and individuals identified as a restricted party on one or more screening lists of the departments of Commerce, State, and Treasury are not eligible to compete. See the Consolidated Screening List.
- This prize competition is expected to positively impact U.S. economic competitiveness. Participation in a foreign government talent recruitment program[9] could conflict with this objective by resulting in

9 "Foreign government talent recruitment program" is defined as an effort directly or indirectly organized, managed, or funded by a foreign government to recruit science and technology professionals or students (regardless of citizenship or national origin, and whether having a full-time or part-time position). Some foreign government-sponsored talent recruitment programs operate with the intent to import or otherwise acquire from abroad, sometimes through illicit

unauthorized transfer of scientific and technical information to foreign government entities. Therefore, individuals participating in foreign government talent recruitment programs of foreign countries of risk are not eligible to compete. Further, teams that include individuals participating in foreign government talent recruitment programs of foreign countries of risk[10] are not eligible to compete.

- As part of your submission to this prize program, you will be required to sign the following statement:

I am providing this submission package as part of my participation in this prize. I understand that by providing this submission to the federal government, I certify under penalty of perjury that the named competitor meets the eligibility requirements for this prize competition and complies with all other rules contained in the Official Rules document. I further represent that the information contained in the submission is true and contains no misrepresentations. I understand false statements or misrepresentations to the Federal Government may result in civil and/or criminal penalties under 18 U.S.C. § 1001 and § 287.

2. PROGRAM GOAL ELIGIBILITY REQUIREMENTS

Only submissions relevant to the goals of this program are eligible to compete. DOE will review all submissions to ensure that the following statements are true:

- The proposed solution realizes exceptional performance in lighting energy efficiency, lighting quality, data-driven lighting system operation, and sustainable product life cycle considerations.
- The proposed lighting system solution is appropriate for providing ambient lighting in commercial sector building interiors. The luminaires are not specifically intended for task, accent, display, outdoor, or industrial applications.
- The proposed solution represents an innovation that will move the industry beyond its current state.
- The proposed solution is not dependent on new, pending, or proposed federal, state, or local government legislation, resolutions, appropriations, measures, or policies.
- The proposed solution does not involve the lobbying of any federal, state, or local government office.
- The proposed solution is based on fundamental technical principles and is consistent with a basic understanding of the U.S. market economy.

If any of these statements are not true, the prize submission will not be scored or considered for a prize.

VI. ADDITIONAL TERMS AND CONDITIONS

1. UNIVERSAL CONTEST REQUIREMENTS

Submissions to the L-Prize Concept, Prototype, and/or Manufacturing and Installation phases are subject to the

means, proprietary technology or software, unpublished data and methods, and intellectual property to further the military modernization goals and/or economic goals of a foreign government. Many, but not all, programs aim to incentivize the targeted individual to physically relocate to the foreign state for the above purpose. Some programs allow for or encourage continued employment at U.S. research facilities or receipt of federal research funds while concurrently working at and/or receiving compensation from a foreign institution, and some direct participants not to disclose their participation to U.S. entities. Compensation could take many forms including cash, research funding, complimentary foreign travel, honorific titles, career advancement opportunities, promised future compensation, or other types of remuneration or consideration, including in-kind compensation.

[10] Currently, the list of countries of risk includes Russia, Iran, North Korea, and China.

following terms and conditions:

- Competitors must register at https://www.herox.com/lprize to participate in the L-Prize.
- The final content of your submission must be posted online at https://www.herox.com/lprize before the published deadlines for the relevant phases. Late submissions and/or any other forms of submission may be disqualified.
- The cover page and summary slide you submit will be made public.
- Submissions are not intended to be made public; however, see Subsection 10 regarding the Freedom of Information Act.
- All required submission elements must be included. The Prize Administrator may disqualify a submission after an initial screening if it fails to provide all required submission elements.
- Submissions must be in English and in a PDF format or readable by Microsoft Word. Scanned handwritten submissions will be disqualified.
- Submissions will be disqualified if they contain any matter that, in the sole discretion of the Prize Administrator, is indecent, obscene, defamatory, libelous, lacking in professionalism, or demonstrates a lack of respect for people or life on this planet.
- If a competitor clicks "Accept" on the HeroX platform and proceeds to register for any of the contests described in this document, these rules will form a valid and binding agreement between the competitor and the U.S. Department of Energy that is in addition to the existing HeroX Terms of Use for all purposes relating to these contests. You should print and keep a copy of these rules. These provisions only apply to the contests described here and no other contests on the HeroX platform or anywhere else.
- The Prize Administrator, when feasible, may give participants an opportunity to fix non-substantive mistakes or errors in their submission packages.
- For the Concept Phase, up to three submissions from the same lead organization will be accepted and each may be considered for prize awards; however, individual team members must be distinct.
- For the Prototype and Manufacturing and Installation phases, only one submission will be accepted by a single lead organization and considered for a prize award.

2. VERIFICATION FOR PAYMENTS

The Prize Administrator will verify the identity and the role of a participant potentially qualified to receive a prize. Receiving a prize payment is contingent upon fulfilling all requirements contained herein. The Prize Administrator will contact winning participants using provided email contact information after the date that results are announced. Each participant will be required to sign and return to the Prize Administrator, within 30 days of the date the notice is sent, a completed NREL Request for ACH Banking Information form, and a completed W9 form (https://www.irs.gov/pub/irs-pdf/fw9.pdf). At the sole discretion of the Prize Administrator, a winning participant will be disqualified from the competition and receive no prize funds if: (i) the person/entity cannot be contacted via the contact information provided; (ii) the person/entity fails to sign and return the required documentation within the required time period; (iii) the notification is returned as undeliverable; (iv) the submission or person/entity is disqualified for any other reason.

3. TEAMS AND SINGLE ENTITY AWARDS

The Prize Administrator will award a single dollar amount to the designated primary submitter (team leader) whether a team consists of a single entity or multiple entities. The primary submitter is solely responsible for allocating any prize funds among member participants as they deem appropriate. The Prize Administrator will not arbitrate, intervene, advise on, or resolve any matters between team members.

4. SUBMISSION RIGHTS

By making a submission and consenting to the rules of the contest, a competitor is granting to DOE, the Prize Administrator, and any other third parties supporting DOE in the contest, a license to display publicly and use the parts of the submission that are designated as "public" for governmental purposes. This license includes posting or linking to the public portions of the submission on the Prize Administrator's or HeroX's applications, on the contest website, DOE websites, and partner websites, and the inclusion of the submission in any other media, worldwide. The submission may be viewed by DOE, the Prize Administrator, and judges for purposes of the contests, including, but not limited to, screening and evaluation purposes. The Prize Administrator and any third parties acting on their behalf will also have the right to publicize competitors' names and, as applicable, the names of competitors' team members and organizations that participated in the submission on the contest website indefinitely.

Intellectual property developed by a participant in the prize competition is owned by the participant. The participant, however, is granting the Government use rights as described in this section, and to the extent that submissions are not marked, as described in Section VI.10.

5. COPYRIGHT

Each participant represents and warrants that the participant is the sole author and copyright owner of the submission; that the submission is an original work of the participant or that the participant has acquired sufficient rights to use and to authorize others, including the Prize Administrator, to use the submission, as specified throughout the rules; that the submission does not infringe upon any copyright or any other third-party rights of which the participant is aware, or should be aware; and that the submission is free of malware.

6. CONTEST SUBJECT TO APPLICABLE LAW

All contests are subject to all applicable federal laws and regulations. Participation constitutes each participant's full and unconditional agreement to these rules and administrative decisions, which are final and binding in all matters related to the contest. This notice is not an obligation of funds; the final awards are contingent upon the availability of appropriations.

7. RESOLUTION OF DISPUTES

The U.S. Department of Energy is solely responsible for administrative decisions, which are final and binding in all matters related to the contest.

Neither the U.S. Department of Energy nor the Prize Administrator will arbitrate, intervene, advise on, or resolve any matters between team members or among competitors.

8. PUBLICITY

The L-Prize Concept, Prototype, and Manufacturing and Installation phase winners (collectively, "winners") will be featured on the DOE and NREL websites.

Except where prohibited, participation in the contest constitutes each winner's consent to DOE's and its agents' use of each winner's name, likeness, photograph, voice, opinions, and/or hometown and state information for promotional purposes through any form of media worldwide, without further permission, payment, or consideration.

9. LIABILITY

Upon registration, all participants agree to assume any and all risks of injury or loss in connection with or in any way arising from participation in this contest. Upon registration, except in the case of willful misconduct, all participants agree to and, thereby, do waive and release any and all claims or causes of action against the federal government and its officers, employees, and agents for any and all injury and damage of any nature whatsoever (whether existing or thereafter arising, whether direct, indirect, or consequential, and whether foreseeable or not), arising from their participation in the contest, whether the claim or cause of action arises under contract or tort.

In accordance with the delegation of authority to run this contest delegated to the director of the Building Technologies Office, the director has determined that no liability insurance naming DOE as an insured will be required of competitors to compete in this competition per 15 USC 3719(i)(2). Competitors should assess the risks associated with their proposed activities and adequately insure themselves against possible losses.

10. RECORDS RETENTION AND FOIA

All materials submitted to DOE as part of a submission become DOE records and are subject to the Freedom of Information Act. The following applies only to portions of the submission not designated as public information in the instructions for submission: If a submission includes trade secrets or information that is commercial or financial, or information that is confidential or privileged, it is furnished to the government in confidence with the understanding that the information shall be used or disclosed only for evaluation of the submission. Such information will be withheld from public disclosure to the extent permitted by law, including the Freedom of

Information Act. Without assuming any liability for inadvertent disclosure, DOE will seek to limit disclosure of such information to its employees and to outside reviewers when necessary for review of the submission or as otherwise authorized by law. This restriction does not limit the government's right to use the information if it is obtained from another source.

Submissions containing confidential, proprietary, or privileged information must be marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the Freedom of Information Act or otherwise. The U.S. government is not liable for the disclosure or use of unmarked information, and may use or disclose such information for any purpose.

The submission must be marked as follows and identify the specific pages containing trade secrets, confidential, proprietary, or privileged information:

Notice of Restriction on Disclosure and Use of Data:

Pages [list applicable pages] of this document may contain trade secrets, confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes. [End of Notice]

The header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Trade Secrets, Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure." In addition, each line or paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets.

Competitors will be notified of any Freedom of Information Act requests for their submissions in accordance with 29 C.F.R. § 70.26. Competitors may then have the opportunity to review materials and work with a FOIA representative prior to the release of materials.

11. PRIVACY

Competitors that choose to provide HeroX with personal information by registering or completing the submission package through the contest website understand that such information will be transmitted to DOE and may be kept in a system of records. Such information will be used only to respond to competitors in matters regarding their submissions and/or the contest unless they choose to receive updates or notifications about other contests or programs from DOE on an opt-in basis. DOE, NREL, and PNNL are not collecting any information for commercial marketing.

12. GENERAL CONDITIONS

DOE reserves the right to cancel, suspend, and/or modify the contest, or any part of it, at any time. If any fraud, technical failures, or any other factor beyond DOE's reasonable control impairs the integrity or proper functioning of the contests, as determined by DOE in its sole discretion, DOE may cancel the contest.

Although DOE may indicate that it will select up to several winners for each contest, DOE reserves the right to only select competitors that are likely to achieve the goals of the program. If, in DOE's determination, no competitors are likely to achieve the goals of the program, DOE will select no competitors to be winners and will award no prize money.

ALL DECISIONS BY DOE ARE FINAL AND BINDING IN ALL MATTERS RELATED TO THE CONTEST.

13. PROGRAM POLICY FACTORS

While the scores of the Expert Reviewer Panel will be carefully considered, it is the role of DOE to maximize the impact of contest funds. Some factors outside the control of competitors and beyond the Expert Reviewer Panel's scope of review may need to be considered to accomplish this goal. The following is a list of such factors. In addition to the reviewers' scores, the program policy factors below may be considered in no particular order for determining winners and associated prize amounts:

- The level of innovation demonstrated by the proposed lighting system.
- The feasibility of the proposed lighting system.
- Geographic diversity and potential economic impact of projects.
- Whether the use of additional DOE funds and provided resources are non-duplicative and compatible with the stated goals of this program and the DOE mission generally.
- The degree to which the submission addresses diversity, equity, and/or inclusion in how the solution is designed, manufactured, and/or deployed, including but not limited to team leadership, partners, affiliations, and locations of competitors and installation sites. For example, involvement of MSIs including HBCUs/ OMIs,[11] or businesses operating from Opportunity Zones,[12] is encouraged.
- The degree to which the submission exhibits technological or programmatic diversity when compared to the existing DOE project portfolio and other competitors.
- The level of industry involvement and demonstrated ability to accelerate commercialization and overcome key market barriers.
- The degree to which the submission is likely to lead to increased employment and manufacturing in the United States or provide other economic benefit to U.S. taxpayers.
- The degree to which the activities described in the submission package to this contest have been or will be performed in the United States.
- The degree to which the submission will accelerate transformational technological, financial, or workforce advances in areas that industry by itself is not likely to undertake because of technical or financial uncertainty.
- The degree to which the submission supports complementary DOE-funded efforts or projects which, when taken together, will best achieve the goals and objectives of DOE.
- The degree to which the submission expands DOE's funding to new competitors and recipients who have not been supported by DOE in the past.
- The degree to which the submission enables new and expanding market segments.
- Whether the project promotes increased coordination with nongovernmental entities for the demonstration of technologies and research applications to facilitate technology transfer.
- Whether submission content sufficiently confirms the competitor's intent to commercialize early-stage technology and establish a viable U.S.-based business in the near future.

[11] Minority Serving Institutions (MSIs), including HBCUs/OMIs as educational entities recognized by the Office of Civil Rights (OCR), U.S. Department of Education, and identified on the OCR's Department of Education U.S. accredited postsecondary minorities' institution list. See: https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html.

[12] Opportunity Zones were added to the Internal Revenue Code by section 13823 of the Tax Cuts and Jobs Act of 2017, codified at 26 U.S.C. 1400Z-1. The list of designated Qualified Opportunity Zones can be found in IRS Notices 2018-48 (PDF) and 2019-42 (PDF). Further, a visual map of the census tracts designated as Qualified Opportunity Zones may also be found at Opportunity Zones Resources. Also see frequently asked questions about Qualified Opportunity Zones.

14. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE

DOE's administration of the L-Prize is subject to NEPA (42 USC 4321, et seq.). NEPA requires federal agencies to integrate environmental values into their decision-making processes by considering the potential environmental impacts of their proposed actions. For additional background on NEPA, please see DOE's NEPA website, http://nepa.energy.gov.

While NEPA compliance is a federal agency responsibility and the ultimate decisions remain with the federal agency, all participants in the L-Prize will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their participation in the prize competition. Participants may be asked to provide DOE with information on fabrication and testing of their device such that DOE can conduct a meaningful evaluation of the potential environmental impacts.

15. RETURN OF FUNDS

As a condition of receiving a prize, competitors agree that if the prize was awarded based on fraudulent or inaccurate information provided by the competitor to DOE, DOE has the right to demand that any prize funds or the value of other non-cash prizes be returned to the government.

16. REQUEST TO WAIVE THE "DOMESTIC OWNERSHIP AND CONTROL" ELIGIBILITY REQUIREMENT

If an entity seeking to compete as the registered competitor does not have domestic ownership and control, the entity should include a waiver request that addresses the following waiver criteria and content requirements below along with their submission. DOE may consider issuing a waiver of that eligibility requirement where the entity submits a compelling justification; the entity is incorporated in and maintains a primary place of business in the United States; and the entity otherwise meets the eligibility criteria. There are no rights to appeal DOE's decision on the waiver request.

Waiver Criteria
Entities seeking a waiver must demonstrate to the satisfaction of DOE that its participation: (1) has a high likelihood of furthering the objectives of this prize competition and (2) aligns with the best interest of U.S. industry and U.S. economic development.

Content for Waiver Request
A waiver request must include the following information:

a. Entity's name and place of incorporation;
b. The location of the entity's primary place of business;
c. A statement describing the extent to which the entity is owned or controlled by a foreign government, agency, firm, corporation, or person who is not a citizen or permanent resident of the United States, including the applicable percentage of ownership/control;
d. A compelling justification that addresses the waiver criteria stated above;
e. A description of the project's anticipated contributions to the U.S. economy;

f. A description of how the entity has benefitted U.S. research, development, and manufacturing, including contributions to employment in the United States and growth in new U.S. markets and jobs; and
g. A description of how the entity has promoted domestic manufacturing of products and/or services.

Requests should be submitted through the HeroX portal: https://www.herox.com/lprize.

APPENDIX A: L-Prize Technical Requirements

The L-Prize technical requirements are organized into four categories: efficacy, quality of light, connectivity, and product life cycle. These requirements apply to all three phases: Concept, Prototype, and Manufacturing and Installation. Each technical requirement in this appendix includes:

- Definition of the requirement
- Description of the minimum requirement
- Description of points that may be earned
- Technical materials that competitors must submit for each phase to support each requirement
- Supplemental testing guidance as required
- Referenced documents or standards.

At the start of the Concept Phase, DOE will open a comment period for feedback on the requirements of the subsequent (Prototype and Manufacturing and Installation) phases. Prior to the opening of these phases, respectively, DOE may issue revised requirements based on feedback received and prior phase experience. See Table 2 for specific dates regarding the comment period.

VII. Efficacy Requirements

Luminaire Efficacy	**The total emitted luminous flux from the luminaire divided by the total source electrical input power.**
Minimum Requirement(s) The initial luminous efficacy of each luminaire must be ≥ 150 lumens per watt.	**Possible Points** Two points **(+2)** will be awarded for each additional increment of 10 lumens per watt above 150 up to a maximum of 10 points. ≥ 160 lumens per watt = 2 additional points ≥ 170 lumens per watt = 4 additional points ≥ 180 lumens per watt = 6 additional points ≥ 190 lumens per watt = 8 additional points ≥ 200 lumens per watt = 10 additional points
Method of Evaluation For luminaires with integral power supplies that accept AC at input: The Expert Reviewer Panel will review the submitted ANSI/IES LM-79 test report(s) to verify the efficacy of the luminaire. For luminaires/systems with remote power supplies including low-voltage DC and PoE systems: The Expert Reviewer Panel will review the submitted ANSI/IES LM-79 test report(s) and remote power supply testing report to verify the efficacy of the luminaire. The efficacy of the luminaire from the LM-79 test will be multiplied by the efficiency of the remote power supply that accepts the AC line-voltage input from a building electrical system. The resulting efficacy value will be used as the actual efficacy of the competitor's submittal. See Supplemental Testing Guidance for more information.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases) For single-CCT luminaires with integral power supplies that accept AC at input: ☐ ANSI/IES LM-79 test report at 100% light output For single-CCT luminaires with remote power supplies including low-voltage DC and PoE systems: ☐ ANSI/IES LM-79 test report at 100% light output ☐ Power supply testing report For white-tunable luminaires with integral power supplies that accept AC at input: ☐ ANSI/IES LM-79 test report at 100% light output at lower end of CCT range ☐ ANSI/IES LM-79 test report at 100% light output at 25% color control input signal ±5% ☐ ANSI/IES LM-79 test report at 100% light output at 50% color control input signal ±5% ☐ ANSI/IES LM-79 test report at 100% light output at 75% color control input signal ±5% ☐ ANSI/IES LM-79 test report at 100% light output at upper end of CCT range For white-tunable luminaires with remote power supplies including low-voltage DC and PoE systems: ☐ ANSI/IES LM-79 test report at 100% light output at lower end of CCT range	

- ☐ ANSI/IES LM-79 test report at 100% light output at 25% color control input signal ±5%
- ☐ ANSI/IES LM-79 test report at 100% light output at 50% color control input signal ±5%
- ☐ ANSI/IES LM-79 test report at 100% light output at 75% color control input signal ±5%
- ☐ ANSI/IES LM-79 test report at 100% light output at upper end of CCT range
- ☐ Power supply testing report

Supplemental Testing Guidance

For luminaires/systems with remote power supplies including low-voltage DC and PoE systems, the luminaire must be LM-79 tested at the rated DC input voltage to the luminaire without the remote power supply. The resulting efficacy from this LM-79 test will be multiplied by the efficiency of a remote power supply for the system assuming 50% ± 5% loading of that power supply. A power supply testing report for a recommended power supply that would be installed with the system must be provided. This recommended power supply should be representative of a power supply that would be installed in most typical installations. The testing report may be based on benchtop testing (measurements performed by a manufacturer that are not from an accredited testing lab); however, DOE may verify the submitted testing report performance values through its own laboratory testing.

The following values must be included in the power supply testing report at (1) the maximum rated power load, (2) 75% ± 5% of maximum load, (3) 50% ± 5% of maximum load, and (4) 25% ± 5% of maximum load:

- Input power, shown to the nearest hundredth of a watt
- DC output power, shown to the nearest hundredth of a watt
- Electrical efficiency (power output divided by power consumed), shown as a percentage to two decimal places
- Power factor, shown to three significant digits
- THD of the current waveform as a percentage, shown to one decimal place.

Example testing report below:

Manufacturer Name		**Model Number**		**AC Input Voltage Range (V)**		**DC Output Voltage Range (V)**	
ABC Corp.		ABC123		120–277V		48V	
Input Voltage (V)	**Output Power Range (W)**	**Loading Percentage**	**Input Power (W)**	**DC Output Power (W)**	**Electrical Efficiency (%)**	**Power Factor**	**THD (current)**
277	30–300	100%	315.19	300.00	95.18%	0.932	5.1%
		75%	241.65	225.00	93.11%	0.928	4.1%
		50%	164.74	150.00	91.05%	0.911	4.0%
		25%	87.75	75.00	85.47%	0.908	3.8%

Using this example testing report, if an LM-79 test of the luminaire showed an efficacy of 179 lm/W, then DOE would consider the actual efficacy of the competitor's submittal to be 179 x 91.05% = 163 lm/W.

Referenced Documents

- ANSI/IES LM-79-19: *Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products*

VIII. Quality of Light Requirements

Light Output

The luminous flux output by a light source.

Minimum Requirement(s)	**Possible Points**
The initial luminous flux must be > 2,000 lumens	n/a

Method of Evaluation

The Expert Reviewer Panel will review the submitted ANSI/IES LM-79 test report(s) to confirm the light output.

Materials To Be Submitted by Competitor (CONCEPT Phase)

- ☐ Completed Concept Phase Technical Performance and Scoring Form

Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases)

For single-CCT luminaires:

- ☐ ANSI/IES LM-79 test report at 100% light output

For white-tunable luminaires:

- ☐ ANSI/IES LM-79 test report at 100% light output at lower end of CCT range
- ☐ ANSI/IES LM-79 test report at 100% light output at 25% color control input signal ±5%
- ☐ ANSI/IES LM-79 test report at 100% light output at 50% color control input signal ±5%
- ☐ ANSI/IES LM-79 test report at 100% light output at 75% color control input signal ±5%
- ☐ ANSI/IES LM-79 test report at 100% light output at upper end of CCT range

Supplemental Testing Guidance

n/a

Referenced Documents

- ANSI/IES LM-79-19: *Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products*

Color Rendition

How a light source makes the color of an object appear to human eyes and how well subtle variations in color shades are revealed.

Minimum Requirement(s)
The color rendition performance must meet a preference rating of P2 and fidelity rating of F3 in accordance with ANSI/IES TM-30-20, Annex E

Rf ≥ 85; Rf,h1 ≥ 85; Rcs,h1 ≥ -7%; Rg ≥ 92

Possible Points
Two points **(+2)** will be awarded for a preference rating of P1 and fidelity rating of F3.

Rf ≥ 85; Rf,h1 ≥ 85; Rcs,h1 ≥ -1%; Rg ≥ 95

Method of Evaluation
The Expert Reviewer Panel will review the submitted ANSI/IES LM-79 test report(s) to confirm the color rendering performance. The .SPDX data will also be evaluated to produce and check color rendering performance. The Rf; Rf,h1; Rcs,h1; and Rg values shown in the LM-79 test report should match those produced from the .SPDX data.

Materials To Be Submitted by Competitor (CONCEPT Phase)

- ☐ Completed Concept Phase Technical Performance and Scoring Form

Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING and INSTALLATION Phases)
For single-CCT luminaires:

- ☐ ANSI/IES LM-79 test report
- ☐ Full ANSI/IES TM-30 report as specified in TM-30 Annex E
- ☐ .SPDX file in accordance with IES TM-27-20

For white-tunable luminaires:

- ☐ ANSI/IES LM-79, ANSI/IES TM-30 test reports, .SPDX file at lower end of CCT range
- ☐ ANSI/IES LM-79, ANSI/IES TM-30 test reports, .SPDX file at 25% color control input signal ±5%
- ☐ ANSI/IES LM-79, ANSI/IES TM-30 test reports, .SPDX file at 50% color control input signal ±5%
- ☐ ANSI/IES LM-79, ANSI/IES TM-30 test reports, .SPDX file at 75% color control input signal ±5%
- ☐ ANSI/IES LM-79, ANSI/IES TM-30 test reports, .SPDX file at upper end of CCT range

Supplemental Testing Guidance
n/a

Referenced Documents

- ANSI/IES LM-79-19: *Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products*
- ANSI/IES TM-30-20: *IES Method for Evaluating Light Source Color Rendition*
- ANSI/IES TM-27-20: *IES Standard Format for the Electronic Transfer of Spectral Data*

Chromaticity

The quality of a color, independent of brightness.

Minimum Requirement(s)
The nominal correlated color temperature (CCT) must be 4000K as defined in ANSI C78.377-2017, except for white-tunable products.

White-tunable products must provide a range of CCT adjustment where the lower end of the range is nominal 2700K and the upper end of the range is nominal 5000K as defined in ANSI C78.377-2017.

The Duv must be between -0.006 and 0.000 as defined in ANSI C78.377-2017, except for white-tunable products.

For white-tunable products, the Duv must be between -0.006 and 0.000 at the upper and lower endpoints of the CCT range, or at five measurement points across the CCT range, as specified by the white-tunable requirement.

Chromaticity consistency: all samples must have a chromaticity within a circle with a u'v' radius of 0.0015.

Possible Points
n/a

Method of Evaluation
The Expert Reviewer Panel will review the submitted ANSI/IES LM-79 test report(s) to confirm the CCT and chromaticity coordinates.

Materials To Be Submitted by Competitor (CONCEPT Phase)

- ☐ Completed Concept Phase Technical Performance and Scoring Form

Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases)
For single-CCT luminaires:

- ☐ ANSI/IES LM-79 test report

For white-tunable luminaires:

- ☐ ANSI/IES LM-79 test report at lower end of CCT range
- ☐ ANSI/IES LM-79 test report at 25% color control input signal ±5%
- ☐ ANSI/IES LM-79 test report at 50% color control input signal ±5%

- ☐ ANSI/IES LM-79 test report at 75% color control input signal ±5%
- ☐ ANSI/IES LM-79 test report at upper end of CCT range

Supplemental Testing Guidance
n/a

Referenced Documents
- ANSI/IES LM-79-19: *Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products*
- ANSI C78.377-2017: *Electric Lamps - Specifications For The Chromaticity Of Solid-State Lighting Products*

White-Tunable

The capability to control the color temperature of a light source.

Minimum Requirement(s)
White-tunable capability is optional.

Possible Points
Four points **(+4)** will be awarded to a luminaire with white-tunable capability.
- White-tunable capability must be controlled such that the CCT and intensity can be adjusted independently by an external control device with the logic for this independent adjustment contained within the LED driver, not within the external control device.
- The upper and lower endpoints of CCT adjustment by the system must be 2700K and 5000K.
- The luminaire must meet efficacy, quality of light, and life cycle requirements at five points across the tunable range as specified within each requirement, as applicable. These five points shall be defined by the color control input signal as (1) the lower end of CCT range, (2) 25% ±5%, (3) 50% ± 5%, (4) 75% ± 5%, and (5) the upper end of CCT range. If these specific levels cannot be definitively achieved by the control, then five color control signal levels spaced as equally as possible across the control signal range must be used. The supplied signals must be recorded in a manner that supports repeatability. This methodology will be further defined by an ANSI/IES TM standard expected to be published prior to the launch of the Prototype Phase.

Method of Evaluation
The Expert Reviewer Panel will review the submitted test reports at five CCT adjustment points. See the individual Efficacy, Quality of Light, and Life Cycle requirements for specific materials to be submitted for white-tunable products.

Materials To Be Submitted by Competitor (CONCEPT Phase)
- ☐ Completed Concept Phase Technical Performance and Scoring Form

Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases)
- ☐ See individual requirements for materials to be submitted for white-tunable luminaires.

Supplemental Testing Guidance
The proposed testing approach requiring test reports at five CCT adjustment points defined by the color control signal will be fully defined in the forthcoming ANSI/IES TM-xx-xx: *Photometric and Electrical Measurements of Tunable-White Solid-State Lighting Products*. Actual testing is not required until the Prototype Phase, and DOE will update the L-Prize rules to align with this document once it is published.

Referenced Documents
- ANSI/IES LM-79-19: *Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products*
- ANSI/IES TM-xx-xx: *Photometric and Electrical Measurements of Tunable-White Solid-State Lighting Products* (forthcoming, not yet published)

Glare Control

The ability of a light source to limit discomfort glare. Discomfort from glare can cause annoyance, distraction, or discomfort but does not necessarily impair the visibility of objects.

Minimum Requirement(s)

Every unit in the test sample must have a unified glare rating (UGR) ≤ 19, per CIE 190:2010:

UGR	Discomfort Glare Criterion
19	Just acceptable
16	Perceptible
13	Just perceptible
10	Imperceptible

Possible Points

n/a

Method of Evaluation

Note: For the Manufacturing and Installation Phase, DOE is considering an alternative method to verify UGR performance based on actual UGR calculations performed at the competitor's installation site(s) as part of their submission. This alternative method would be published prior to the launch of the Manufacturing and Installation Phase. The method of evaluation described below determines UGR performance based on a reference application defined in CIE 190:2010. Competitors should use the CIE 190:2010 method described below for the Concept and Prototype phases.

CIE 190:2010 Method

The Expert Reviewer Panel will check that the .IES file matches the submitted ANSI/IES LM-79 report, assess the competitor's documented determination of luminous area contained within the .IES file for compliance with ANSI/IES LM-63, and calculate a corrected CIE 190-2010 UGR table from the submitted .IES file using Photometric Toolbox® version 2.9 or newer to confirm the submitted UGR. The corrected UGR value resulting from the Photometric Toolbox calculation using the standard conditions listed in CIE 190:2010 Section 4.2 will be used to assess whether the requirement of UGR ≤ 19 has been met. The following reference conditions will be used:

- Room dimension: X = 4H, Y = 8H
- Reflectances: 70/50/20%

See Supplemental Testing Guidance for important additional information about this requirement, and see Appendix C for requirements for .IES files and LM-79 test reports.

Materials To Be Submitted by Competitor (CONCEPT Phase)

- ☐ Completed Concept Phase Technical Performance and Scoring Form

Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases)

For single-CCT luminaires:

- ☐ ANSI/IES LM-79 test report
- ☐ .IES file in accordance with ANSI/IES LM-63
- ☐ Documented determination of luminous area
- ☐ CIE 190-2010 corrected UGR value table

For white-tunable luminaires:

- ☐ ANSI/IES LM-79 test report at highest light output of the five required CCT measurement points
- ☐ .IES file in accordance with ANSI/IES LM-63
- ☐ Documented determination of luminous area
- ☐ CIE 190-2010 corrected UGR value table

Supplemental Testing Guidance

- The goal of this requirement is to limit discomfort from glare in any winning entries.
- Due to the unique design possibilities, and the opportunity for non-uniform luminance from LED luminaires, the standard LM-63 luminous area calculation may not accurately represent the actual luminous area of the luminaire, which could contribute to an inaccurate UGR rating. The UGR calculation and resulting UGR values can be highly dependent on the luminous area value contained in the .IES file. Competitors should follow ANSI/IES LM-63-19 in determining this luminous area and are required to submit written documentation outlining and illustrating how the luminous area of the luminaire was determined. The Expert Reviewer Panel will assess the submitted luminous area determination and check that it complies with LM-63. DOE will accept luminous area determinations that appear close to the Expert Reviewer Panel's own determination based on the submitted product information. DOE may follow up with competitors when there appears to be a significant discrepancy between a competitor's determination and the Expert Reviewer Panel's determination. Competitors are recommended to select the most conservative (smallest) estimation of luminous area using LM-63.
- UGR is undefined for luminaires with 100% uplight (indirect luminaires). However, as they do not produce discomfort glare, these luminaires will be exempt from the UGR requirement.
- While the current requirements reference LM-63 for determination of luminous area, competitors should be aware that a new methodology and testing procedure for determining luminous area for UGR calculations is under development by CIE. This method is described in CIE 232-2019 Section 3.4 and may be required to be used in the Manufacturing and Installation Phase, should a testing procedure be published before the phase opens. Any revisions to rules for the Manufacturing and Installation Phase will be released before the phase opens.

Referenced Documents

- ANSI/IES LM-79-19: *Approved Method - Electrical and Photometric Measurements of Solid-State Lighting Products*
- ANSI/IES LM-63-19: *IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information*
- CIE 190-2010: *Calculation and Presentation of United Glare Rating Tables for Indoor Lighting Luminaires*
- CIE 232-2019: *Discomfort Caused by Glare from Luminaires with a Non-Uniform Source Luminance*

- Photometric Toolbox V2.9

Temporal Light Modulation (TLM, aka "flicker" waveform)

TLM is the light modulation (stimulus) that may produce unwanted visual or non-visual responses. TLM should minimize undesired visual responses of light by (direct) flicker, the stroboscopic effect, and the phantom array effect.

Minimum Requirement(s)	**Possible Points**
Every unit in the test sample must exhibit a fundamental TLM frequency > 90 Hz and a stroboscopic effect visibility measure (SVM) ≤ 0.9 at dimming levels of 100%, 50%, and the minimum dimmed light output.	Two points **(+2)** will be awarded for SVM ≤ 0.4 at dimming levels of 100%, 50%, and the minimum dimmed light output.

Method of Evaluation

The Expert Reviewer Panel will review the submitted ANSI/IES LM-90-20 testing reports at 100%, 50%, and the minimum dimmed light output.

Materials To Be Submitted by Competitor (CONCEPT Phase)

- ☐ Completed Concept Phase Technical Performance and Scoring Form

Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases)

For single-CCT luminaires:

- ☐ ANSI/IES LM-90 test report with documentation of fundamental frequency at 100% light output
- ☐ ANSI/IES LM-90 test report with documentation of fundamental frequency at 50% light output
- ☐ ANSI/IES LM-90 test report with documentation of fundamental frequency at minimum dimmed light output

For white-tunable luminaires:

- ☐ ANSI/IES LM-90 test report with documentation of fundamental frequency at 100% light output at lower end of CCT range
- ☐ ANSI/IES LM-90 test report with documentation of fundamental frequency at 50% light output at lower end of CCT range
- ☐ ANSI/IES LM-90 test report with documentation of fundamental frequency at minimum dimmed light output at lower end of CCT range
- ☐ ANSI/IES LM-90 test report with documentation of fundamental frequency at 100% light output at upper end of CCT range
- ☐ ANSI/IES LM-90 test report with documentation of fundamental frequency at 50% light output at upper end of CCT range
- ☐ ANSI/IES LM-90 test report with documentation of fundamental frequency at minimum dimmed light output at upper end of CCT range

Supplemental Testing Guidance

The minimum dimmed light output is the minimum dimming level claimed by the competitor and listed in the product literature. It should be the same minimum dimming level claimed by the manufacturer for the Dimming Range requirement.

Referenced Documents

- ANSI/IES LM-90-20: *Measuring Luminous Flux Waveforms for Use in Temporal Light Artifact (TLA) Calculations*

Dimming Range

The range over which it is possible to vary the intensity of the light output of a lamp or luminaire from a maximum to a minimum without unstable performance.

Minimum Requirement(s)	**Possible Points**
Luminaire dimming range must extend from maximum lumen output (100%) to a minimum lumen output value that is ≤ 5% of maximum lumen output. Dimming between minimum and maximum output points must be continuous. The change of chromaticity over the dimming range must be ≤ 0.004, calculated as the distance between coordinate pairs on the CIE 1976 (u',v') diagram.	n/a

Method of Evaluation

The Expert Reviewer Panel will review the submitted ANSI/IES LM-79 testing reports at 100% light output and at the minimum dimmed light output.

Materials To Be Submitted by Competitor (CONCEPT Phase)

- ☐ Completed Concept Phase Technical Performance and Scoring Form

Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases)

For single-CCT luminaires:

- ☐ ANSI/IES LM-79 test report at 100% light output
- ☐ ANSI/IES LM-79 test report at the minimum dimmed light output

For white-tunable luminaires:

- ☐ ANSI/IES LM-79 test report at 100% light output at lower end of CCT range
- ☐ ANSI/IES LM-79 test report at the minimum dimmed light output at lower end of CCT range

☐ ANSI/IES LM-79 test report at 100% light output at upper end of CCT range ☐ ANSI/IES LM-79 test report at the minimum dimmed light output at upper end of CCT range
Supplemental Testing Guidance The minimum dimmed light output is the minimum dimming level claimed by the competitor and listed in the product literature.
Referenced Documents • ANSI/IES LM-79-19: *Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products*

Spectral Power Data	**Data that represents the spectral power distribution of a light source.**
Minimum Requirement(s) Spectral power distribution (SPD) data must be provided in formats defined in both ANSI/IES TM-27-20 and ANSI/IES TM-33-18. The spectral data must be reported for 380–780 nm in ≤ 5 nm increments.	**Possible Points** n/a
Method of Evaluation The Expert Reviewer Panel will check that the competitor has provided files in compliance with the requirements.	
Materials To Be Submitted by Competitor (CONCEPT Phase) n/a	
Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases) For single-CCT luminaires: ☐ .SPDX file in accordance with ANSI/IES TM-2720 ☐ ANSI/IES TM-33 .XML document For white-tunable luminaires: ☐ .SPDX file in accordance with ANSI/IES TM-27-14 at lower end of CCT range ☐ ANSI/IES TM-33 XML document (electronic file) at lower end of CCT range ☐ .SPDX file in accordance with ANSI/IES TM-27-14 at 25% color control input signal ±5% ☐ ANSI/IES TM-33 XML document (electronic file) at 25% color control input signal ±5% ☐ .SPDX file in accordance with ANSI/IES TM-27-14 at 50% color control input signal ±5% ☐ ANSI/IES TM-33 XML document (electronic file) at 50% color control input signal ±5% ☐ .SPDX file in accordance with ANSI/IES TM-27-14 at 75% color control input signal ±5% ☐ ANSI/IES TM-33 XML document (electronic file) at 75% color control input signal ±5% ☐ .SPDX file in accordance with ANSI/IES TM-27-14 at upper end of CCT range ☐ ANSI/IES TM-33 XML document (electronic file) at upper end of CCT range	
Supplemental Testing Guidance n/a	
Referenced Documents • ANSI/IES LM-79-19: *Approved Method - Electrical and Photometric Measurements of Solid-State Lighting Products* • ANSI/IES TM-27-20: *IES Standard Format for the Electronic Transfer of Spectral Data* • ANSI/IES TM-33-18: *Standard Format for the Electronic Transfer of Luminaire Optical Data*	

IX. Connectivity Requirements

Technical Interoperability	The capability to physically connect two or more devices or systems.
Minimum Requirement(s) The lighting system must include network interfaces incorporated into system devices to enable exchange of data with other system devices. The interfaces must comply with at least one existing industry standard specification for basic physical network connectivity such as: IEEE 802.3 (Ethernet), IEEE 802.11 (Wi-Fi), IEEE 802.15.4 (ZigBee, 6LoWPAN), Bluetooth Mesh, etc.	**Possible Points** n/a
Method of Evaluation The Expert Reviewer Panel will review the manufacturer's submitted system and component literature to verify compliance with the requirements.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases) ☐ Manufacturer documentation that identifies the industry standard or specification used for physical network connectivity.	
Supplemental Testing Guidance n/a	
Referenced Documents n/a	

Application Interoperability	The capability to exchange actionable information between two or more devices or systems.
Minimum Requirement(s) The lighting system must provide an application programming interface (API) for application-level interoperability. At a minimum, the API must provide access to: 1) zone and individual luminaire occupancy data, 2) zone characteristics including luminaires within the zone and identifying characteristics about the zone (room name, space type, etc.), 3) fault detection and diagnostics (FDD) data, and 4) energy reporting data. FDD and energy reporting data must align and comply with the separate FDD and Energy Reporting requirements contained in this L-Prize rules document. The API must include developer documentation that includes at a minimum: authentication guide; API resources guidance including all endpoints, error codes, and debugging guidance; up-to-date changelog, and terms of use.	**Possible Points** n/a
Method of Evaluation The Expert Reviewer Panel will review the manufacturer's API documentation to verify compliance with the requirements. The Expert Reviewer Panel will also conduct a laboratory test to query the system API to confirm the required data is available.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases) ☐ API documentation that includes all required information listed in the Application Interoperability requirement.	
Supplemental Testing Guidance n/a	
Referenced Documents n/a	

Addressability	The capability to uniquely identify and/or address each luminaire and device digitally via software.
Minimum Requirement(s) The system must have the ability to uniquely identify and/or address each individual system device. The system must allow for configuration and reconfiguration of devices and control zones independent of electrical circuiting.	**Possible Points** n/a
Method of Evaluation The Expert Reviewer Panel will review the manufacturer's submitted system and component literature to verify compliance with the requirements.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	

Materials To Be Submitted by Competitor (PROTOTYPE Phase) ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement
Materials To Be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase) ☐ System and component literature including datasheets, installation, and configuration manuals ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement
Supplemental Testing Guidance n/a
Referenced Documents n/a

Cybersecurity	**The capability to protect networks, devices, and data from unauthorized access or malicious use.**
Minimum Requirement(s) The system must be certified by a third-party certification body for cybersecurity performance. This requirement applies only to the Manufacturing and Installation Phase and is not required for the Concept and Prototype phases. Acceptable certifications include ANSI/UL 2900-1, ANSI/ISA/IEC 62443, ioXt, UL ioT Security Rating (UL 1376), CSA Cybersecurity Verification Program (CVP) (CSA T200), and Intertek Cyber Assured.	**Possible Points** n/a
Method of Evaluation The Expert Reviewer Panel will review the letter or certificate of compliance provided by the third-party cybersecurity certification organization. The Expert Reviewer Panel may also review certification registries and request additional information as required from the competitor to verify the requirement is met.	
Materials To Be Submitted by Competitor (CONCEPT and PROTOTYPE Phases) n/a	
Materials To Be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase) ☐ Letter or certificate of compliance from third-party cybersecurity certification organization	
Supplemental Testing Guidance n/a	
Referenced Documents n/a	

Energy Reporting	**The capability of the lighting system to measure and report its own energy use.**
Minimum Requirement(s) The system must separately report energy use for every addressable system device (excluding battery-powered devices), including the energy consumed by downstream devices, if applicable. The energy data must be reported for 15-minute (or shorter) intervals and must be reported over the network interfaces, using a described data model (e.g., as documented in an API). The system must be able to store data for at least 24 months. The system must use automated energy measurement and must not use a methodology that requires manual input during system setup for accurate measurement (such as input wattage of each lamp/luminaire). Energy reporting accuracy must be specified, and the methodology for determining accuracy must be documented.	**Possible Points** n/a
Method of Evaluation The Expert Reviewer Panel will review the manufacturer's submitted system and component literature to verify compliance with the requirements. The Expert Reviewer Panel will also install the system in the laboratory and verify compliance with the requirements.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE Phase) ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement	
Materials To Be Submitted by Competitor (MANUFACTURING + INSTALLATION Phase) ☐ System and component literature including datasheets, installation, and configuration manuals ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement	
Supplemental Testing Guidance n/a	
Referenced Documents n/a	

Lighting Control Strategies	Control strategies implemented by a light system to alter its performance, usually to reduce energy consumption.
Minimum Requirement(s) The system must have the capability to implement all of the following adaptive lighting strategies: • Task tuning • Scheduling • Occupancy sensing • Daylight harvesting The system must also be capable of manual control of lighting by a building occupant.	**Possible Points** n/a
Method of Evaluation The Expert Reviewer Panel will review the manufacturer's submitted system and component literature to verify compliance with the requirements. The Expert Reviewer Panel may test these capabilities in a laboratory setting to verify compliance.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE Phase) ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement	
Materials To Be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase) ☐ System and component literature including datasheets, installation, and configuration manuals ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement	
Supplemental Testing Guidance n/a	
Referenced Documents n/a	

System Resilience	The capability of luminaires and local control devices to continue to function in the event of loss of connection to power, data network, and/or system controllers.
Minimum Requirement(s) With a loss of connection to the internet, all lighting control strategies (task tuning, scheduling, occupancy sensing, daylight harvesting, and manual control) must continue to be implemented by luminaires and associated control devices in their pre-programmed state prior to loss of connection. With loss of connection to electrical power of up to 48 hours, and upon power reconnection, all lighting control strategies must continue to be implemented by luminaires according to their configuration prior to loss of connection.	**Possible Points** One point **(+1)** will be awarded to systems that maintain control strategy implementation with loss of connection to the next higher networked element in the system's topology, such as a gateway.
Method of Evaluation The Expert Reviewer Panel will review the manufacturer's submitted system and component literature to verify compliance with the requirements. The Expert Reviewer Panel may test these capabilities in a laboratory setting by disconnecting from the internet, network, and/or electrical power to verify system resilience.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE Phase) ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement	
Materials To Be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase) ☐ System and component literature including datasheets, installation, and configuration manuals ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement	
Supplemental Testing Guidance n/a	
Referenced Documents n/a	

Fault Detection and Diagnostics (FDD)	The capability of the lighting system to identify and diagnose faults and deliver notifications to operators about them.
Minimum Requirement(s) The lighting system must have the capability to identify and report faults in the system including but not limited to device/equipment errors and loss of network communication. Methods must be provided for automatic notification of faults to building operators.	**Possible Points** One point **(+1)** will be awarded for systems that provide functionality to diagnose specific faults including, at a minimum, LED array/module failure, LED driver failure, electrical service interruption, and electrical power faults (over/under voltage and/or current). The methods to diagnose these faults must be described. Two additional points **(+2)** will be awarded for systems that provide functionality for predictive maintenance including remaining component life for LED module/board and LED driver based on measurements.
Method of Evaluation The Expert Reviewer Panel will review the manufacturer's submitted system and component literature and user interface as possible to verify compliance with the requirements. The Expert Reviewer Panel may test these capabilities in a laboratory setting to verify compliance.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE Phase) ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement	
Materials To Be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase) ☐ System and component literature including datasheets, installation, and configuration manuals ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement	
Supplemental Testing Guidance n/a	
Referenced Documents n/a	

Luminaire Level Lighting Control (LLLC)	Luminaires with integrated controls and sensors within each luminaire.
Minimum Requirement(s) Luminaires must have occupancy and ambient light sensors installed for each luminaire which must be directly integrated or embedded into the form factor during the luminaire manufacturing or assembly process.	**Possible Points** n/a
Method of Evaluation The Expert Reviewer Panel will inspect the submitted luminaire and review the manufacturer's submitted system and component literature and user interface to verify compliance with the requirements.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases) ☐ Sensor datasheet, installation, and configuration manual	
Supplemental Testing Guidance n/a	
Referenced Documents n/a	

Grid Services Capable	The capability of the lighting system to provide grid services including load shed and load modulation.
Minimum Requirement(s) The system must be able to reduce the energy consumption of the lighting system in a predefined way, on a temporary basis, in response to a signal (i.e., from a utility) without manual intervention. The method for configuring the system response must be accessible through a user interface and be specifically described. The system must be OpenADR 2.0a compliant.	**Possible Points** Two points **(+2)** will be awarded for systems that have the capability to configure the system to respond to an OpenADR 2.0b price signal with a varying system response at different price levels. The method for configuring the system response must be accessible through a user interface and be specifically described. Two additional points **(+2)** will be awarded for systems that include configuration features to facilitate meeting/maintaining occupant needs in the event of a grid services/demand response event. The system must include a configurable ramp rate and the ability to define spaces that will 1) always respond, 2) respond conditionally, and 3) never respond to a grid services/demand response event. Conditional responses must include, at a minimum, occupancy and

	daylight inputs. The method for configuring the system response must be accessible through a user interface and be specifically described.
Method of Evaluation The Expert Reviewer Panel will review the manufacturer's submitted system and component literature and user interface as possible to verify compliance with the requirements, and will verify OpenADR certification listing on the OpenADR website. The Expert Reviewer Panel may test these capabilities in a laboratory setting to verify compliance.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE Phase) ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement	
Materials to be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase) ☐ System and component literature including datasheets, installation, and configuration manuals ☐ Instructions to Expert Reviewer Panel for how to demonstrate requirement	
Supplemental Testing Guidance n/a	
Referenced Documents • OpenADR 2.0 Specifications	

Sensor Ready and Upgradeable	**The capability of the luminaire to have standardized (e.g., D4i, ANSI C137.4) power and data connections for advanced lighting sensors and other devices to be installed or upgraded at the time of installation or in the future.**
Minimum Requirement(s) Sensor Ready and Upgrade Capability is optional.	**Possible Points** One point **(+1)** will be awarded for luminaires/systems that include standardized power, data, and sensor capabilities in compliance with D4i or ANSI C137.4-202X (forthcoming) as established the Digital Illumination Interface Alliance and/or ANSI C137.4. One point **(+1)** will be awarded for luminaires that incorporate a standardized sensor port and power/data connections in compliance with Zhaga Book 20 established by the Zhaga Consortium.
Method of Evaluation The Expert Reviewer Panel will verify the LED driver used is listed on the DALI Alliance website as being D4i certified, and/or may request driver programming information. The luminaire will be inspected to verify the sensor port and keepout space dimensions are compliant with Zhaga Book 20, and the sensor connects to the driver via a D4i connection.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE Phase) n/a	
Materials To Be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase) ☐ Sensor and driver literature including datasheets and installation manuals	
Supplemental Testing Guidance n/a	
Referenced Documents • D4i • ANSI C137.4-202X (forthcoming) • Zhaga Book 20	

Ease of Installation and Reconfiguration	The capability to install and/or reconfigure luminaires and lighting devices using Class 2 wiring and connections as defined by the National Electric Code.
Minimum Requirement(s) Ease of Installation and Reconfiguration is optional.	**Possible Points** Two points **(+2)** will be awarded for systems where all power and data connections for luminaires, sensors, and any other edge devices are connected to their associated power and data source using Class 2 power sources and wiring as defined by Article 725 of the 2020 National Electric Code (NEC). The luminaire must be in compliance with NEC Article 411 and ANSI/UL 2108 for low-voltage lighting systems. An ANSI/UL 2108 certification listing is required for the Manufacturing and Installation Phase, but not the Concept and Prototype phases.
Method of Evaluation The Expert Reviewer Panel will review the manufacturer's submitted system and component literature and may conduct laboratory evaluations to check system voltages. In the Manufacturing and Installation Phase, the Expert Reviewer Panel will check for an ANSI/UL 2108 certification of the luminaire.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE Phase) ☐ Manufacturer documentation that identifies the system architecture and associated voltages	
Materials to be submitted by competitor (MANUFACTURING AND INSTALLATION Phase) ☐ System and component literature including datasheets, installation, and configuration manuals ☐ ANSI/UL 2108 certification statement	
Supplemental Testing Guidance n/a	
Referenced Documents • NFPA 70: *National Electric Code 2020* • ANSI/UL 2108: *Standard for Low Voltage Lighting Systems*	

X. Product Life Cycle Requirements

Lumen Maintenance	The elapsed operating time at which the specified percentage of the initial light output is reached, expressed in hours.
Minimum Requirement(s) The luminaire must maintain 70% of the initial light output for at least 50,000 hours. ($L_{70} \geq$ 50,000 hrs)	**Possible Points** One point **(+1)** will be awarded if 90% of the initial light output is maintained for at least 36,000 hours ($L_{90} \geq$ 36,000 hrs)
Method of Evaluation The Expert Reviewer Panel will review the submitted ANSI/IES LM-80 test report(s), ISTMT test report, and ANSI/IES TM-21 calculation to verify compliance with the requirements.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE Phase) ☐ Written technical justification that includes the expected L_{70} and L_{90} performance of the luminaire and the technical basis for the estimate. (LM-80 and ISTMT test reports are not required for the Prototype Phase to allow for LEDs that may not have completed LM-80 testing.)	
Materials To Be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase) For single-CCT luminaires: ☐ ANSI/IES LM-80 test report ☐ ISTMT test report ☐ ANSI/IES TM-21-21 calculation For white-tunable luminaires: ☐ ANSI/IES LM-80 test report for each LED type used in luminaire ☐ ISTMT test report for each LED type/module/array ☐ ANSI/IES TM-21-21 calculation for each LED type/module/array	
Supplemental Testing Guidance See Appendix C for additional information regarding the required ISTMT test.	
Referenced Documents • ANSI/IES LM-80-20: *Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules* • ANSI/IES TM-21-19: *Projecting Long-Term Lumen, Photon, and Radiant Flux Maintenance of LED Light Sources* • ANSI/IES TM-21-21 Calculator (forthcoming)	

Chromaticity Maintenance	A shift in the appearance of color of a light source that occurs over time.
Minimum Requirement(s) The change of chromaticity over the initial 6,000 hours of operation must be ≤ 0.002, calculated as the distance between coordinate pairs on the CIE 1976 (u',v') diagram.	**Possible Points** n/a
Method of Evaluation The Expert Reviewer Panel will review the submitted LM-80 report(s) to verify the chromaticity maintenance of LEDs used in the product.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE Phase) ☐ Written technical justification that includes the expected chromaticity maintenance performance of the LED(s) used in the luminaire and the technical basis for the estimate(s). (An LM-80 test report is not required for the Prototype Phase to allow for LEDs that may not have completed LM-80 testing.)	
Materials To Be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase) For single-CCT luminaires: ☐ ANSI/IES LM-80-20 test report For white-tunable luminaires: ☐ ANSI/IES LM-80-20 test report for each white LED primary used	
Supplemental Testing Guidance n/a	
Referenced Documents • ANSI/IES LM-80-20: *Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules*	

Driver Lifetime	The amount of time an LED driver is expected to perform its intended functions under a specific set of environmental, electrical, and mechanical conditions, expressed using an appropriate statistical metric.
Minimum Requirement(s) The measured temperature of the driver at the temperature measurement point (TMP) specified by the driver manufacturer and tested in-situ must be less than or equal to the maximum case temperature for which the driver is designed to last ≥ 50,000 hrs.	**Possible Points** n/a
Method of Evaluation The Expert Reviewer Panel will review the LED driver ISTMT test report and driver data sheet to verify compliance with the requirements.	
Materials To Be Submitted by Competitor (CONCEPT Phase) ☐ Completed Concept Phase Technical Performance and Scoring Form	
Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases) ☐ Driver ISTMT test report ☐ Photographic documentation of the actual thermocouple applied to the temperature measurement point with an arrow indicating the thermocouple attachment point ☐ Datasheet or documentation from the driver manufacturer that indicates the maximum case temperature for which the driver is designed to last ≥ 50,000 hours, as well as the TMP location it designates for thermal testing	
Supplemental Testing Guidance Custom and integrated drivers must provide documentation equivalent to that required for drivers from third-party vendors.	
Referenced Documents • n/a	

Replaceable Components	The ability to easily replace individual components of a luminaire without having to move or replace the entire luminaire. Examples of replaceable electronic components include LED light engines, LED arrays or modules, and LED drivers.
Minimum Requirement(s) The luminaire must include the following design features: • LED light engine, LED driver, and/or LED control circuitry if separate from driver or light engine (as defined in ANSI/IES LS-1-20) are replaceable. • The product design allows for ease of replacement of these electronic components (using conventional, readily available tools) while the luminaire remains in place.	**Possible Points** Two points **(+2)** will be awarded for luminaires that include LED arrays or modules (as defined in ANSI/IES LS-1-20) that are easily replaceable. The array or module must be easily accessible and replaceable using conventional, readily available tools, while the luminaire remains in place.

• Permanent labeling is located on the luminaire itself to indicate that the luminaire is modular and capable of upgrades. Other labels indicate who can make the component replacement (end-user vs. qualified technician). Competitors must provide a list of each electronic component in the luminaire and identify which are replaceable.	

Method of Evaluation

Competitor will document and report each of the required design features and detail the replaceability or lack thereof of all electronic components, by providing drawings and written instructions for replacing components.

The Expert Reviewer Panel will follow submitted literature to attempt to access components, to evaluate accessibility and replaceability, and may follow up or make their own assessments regarding replaceability. The following areas will be evaluated:

- For components intended to be replaced — ease of access and component replacement
- Clarity and completeness of written instructions
- Clarity and completeness of labeling on the luminaire

Documentation must clearly identify the labeling used and show how the components are replaceable, meeting the criteria laid out in these rules.

Materials To Be Submitted by Competitor (CONCEPT Phase)

- ☐ Completed Concept Phase Technical Performance and Scoring Form

Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases)

- ☐ Drawings and written instructions for replacing components, which document and report each of the required design features and detail the replaceability or lack thereof of all electronic components.

Supplemental Testing Guidance

n/a

Referenced Documents

- ANSI/IES LS-1-20: *Lighting Science: Nomenclature and Definitions for Illuminating Engineering*

Design for Disassembly (DfD)

A product development process that allows for upgradeability in the use phase (longer lifetimes) and reuse/recycling/remanufacturing of all components in the end-of-life (EoL) phase. The goal of this requirement is for designers and manufacturers to engineer products with DfD and EoL considerations in mind. At EoL, it should be easy for a laborer to separate e-waste as well as materials that could be reused, remanufactured and/or recycled.

Minimum Requirement(s)

Design for Disassembly is optional.

Possible Points

Three points **(+3)** will be awarded for a luminaire with a completed DfD calculation process using one of the method(s) listed below. If the competitor plans to use Option 3, the reasons for the alternative must be clearly documented:

- Option 1, recommended for both Prototype and Manufacturing and Installation phases: Kroll and Hanft (1998) Disassembly Evaluation Chart (intended as a tool for product designers, during the early design process)
- Option 2, recommended for Manufacturing and Installation Phase only: Disassembly Effort Index (DEI) from Das et al. 2000 (best if a prototype is already available)
- Option 3: Competitors can propose to use an alternative published and peer reviewed DfD assessment protocol that is based on absolute metrics (ex. time has been acknowledged as a valid indicator of disassemblability and disassembly modelling). The goal of the DfD assessment protocol must be improved design for recycling, maintenance, enhance serviceability and/or to affect end-of-life (EOL) objectives.

One additional point **(+1)** will be awarded for permanent labeling located on the luminaire components to indicate best practice for reuse, recycling, or disposal. Documentation must also be provided outlining the approach to labeling and showing the actual labeling used on the luminaire.

Method of Evaluation

The Expert Reviewer Panel will review and assess the DfD documentation supplied from the competitor as well as any labeling provided on the luminaire. It is assumed that if a team completes the DfD calculation and evaluation process, and provides the requested drawings or written documentation, they have spent time considering and implementing the EoL and DfD criteria, which is the goal of this requirement. DOE reserves the right to review and assess the documentation for increased ability for the luminaire to be disassembled at end of life and may conduct further investigation or interviews related to the DfD process.

Materials To Be Submitted by Competitor (CONCEPT Phase)

- ☐ Completed Concept Phase Technical Performance and Scoring Form

Materials To Be Submitted by Competitor (PROTOTYPE and MANUFACTURING AND INSTALLATION Phases)

- ☐ **Option 1 – Kroll and Hanft 1998 results and assessment**

This system uses a spreadsheet-like chart and a catalog of difficulty ratings for common manual disassembly tasks. Competitors must supply a written document outlining the scoring process (including any special cases, comments, assumptions made, or lessons learned), any weaknesses discovered in the design, iterations in the design or engineering process that resulted from the DfD process, and final scoring (design effectiveness and disassembly time(s)). Documentation must also include any relevant materials such as disassembly instructions and outline any innovations that would allow for ease of disassembly at EoL. The Expert Reviewer Panel will review the submitted documentation but will not compare the final scoring numbers against other products. The panel will review the written documentation, scoring chart, and other requested documentation to evaluate what modifications were made during the design process to improve the ability of the product to be disassembled.

- ☐ **Option 2 – Disassembly Effort Index (DEI) results and assessment**

This system uses a DEI scoring card (an example is provided in the Das et al. 2000 paper). Competitors must supply a written document outlining the DEI scoring process (including any assumptions made or lessons learned), any iterations in the design or engineering process that resulted from the DfD process, and final DEI scoring. The document must also include the calculated cost factor (C_d) and any assumptions or results from that process. Documentation must also include relevant materials such as disassembly instructions and outline any innovations that would allow for ease of disassembly at EoL. The Expert Reviewer Panel will review the submitted documentation but will not compare the final scoring numbers against other products. The panel will review the written documentation, scoring chart, and other requested documentation to evaluate what modifications were made to improve the ability of the product to be disassembled.

- ☐ **Option 3 – Competitor-selected method results and assessment**

Competitor will provide the completed evaluation calculation or chart, as well as report the approach to design for disassembly by providing drawings or written documentation. Design or engineering decisions that were modified based on the DfD process, to improve the luminaire's ability to be disassembled, should be clearly identified. Documentation must also include end-user instructions for disassembly at EoL. Competitors must provide written documentation explaining why the alternative DfD evaluation method was selected, and what the benefits of the method are. Provide any references or other background documentation, including the peer reviewed publication and or information about the history and the goals of the evaluation protocol. Documentation must also include any relevant materials such as disassembly instructions and outline any innovations that would allow for ease of disassembly at EoL. The Expert Reviewer Panel will assess the submitted documentation to evaluate what modifications were made to improve the ability of the product to be disassembled.

Supplemental Testing Guidance

n/a

Referenced Documents

- Kroll, Ehud and Thomas A. Hanft. 1998. "Quantitative Evaluation of Product Disassembly for Recycling." *Research in Engineering Design* 1–14.
- Das, Sanchoy K., Pradeep Yedlarajiah and Raj Narendra. 2000. "An approach for estimating the end-of-life product disassembly effort and cost." *International Journal of Production Research* 657–673.

Innovation and Inclusion

Innovation for technical performance and innovation for diversity, equity, and inclusion do not have specific technical requirements. The Expert Reviewer Panel will consider innovations described in the Competitor's submission in scoring these aspects as described in the Concept Phase SUBMISSION EVALUATION, Prototype Phase SUBMISSION EVALUATION, and Manufacturing and Installation Phase SUBMISSION EVALUATION sections, respectively.

APPENDIX B: U.S. Content, Production, and Installation and Additional Life Cycle and Operation Requirements (Manufacturing and Installation Phase Only)

The L-Prize manufacturing and installation requirements are organized into two categories: U.S. Content, Production, and Installation and Additional Life Cycle and Operation Considerations. These requirements apply only to the Manufacturing and Installation Phase. Competitors will earn points for production and U.S. installations, both weighted by a factor reflecting U.S. content and final assembly, and additional points for installations that incorporate provisions for system optimization and upgrade, and end-of-life. Each manufacturing and installation requirement in this appendix includes:

- Definition of the requirement
- Description of the minimum requirement
- Description of points that may be earned
- Materials that must be submitted by the competitor for each phase
- Supplemental testing guidance as required
- Referenced standards.

DOE requests feedback on these requirements during the Concept Phase. Prior to the opening of the Manufacturing and Installation Phase, DOE may issue revised requirements based on feedback received and prior phase experience. See Table 2 for specific dates regarding the comment period.

XI. U.S. Content, Production, and Installation Requirements

<table>
<tr><th>U.S. Content</th><th colspan="2">The total U.S. content of the luminaire including all integral subsystem components, represented as a percentage value “Z”. (If U.S. content is 50%, then Z=0.50. If U.S. content is 75%, then Z=0.75, etc.)</th></tr>
<tr><td colspan="2">Minimum Requirement(s)
The total US content value “Z” of the finished luminaire including all integral subsystem components must be at least 50% based on a Regional Value Content (RVC) calculation in accordance with United-States-Mexico-Canada Agreement (USMCA) Chapter 4. The final assembly of the finished luminaire (including integral subsystem components such as housing, driver, LED modules, integral sensors, optics, etc.) must be in the United States. External system devices that are external to the luminaire and connected to the luminaire only via an electrical conductor or wireless signal such as external gateways, remote sensors, and remote switches are excluded from the U.S. content calculation and the U.S. assembly requirement. Though these external devices are excluded, the Expert Reviewer Panel may award additional technical innovation points for U.S. content of external devices. Competitors should highlight any U.S. content of these external devices in their submission. Additional requirements or guidelines for the U.S. content requirements and calculation may be provided prior to the opening of the manufacturing and installation phase. DOE seeks input on the current proposed U.S. content requirements through the comment period.</td><td>Possible Points
n/a</td></tr>
<tr><td colspan="3">Method of Evaluation
The Expert Reviewer Panel will review the competitor’s determination of U.S. content percentage “Z”. The specific methodology to be used, review process, references, and required materials will be published prior to the opening of the Manufacturing and Installation Phase.</td></tr>
<tr><td colspan="3">Materials To Be Submitted by Competitor (CONCEPT and PROTOTYPE Phases)
n/a</td></tr>
<tr><td colspan="3">Materials To Be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase)
☐ TBD; will be published prior to launch of the Manufacturing and Installation Phase</td></tr>
</table>

Supplemental Testing Guidance TBD; will be published prior to launch of the Manufacturing and Installation Phase
Referenced Documents • TBD; will be published prior to launch of the Manufacturing and Installation Phase

Production	**The number of luminaire units manufactured, fully assembled, and "finished".**
Minimum Requirement(s) There is no specific requirement for number of units produced; however, there is a minimum number of total points that must be earned for U.S. Content, Production, and Installation. See 6. SUBMISSION EVALUATION section.	**Possible Points** One point **(+1)** per 100 units produced x "Z" Scaling Factor = Total U.S. Content and Production Points
Method of Evaluation The Expert Reviewer Panel and/or Prize Administrator will conduct a physical inspection to verify the number of units produced.	
Materials to be submitted by competitor (CONCEPT and PROTOTYPE Phases) n/a	
Materials to be submitted by competitor (MANUFACTURING + INSTALLATION Phase) • TBD; will be published prior to launch of the Manufacturing and Installation Phase	
Supplemental Testing Guidance TBD; will be published prior to launch of the Manufacturing and Installation Phase	
Referenced Documents • TBD; will be published prior to launch of the Manufacturing and Installation Phase	

U.S. Installations	**The number of luminaire units installed in a U.S. address. Installations at a manufacturer's own facility will not count towards the number of units.**
Minimum Requirement(s) There is no specific requirement for number of units installed; however, there is a minimum number of total points that must be earned for U.S. Content, Production, and Installation. See 6. SUBMISSION EVALUATION section.	**Possible Points** One point **(+1)** per 100 units installed in the U.S. x "Z" Scaling Factor = Total U.S. Installation Points
Method of Evaluation The Expert Reviewer Panel and/or Prize Administrator will conduct a physical inspection to verify the number of units installed.	
Materials to be submitted by competitor (CONCEPT and PROTOTYPE Phases) n/a	
Materials to be submitted by competitor (MANUFACTURING + INSTALLATION Phase) • TBD; will be published prior to launch of the Manufacturing and Installation Phase	
Supplemental Testing Guidance TBD; will be published prior to launch of the Manufacturing and Installation Phase	
Referenced Documents • TBD; will be published prior to launch of the Manufacturing and Installation Phase	

XII. Life Cycle and Operation Considerations (LCOC) Requirements

System Maintenance, Optimization, and Upgrade	**A business model or contract that includes ongoing lighting system maintenance, system optimization, and upgrade provisions for the luminaire(s) over the lifetime of the installation, including but not limited to business models such as efficiency-as-a-service and lighting-as-a-service.**
Minimum Requirement(s) There is no specific minimum requirement for system maintenance, optimization, and upgrade; however, there is a minimum number of total points that must be earned for U.S. Content, Production, and Installation. See 6. SUBMISSION EVALUATION section.	**Possible Points** 0.25 points per 100 units installed under a business model or contract that includes ongoing lighting system maintenance, optimization of the luminaire(s), and upgrade provisions for the luminaire(s) over the lifetime of the installation. The business model or contract should include provisions to allow for reduction of energy consumption over the lifetime of the installation and should support extending the useable lifetime of luminaires.
Method of Evaluation Competitor will catalog and report all installed units that meet the requirements, as well as provide contact information for the owner or	

manager (or other appropriate representative) at the installation sites. Competitor must provide a copy of the contract agreement outlining the required details. The Expert Reviewer Panel may follow up or make their own inquiries regarding the installed units and the details of the contract(s) provided.
Materials To Be Submitted by Competitor (CONCEPT and PROTOTYPE Phases) n/a
Materials To Be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase) ☐ Catalog of installed units that meet the requirements ☐ Contact information for owner or manager at the installation sites ☐ Copy of contract agreement outlining the required details
Supplemental Testing Guidance n/a
Referenced Documents n/a

End-of-Life Reclaim, Recycle, or Re-use	**A contract requiring the competitor or partner to take back the luminaire(s) at their end of life (EoL) in order to re-use or remanufacture parts and to appropriately recycle, upcycle, or dispose of any materials or e-waste that cannot be re-used.**
Minimum Requirement(s) There is no specific minimum requirement for end-of-life reclaim, recycle, and re-use; however there is a minimum number of total points that must be earned for U.S. Content, Production, and Installation. See SUBMISSION EVALUATION section.	**Possible Points** 0.25 points per 100 units installed under a business model or contract that includes reclaim and responsibility of installed luminaires(s) and provides proper and environmentally conscious recycling, re-use, upcycling, remanufacturing, and/or disposal of e-waste at EoL.
Method of Evaluation Competitor will catalog and report all installed units that meet the requirements, as well as provide contact information for the owner or manager (or other appropriate representative) at the installation sites. Competitor must provide a copy of the contract agreement outlining the required details. The Expert Reviewer Panel may follow up or make their own inquiries regarding the installed units and the details of the contract(s) provided.	
Materials To Be Submitted by Competitor (CONCEPT and PROTOTYPE Phases) n/a	
Materials To Be Submitted by Competitor (MANUFACTURING AND INSTALLATION Phase) ☐ Catalog of installed units that meet the requirements ☐ Contact information for owner or manager at the installation sites ☐ Copy of contract agreement outlining the required details	
Supplemental Testing Guidance n/a	
Referenced Documents n/a	

APPENDIX C: Testing Laboratory and Reporting Requirements

LM-79 Testing and Reporting Requirements

ANSI/IES LM-79-19 testing must be conducted, and reports must be issued, by a testing laboratory with a current accreditation for LM-79 testing from one of the following organizations:

- National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP)
- International Accreditation Service (IAS)
- National Accreditation Board for Testing and Calibration Laboratories (NABL)
- The American Association for Laboratory Accreditation (A2LA)
- Taiwan Accreditation Foundation (TAF)
- United Kingdom Accreditation Service (UKAS)

The DesignLights Consortium (DLC) maintains a current list of laboratories with these accreditations.

LM-79 test reports must include the following information:

- Electrical characteristics (wattage, input voltage, THD, and PF)
- Total luminous flux
- Luminous intensity distribution (candela array)
- Efficacy
- Chromaticity ((x,y) and (u'v'))
- CCT and Duv
- ANSI/IES TM-30-18 Full Report (per Annex D, Figure D-3) (Though it is preferred to provide this report as part of the larger LM-79 report, it is also permissible to provide the TM-30-18 report separately.)
- CIE 13.3-1995 complete Color Rendering Index detail
- .IES file (ANSI/IES LM-63-19) meeting the following requirements:
    - Test report number, test lab, issue date, manufacturer, and luminaire catalog number are correctly indicated using the keywords [TEST], [TESTLAB], [ISSUEDATE], [MANUFAC], and [LUMCAT], respectively.
    - The multiplier field must only be 1.0, i.e., the candela values must be from an actual goniophotometer test, and scaled values are not permitted.
    - The luminous intensity data shall be presented using Type C photometry format.
    - The luminous dimensions must appropriately reflect the luminous opening of the luminaire. See the Supplemental Testing Guidance section of the Glare Control requirement for more information regarding determining the luminous area.
    - The angular resolution for the luminous intensity distribution data must comply with the scanning resolution specified in Section 7.3.3 in LM-79-19 and be fine enough to accurately characterize the product's intensity distribution. For products with a wide-angle, smooth intensity distribution, the luminous intensity distribution data must be in a resolution of 5 degrees or less in the vertical plane and 22.5 degrees or less in horizontal planes. A smaller vertical angular increment must be used for products whose luminous intensity changes rapidly as a function of angle.
- Accompanying .SPDX document (IES TM-27-20) and XML document (IES TM-33-18) with spectral power distribution data from 380780 nm in ≤5 nm increments. The product model number must be present and match in both the TM-27 and LM-79 documents.

Test reports containing only a partial set of LM-79 metrics (for example, an integrating sphere test report

without luminous flux reported) will be considered incomplete.

LM-80 Testing and Reporting Requirements

ANSI/IES LM-80-20 testing must be conducted, and reports must be issued by, a testing laboratory with a current accreditation from one of the following organizations:

- National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP)
- International Accreditation Service (IAS)
- National Accreditation Board for Testing and Calibration Laboratories
- The American Association for Laboratory Accreditation (A2LA)
- Taiwan Accreditation Foundation (TAF)
- United Kingdom Accreditation Service (UKAS)

ISTMT Testing and Reporting Requirements

In-Situ Temperature Measurement Test (ISTMT) results must be from a laboratory meeting at least one of the following requirements:

- Approved by the Occupational Safety and Health Administration (OSHA) as a Nationally Recognized Testing Laboratory (NRTL). List of OSHA NRTLs.
- Approved through an OSHA NRTL data acceptance program or OSHA Satellite Notification and Acceptance Program (SNAP).
- Accredited for ANSI/UL 1598 or CSA C22.2 No. 250.0-08, including sections 19.7, 19.10-16, by an accreditation organization that is an ILAC MRA signatory.

These requirements are applicable for laboratories conducting both LED ISTMTs and driver ISTMTs.

UL 1598 testing may be used for the ISTMT report if the lab that conducted the test meets the laboratory requirements for ISTMT.