

A photograph of three people—two women and one man—collaborating at a laptop in a dimly lit room at night. The background is filled with out-of-focus city lights, creating a bokeh effect. The woman standing is pointing at the laptop screen, while the other two look on attentively.

L•PRIZE[®]

U.S. Department of Energy

L-Prize Manufacturer Webinar
July 15, 2021

Speakers



Rebecca Bennett

National Renewable
Energy Laboratory



Brian Walker

U.S. Department
of Energy



Gabe Arnold

Pacific Northwest
National Laboratory



Kate Hickcox

Pacific Northwest
National Laboratory

Housekeeping

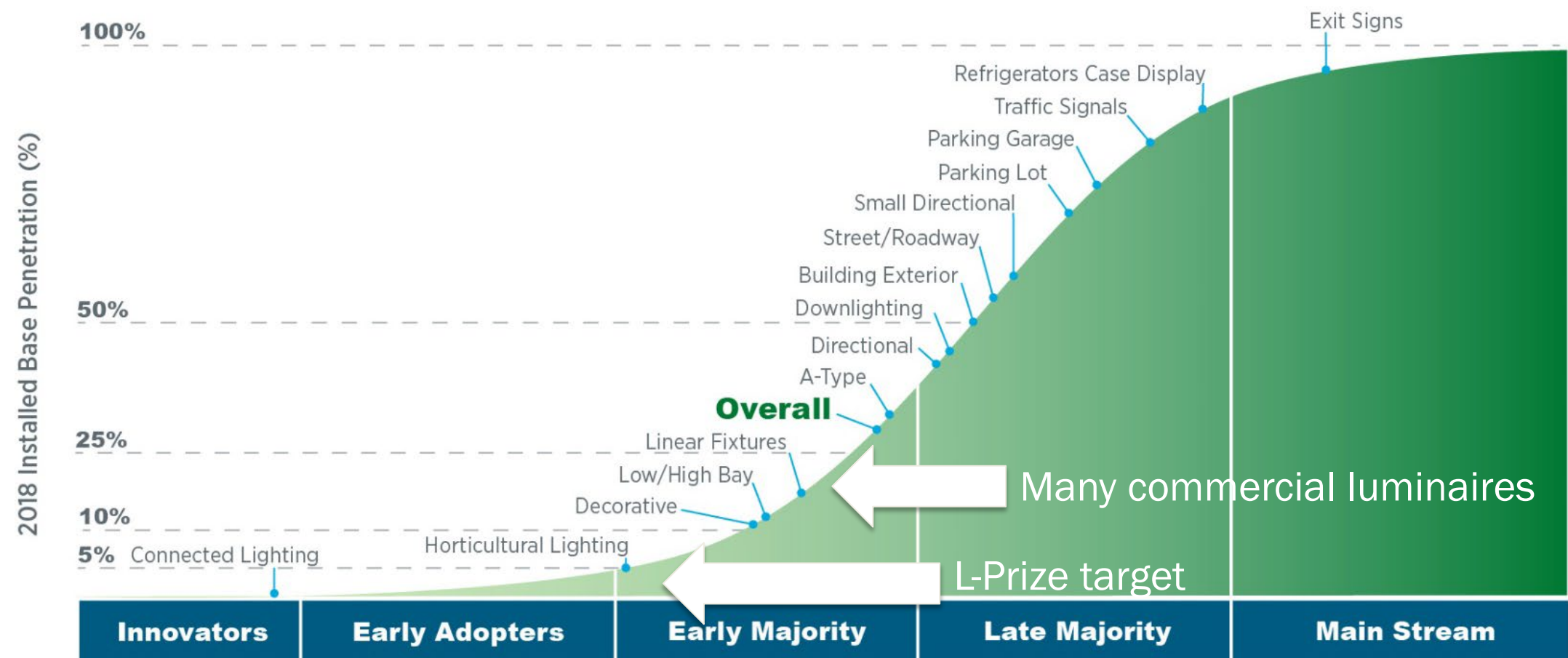
- Attendees will be on mute throughout the presentation
- If you have any questions, please type them into the Q&A panel and we will do our best to address each question
- We may be unable to answer some or all technical or teaming questions. If we are unable to answer any questions today, we will record them and post responses in the HeroX Forum: www.herox.com/LPrize/forum

L-Prize

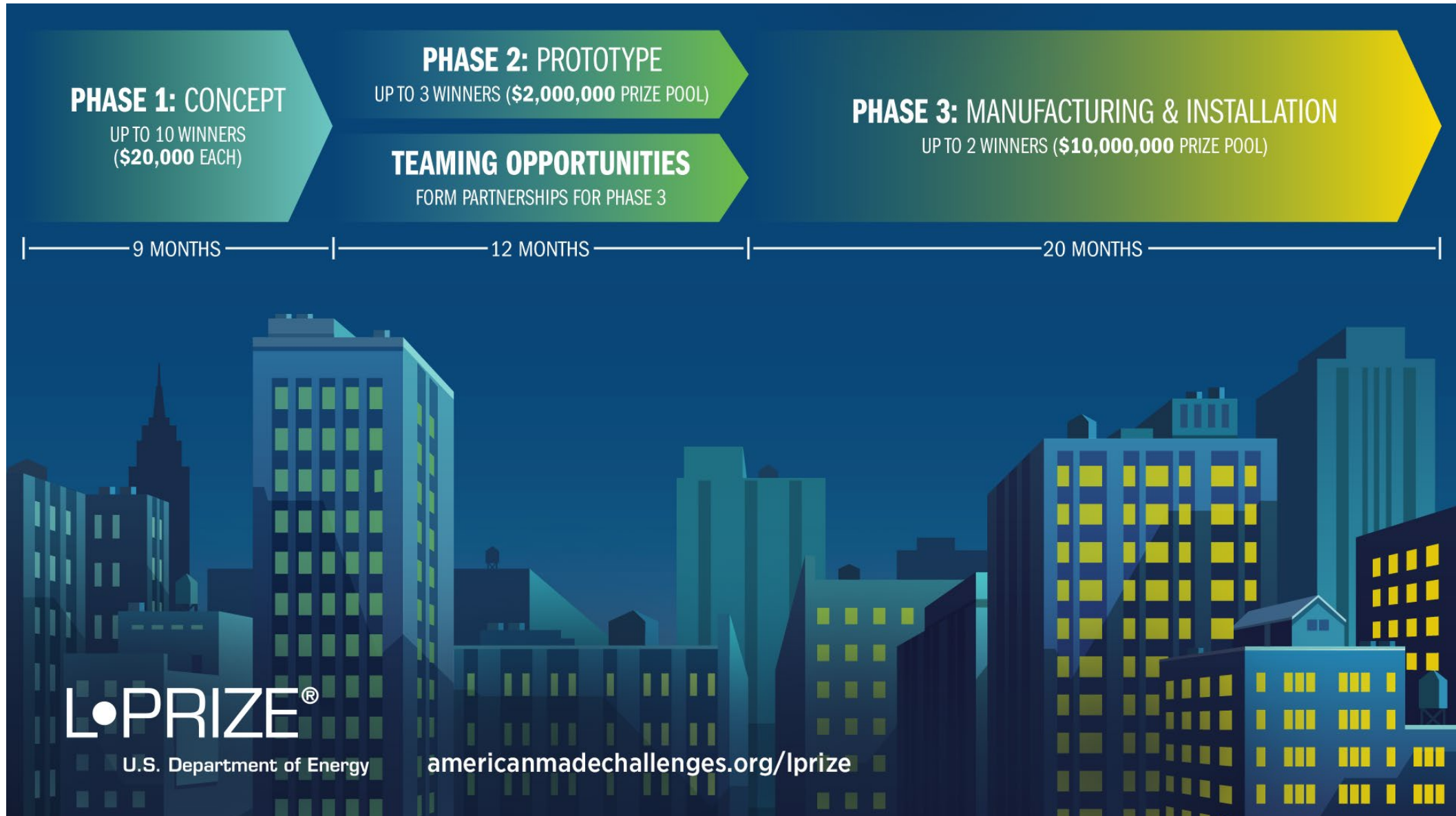
Introduction and Overview

LED Technology Shows Progress and Potential

Adoption of LED products lags in the commercial buildings sector



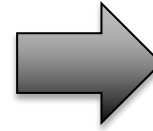
L-Prize Phases and Awards



L-Prize Innovation Goals and Focus



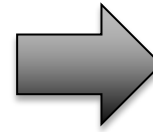
Efficacy



Increase lighting efficacy (lm/W) by 25 to 50% vs. today



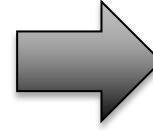
Quality of Light



Encourage lighting that reinforces health, productivity, and well-being



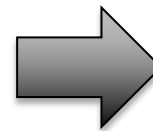
Connectivity



Integrate controls to increase energy savings and performance, enable grid flexibility



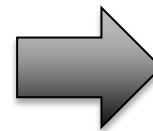
Product Life Cycle



Reduce environmental impact over life cycle with sustainable use and end of life



Innovation and Inclusion



Realize innovation for diversity, equity, and inclusion

Consistent, Challenging Technical Requirements for All Phases

Efficacy	Quality of Light	Connectivity	Product Life Cycle	Innovation and Inclusion
<ul style="list-style-type: none">✓+☐ Luminaire efficacy	<ul style="list-style-type: none">✓ Chromaticity✓ Dimming range✓ Glare control✓ Light output✓ Spectral data reporting✓+☐ Color rendition✓+☐ Flicker☐ White-tunable	<ul style="list-style-type: none">✓ Interoperability✓ Addressability✓ Energy reporting✓ Lighting control strategies✓ Luminaire-level lighting control✓+☐ System resilience✓+☐ Fault detection and diagnostics✓+☐ Grid services capable☐ Sensor ready and upgradeable☐ Ease of install and configuration	<ul style="list-style-type: none">✓ Driver lifetime✓ Chromaticity Maintenance✓+☐ Replaceable components✓+☐ Lumen maintenance☐ Design for disassembly	<ul style="list-style-type: none">☐ Technical innovation☐ Innovation for diversity, equity, and/or inclusion
<p>Key ✓ = Mandatory ✓+☐ = Mandatory + Optional Points ☐ = Optional Points Only</p>				

Manufacturing and Installation Phase

- Retains innovation requirements from prototype
- U.S. energy savings
- U.S. economic benefits
- Innovation in real products



Production



U.S. Content



U.S.
Installations

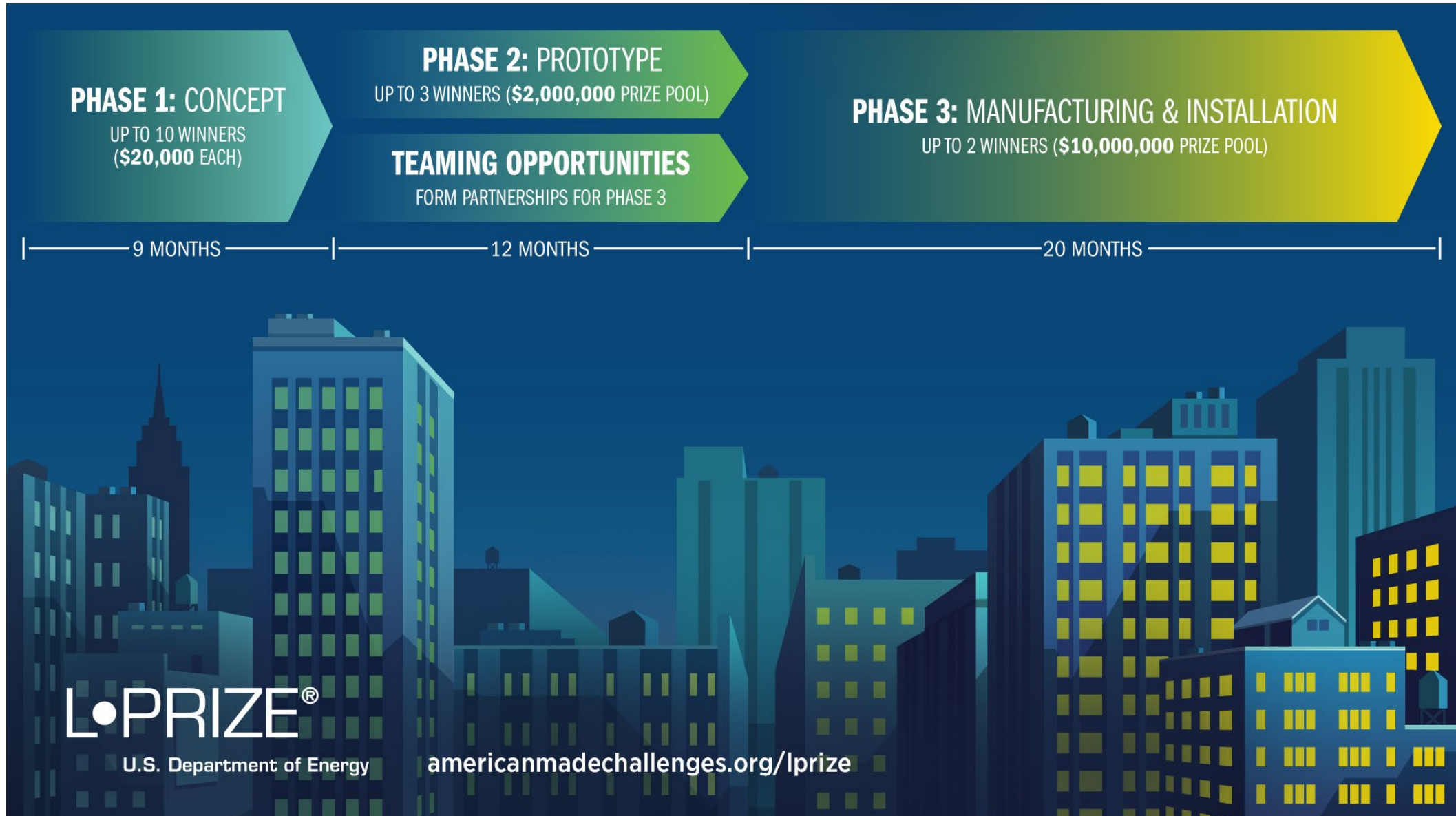
Participation Opportunities

- All contest phases are open to all innovators (researchers, universities, designers, manufacturers, etc.)
- Competitors may choose to participate in any one or any combination of phases. You are not required to participate in all three phases.
- Teaming Opportunities
 - An RFI will be issued with the Prototype Phase and kept open to identify teaming partners interested in production and installation of winning designs
 - A teaming partner list will be published and regularly updated
 - Manufacturing partners
 - ESCOs
 - Utilities
 - Installation contractors
 - Etc.

L-Prize

Technical Requirements Overview

L-Prize Phases and Awards



L-Prize Scope and Target Applications

- Light-emitting diode (LED) technology
- Complete lighting system (luminaires, sensors, control devices, interfaces)
- Commercial and institutional sector applications
- Luminaires must be appropriate for ambient lighting in building interiors such as offices, healthcare facilities, educational facilities, and other applications where linear lighting has been predominant
- Luminaires designed or intended for task, accent, display, outdoor, and industrial applications including high/low bay are not eligible
- Specific form factors are not required — innovation is welcomed

Consistent, Challenging Technical Requirements for All Phases

Efficacy	Quality of Light	Connectivity	Product Life Cycle	Innovation and Inclusion
<ul style="list-style-type: none">✓+☐ Luminaire efficacy	<ul style="list-style-type: none">✓ Chromaticity✓ Dimming range✓ Glare control✓ Light output✓ Spectral data reporting✓+☐ Color rendition✓+☐ Flicker☐ White-tunable	<ul style="list-style-type: none">✓ Interoperability✓ Addressability✓ Energy reporting✓ Lighting control strategies✓ Luminaire-level lighting control✓+☐ System resilience✓+☐ Fault detection and diagnostics✓+☐ Grid services capable☐ Sensor ready and upgradeable☐ Ease of install and configuration	<ul style="list-style-type: none">✓ Driver lifetime✓ Chromaticity Maintenance✓+☐ Replaceable components✓+☐ Lumen maintenance☐ Design for disassembly	<ul style="list-style-type: none">☐ Technical innovation☐ Innovation for diversity, equity, and/or inclusion
<p>Key ✓ = Mandatory ✓+☐ = Mandatory + Optional Points ☐ = Optional Points Only</p>				

Background and Goals for Efficacy

Up to 10 points possible

Efficacy
✓+☐ Luminaire efficacy

Increase lighting efficacy by 25–50% vs. today, combined with excellent quality of light and connectivity

- Current commercial linear LED products average 120 lm/W
- Technical potential of LED is 200+ lm/W
- L-Prize seeks innovation to address historical trade-offs between efficacy, quality of light, and connectivity
- Winning submissions will be high-efficacy with excellent color quality, glare control, flicker control, and advanced connectivity

Key

✓ = Mandatory

✓+☐ = Mandatory + Optional Points

☐ = Optional Points Only

Please see Appendix A of Official Rules for all Concept Phase requirement details: www.herox.com/LPrize/resources

Concept Technical Requirements and Points Summary (Table 3)

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	$L_{70} \geq 50,000$ hrs	1 pt. for $L_{90} \geq 36,000$ 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	

Efficacy Requirements



Category	Topic	Minimum Requirement(s)	Possible Points
Efficacy	Luminaire Efficacy	150 lm/W	Up to 10 pts. for higher efficacy performance above 150 lm/W

Please see Appendix A of Official Rules for all Concept Phase requirement details: www.herox.com/LPrize/resources

Background and Goals for Quality of Light

Up to 8 points possible

Quality of Light

- ✓ Chromaticity
- ✓ Chromaticity shift
- ✓ Dimming range
- ✓ Glare control
- ✓ Light output
- ✓ Spectral data reporting
- ✓+□ Color rendition
- ✓+□ Flicker
- White-tunable

Quality of Light impacts health, productivity, and well-being

- L-Prize will harness quality of light benefits of LED technology
- Increase the value of efficient, connected lighting
- Demonstrate that high efficacy and quality of light can go hand-in-hand
- Winning submissions will have excellent color quality, glare control, and flicker control, and provide the spectral data to support future light and health applications

Key

✓ = Mandatory

✓+□ = Mandatory + Optional Points

□ = Optional Points Only

Please see Appendix A of Official Rules for all Concept Phase requirement details: www.herox.com/LPrize/resources

Quality of Light Requirements

8 pts.
possible

Category	Topic	Minimum Requirement(s)	Possible Points
Quality of Light	Light Output	> 2,000 lm	n/a
	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 \leq 19	n/a
	Temporal Light Modulation (Flicker)	Fundamental frequency > 90 Hz, SVM \leq 0.9	2 pts. for improved flicker performance SVM \leq 0.4
	Dimming Range	Dims to 5% or lower	n/a
	Spectral Power Data (SPD)	SPD data in 5-nm increments	n/a

Please see Appendix A of Official Rules for all Concept Phase requirement details: www.herox.com/LPrize/resources

Background and Goals for Connectivity

Up to 11 points possible

Connectivity
<div>✓ Interoperability</div> <div>✓ Addressability</div> <div>✓ Energy reporting</div> <div>✓ Lighting control strategies</div> <div>✓ Luminaire-level lighting control</div> <div>✓+<input type="checkbox"/> System resilience</div> <div>✓+<input type="checkbox"/> Fault detection and diagnostics</div> <div>✓+<input type="checkbox"/> Grid services capable</div> <div><input type="checkbox"/> Sensor ready and upgradeable</div> <div><input type="checkbox"/> Ease of install and configuration</div>

Connectivity unlocks additional energy savings and value; enables smart buildings

- Requires interoperability, addressability, and energy reporting that are essential building blocks of smart buildings
- Advanced capabilities for lighting control
- Granular occupancy data for building system optimization
- Fault detection and diagnostics for operation and maintenance savings
- Next level grid service capabilities to realize Grid-interactive Efficient Buildings (GEBs)
- Incentivizes futureproof upgradeability, and simplified plug-and-play installation

Key

- ✓ = Mandatory
- ✓+☐ = Mandatory + Optional Points
- ☐ = Optional Points Only

Please see Appendix A of Official Rules for all Concept Phase requirement details: www.herox.com/LPrize/resources

Connectivity Requirements

12 pts.
possible

Category	Topic	Minimum Requirement(s)	Possible Points
Connectivity	Technical Interoperability	Complies with industry standard specification for basic network connectivity	n/a
	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

Please see Appendix A of Official Rules for all Concept Phase requirement details: www.herox.com/LPrize/resources

Background and Goals for Life Cycle Requirements

Up to 7 points possible

Product Life Cycle
<div>✓ Driver lifetime</div> <div>✓ Chromaticity Maintenance</div> <div>✓+☐ Replaceable components</div> <div>✓+☐ Lumen maintenance</div> <div>☐ Design for disassembly</div>

The circular economy is essential to supporting a low carbon and resource efficient economy

- Product life cycle improvements (e.g., replaceable components, safe end-of-life strategies) have the potential to decrease negative life cycle impacts from lighting products and systems
- Examples where luminaire prototype and product designers can make impactful choices that will benefit the environment and our economy:
 - Increase lighting energy efficiency and allow for additional efficiency increases over time
 - Increase useable installed lifetime of the luminaire
 - Reduce the use of materials with high environmental impact (such as aluminum and e-waste)
- Modular design approach supports:
 - Increase of efficacy and lifetime
 - Decrease impact from more harmful components

Key

- ✓ = Mandatory
- ✓+☐ = Mandatory + Optional Points
- ☐ = Optional Points Only

Please see Appendix A of Official Rules for all Concept Phase requirement details: www.herox.com/LPrize/resources

Life Cycle Requirements

7 pts.
possible

Category	Topic	Minimum Requirement(s)	Possible Points
Product Life Cycle	Lumen Maintenance	$L_{70} \geq 50,000$ hrs	1 pt. for $L_{90} \geq 36,000$ hrs
	Chromaticity Maintenance	≤ 0.002 after 6,000 hrs	n/a
	Driver Lifetime	$\geq 50,000$ 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

Three areas where competitors can make sustainable choices

1. Increase lighting energy efficiency and allow for additional efficiency increases over time
2. Increase useable installed lifetime of the luminaire
3. Reduce the use of materials with high environmental impact (such as aluminum and e-waste)

Background and Goals for Innovation and Inclusion

Up to 10 points possible

Innovation and Inclusion

☐ Technical innovation

☐ Innovation for diversity, equity, and/or inclusion

- **Examples of technical innovation include *but are not limited to*:**
 - Achieve excellent optical control and distribution of light while achieving high efficacy
 - Improve ease of installation, commissioning, and use of the system
 - 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)
 - Teams from Opportunity Zones
- **We are looking to you for both technical innovations and innovations for diversity, equity and/or inclusion in your design or process**

Key

✓ = Mandatory

✓+☐ = Mandatory + Optional Points

☐ = Optional Points Only

Please see Appendix A of Official Rules for all Concept Phase requirement details: www.herox.com/LPrize/resources

Innovation and Inclusion Requirements



Category	Topic	Minimum Requirement(s)	Possible Points
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

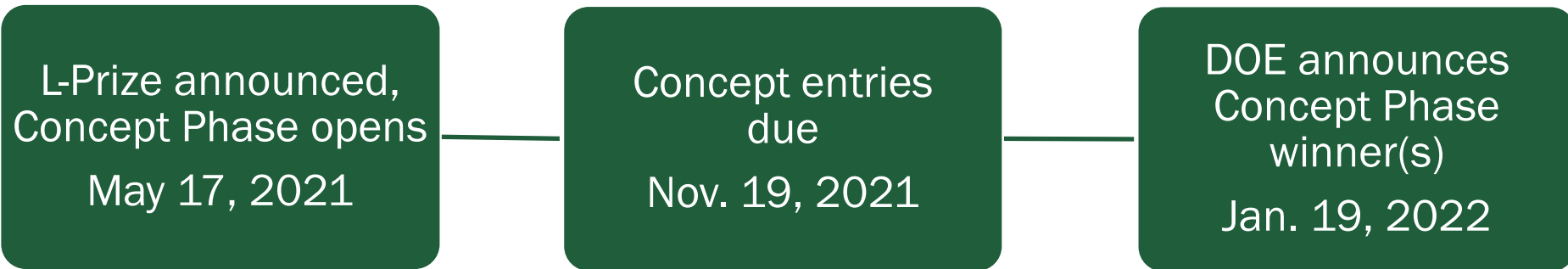
L-Prize

Concept Phase Overview

Concept Phase Overview

Competitors imagine and document lighting systems of the future

- WHO: Manufacturers, designers, researchers, universities, individuals, etc.



A complete submission package will include:

- 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 (optional)



Concept Phase Judging Criteria Based on Estimated Performance

Concept Phase

Concept designs –
no physical products

- Judging based on:
- Estimated technical performance and associated technical justifications
 - Technical feasibility
 - Technical innovation
 - Diversity, equity, and/or inclusion innovation

Prototype Phase

10 physical prototypes

- Judging based on:
- Actual technical performance
 - Technical innovation
 - Diversity, equity, and/or inclusion innovation

Manufacturing and Installation Phase

Real, commercially
available products

- Judging based on:
- Actual technical performance
 - Technical innovation
 - Diversity, equity, and/or inclusion innovation
 - U.S. Content, Manufacturing, and Installations

Report estimated technical performance and justifications using Concept Phase Technical Performance and Scoring Form

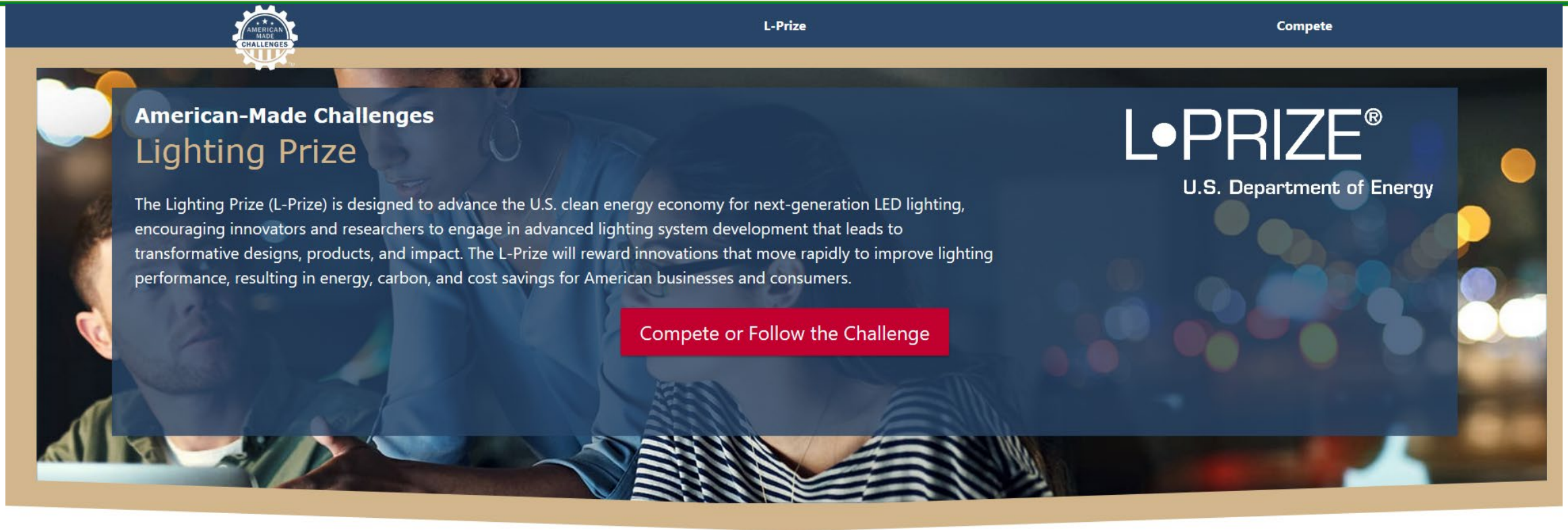
Luminaire Efficacy	The total emitted luminous flux from the luminaire divided by the total source electrical input power, expressed in lumens per watt (lm/W).
Minimum Requirement(s) The initial luminous efficacy of each luminaire must be ≥ 150 lumens per watt.	Possible Point(s) Two points (+2) will be awarded for each additional increment of 10 lumens per watt above 150 up to a maximum of ten 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
Enter the expected lm/W that would be delivered by your concept:	
How many efficacy points would be earned based on this lm/W? (Enter 0, 2, 4, 6, 8, or 10)	
Provide a written technical justification for the expected lm/W performance. <i>Your written justification should demonstrate to the Expert Reviewer Panel that you:</i> <ul style="list-style-type: none"> understand the requirement(s) understand the technical challenges and trade-offs you would face in developing a real product that would achieve the expected performance have proposed a technically valid solution <i>As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used to estimate the expected level of performance. Your answer should be concise and must fit within the provided space.</i>	

Excerpted from "Concept Phase Technical Performance and Scoring Form" available at www.herox.com/LPrize/resources

L-Prize

Website and HeroX Overview

Find Information at <https://americanmadechallenges.org/LPrize>

The image is a screenshot of the American-Made Challenges L-Prize website banner. At the top left is the American-Made Challenges logo, which features a gear with stars and stripes. To its right are two navigation links: "L-Prize" and "Compete". The main banner area has a dark blue background with a blurred image of people. On the left, the text "American-Made Challenges" is in white, and "Lighting Prize" is in a larger, bold, orange font. Below this, a paragraph in white text describes the prize: "The Lighting Prize (L-Prize) is designed to advance the U.S. clean energy economy for next-generation LED lighting, encouraging innovators and researchers to engage in advanced lighting system development that leads to transformative designs, products, and impact. 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." On the right side of the banner, the "L•PRIZE®" logo is displayed in large white letters, with "U.S. Department of Energy" written below it in a smaller white font. At the bottom center, there is a red button with the white text "Compete or Follow the Challenge".

American-Made Challenges
Lighting Prize

The Lighting Prize (L-Prize) is designed to advance the U.S. clean energy economy for next-generation LED lighting, encouraging innovators and researchers to engage in advanced lighting system development that leads to transformative designs, products, and impact. 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.

L•PRIZE®
U.S. Department of Energy

Compete or Follow the Challenge

L-Prize

The first Lighting Prize was awarded by the U.S. Department of Energy (DOE) in 2011, recognizing a high-efficiency LED replacement for the traditional 60-watt A19 incandescent bulb. Today, commercially available LED lights are competitive with all other lighting technologies, but the full technical and application potential of solid-state lighting (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 the value and resiliency of buildings. The L-Prize, a successor to the first Lighting Prize, seeks to unlock

Follow or Compete at www.herox.com/LPrize

Edit



American-Made Challenges

1,602

Share

Following (45)



Lighting Prize (L-Prize)

The L-Prize will advance the state-of-the-art in LED lighting.

Energy, Environment & Resources

Government

Stage:
Comment Period Opens

Prize:
\$12.2 Million Total Prize Pool

BEGIN ENTRY

MY TEAM

- Overview
- Guidelines
- Timeline
- Forum2
- Teams40
- Resources
- FAQ

Challenge Overview

The Lighting Prize (L-Prize) is designed to advance the U.S. clean energy economy for next-generation LED lighting.

Comments on Rules — Due August 13, 2021

- DOE invites comments on the subsequent:
 - Prototype Phase and Manufacturing and Installation Phase
 - Requirements and timelines
- Any revisions to requirements or timelines of subsequent phases will be announced with the opening of the subsequent phase
- Download the Comment Form at www.heriox.com/LPrize/resources

L-Prize®		Comment Form
Rules Document Location: https://americanmadechallenges.org/lprize/docs/L-Prize_Official_Rules.pdf		
Version: Version 1, released May 17, 2021		
Comments Due: July 16, 2021		
Instructions and Background:		<p>DOE invites comments on the L-Prize requirements and timelines. DOE will accept comments at the beginning of the Concept Phase and reserves the right to revise subsequent phase requirements and timelines based on the input received. Any changes to requirements and timelines will be announced with the opening of the subsequent phase.</p> <p>Please follow these steps to ensure your comments are received and considered by the L-Prize Team:</p> <ol style="list-style-type: none">1. Enter your Organization, Name, Email Address, and Phone Number in Row 8 of this worksheet.2. After your review of the Rules Document, please consider each Key Question in Columns B and C and submit your answer in Column D.3. Detailed comments are encouraged and should be added beginning in Row 18 of the worksheet. Please enter the section and page number of the Rules Document you are commenting on.4. Enter your comment in Column D "Comment and Rationale". If applicable, please provide alternate approaches and data to support your comment.5. Save this Excel file with your comments and include your organization name appended to the end of the filename (for example: "L-Prize_Comments_YourOrganizationName.xlsx").6. Email the file to Lprize@NREL.gov by close of business, July 16, 2021.
Reviewer Organization	Reviewer Name	Reviewer Email Address
#	Key Questions	Answers to Key Questions
1	Are the timelines feasible for the Prototype and Manufacturing and Installation Phases?	
2	Are there any hurdles that are preventing you from participating? Is there something DOE should consider, change, or include that would encourage you to participate?	
3	Are there other aspects that should be considered to encourage diversity, equity, and inclusion?	
	Are the proposed U.S. Content and Assembly requirements for...	



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U.S. Department of Energy

QUESTIONS?

www.herox.com/LPrize/forum

Email: LPrize@nrel.gov

www.herox.com/LPrize

www.americanmadechallenges.org/LPrize