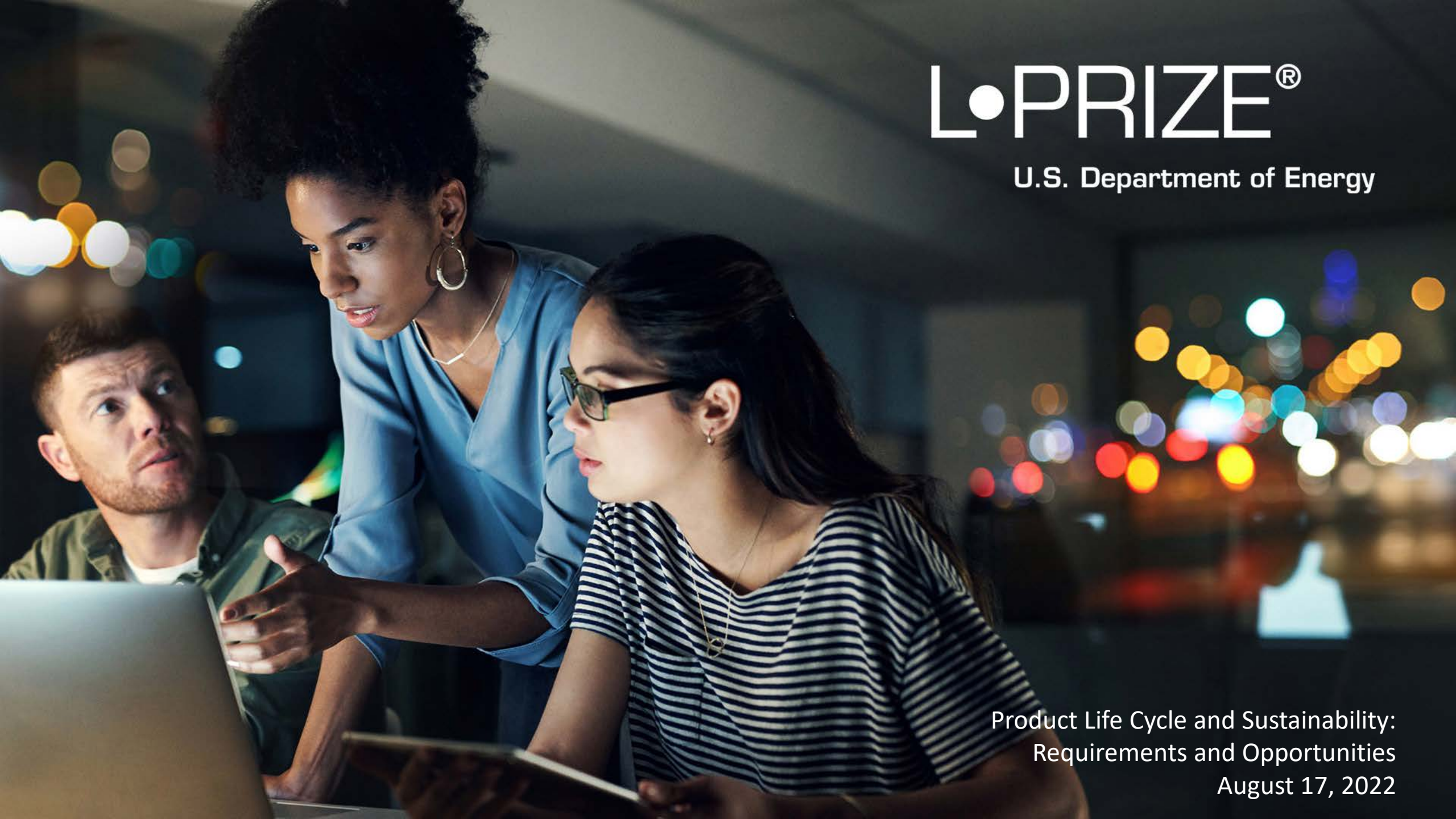
Welcome – we will begin shortly



Product Life Cycle and Sustainability: Requirements and Opportunities

August 17, 2022

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
- In order to ensure we are providing the best information to all potential competitors; we may be unable to some questions here live. Answers to many of the questions received today will be posted in the HeroX Forum following the webinar: www.herox.com/LPrize/forum
- For the video and slides from the Aug 03, 2022 Prototype Phase General Informational Webinar visit: https://www.herox.com/LPrize/resources

Speakers

Wyatt Merrill
U.S. Department of Energy

Kate Hickcox
Pacific Northwest National Laboratory

Gabe Arnold
Pacific Northwest National Laboratory

Why are we offering focus presentations on DEI & Sustainability?

These topics are important to the DOE and new to some in the lighting industry, and we want to provide resources for competitors in these areas

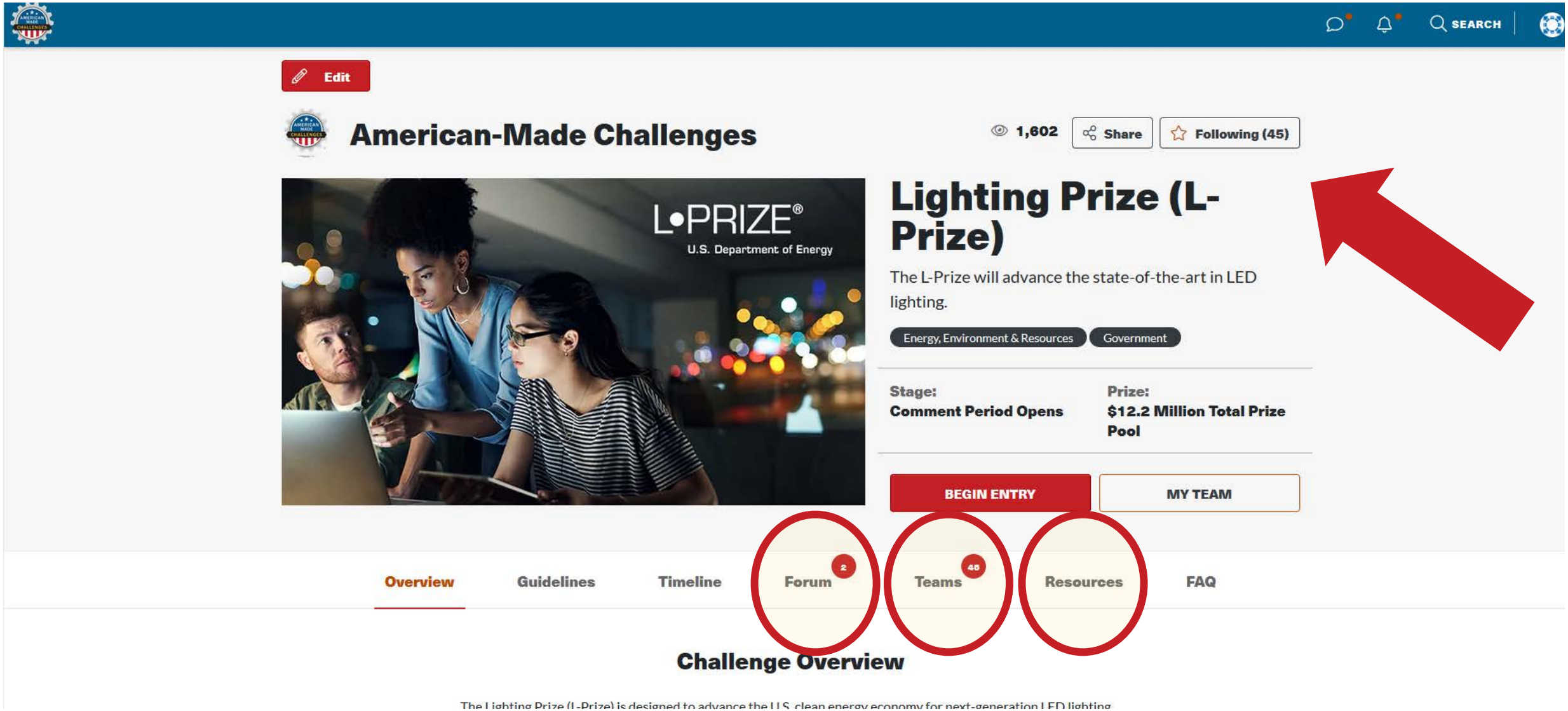
The L-Prize requirements for these topics are updated from the Concept Phase

We got a lot of questions on these topics in the Concept Phase: hope to answer some of those questions

L-Prize

Sustainability

Follow or Compete at www.herox.com/LPrize



Luminaire Track

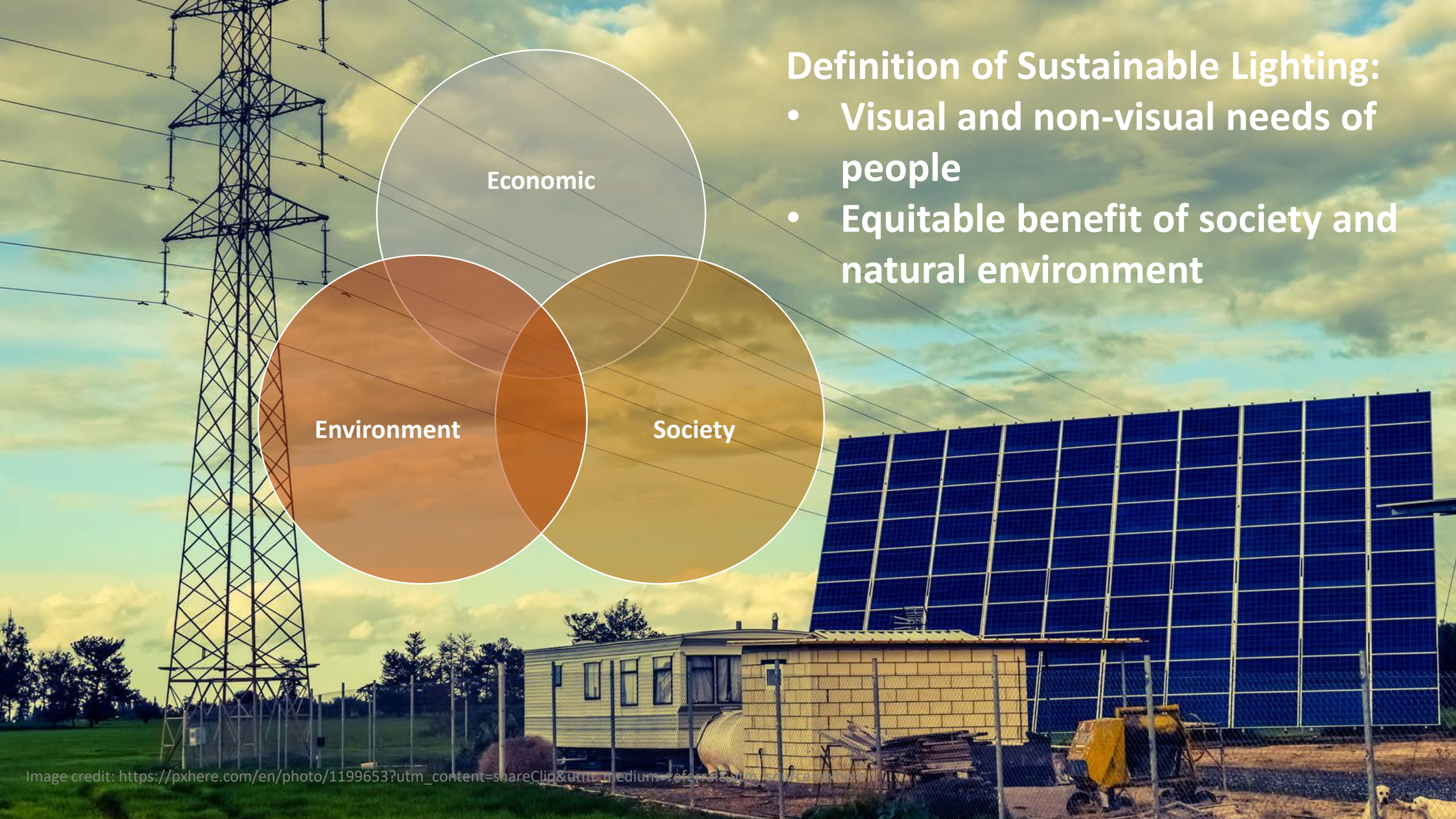
Efficacy	Quality of Light	Connectivity	Product Life Cycle	Technical Innovation	Diversity, Equity, and Inclusion
✓+❑ Luminaire efficacy	✓ Chromaticity ✓ Dimming range ✓ Glare control ✓ Light output ✓ Spectral power data ✓+❑ Color rendition ✓+❑ Flicker ❑ White-tunable	✓ Standards-based digital driver ✓ Standards-based sensor port and connector	✓ Driver lifetime ✓ Chromaticity maintenance ✓+❑ Lumen maintenance ✓+❑ Circular design ❑ Materials and sustainability innovation	❑ Application efficiency ❑ Form factor and aesthetics ❑ Value proposition and cost	❑ DEI plans and protocols ❑ DEI gaps and opportunities ❑ DEI deployment and application

For a video detailing all these categories visit: https://www.herox.com/LPrize/resources

Key
✓ = Mandatory
✓+❑ = Mandatory + Points Available
❑ = Points Only

Connected Systems Track

Connectivity	Product Life Cycle	Technical Innovation	Diversity, Equity, and Inclusion
✓ Standards-based luminaire or system controller ✓ Interoperability ✓ Addressability ✓ Energy reporting ✓ Lighting control strategies ✓ Standards-based luminaire-level lighting control ✓+❑ System resilience ✓+❑ Fault detection and diagnostics ✓+❑ Grid services capable	❑ Life cycle and sustainability innovation	❑ Ease of installation and use ❑ Compatibility and interoperability ❑ Value proposition and cost	❑ DEI plans and protocols ❑ DEI gaps and opportunities ❑ DEI deployment and application



Definition of Sustainable Lighting:

- Visual and non-visual needs of people
- Equitable benefit of society and natural environment

Image credit: https://pxhere.com/en/photo/1199653?utm_content=shareClip&utm_medium=referral&utm_source=pxhere

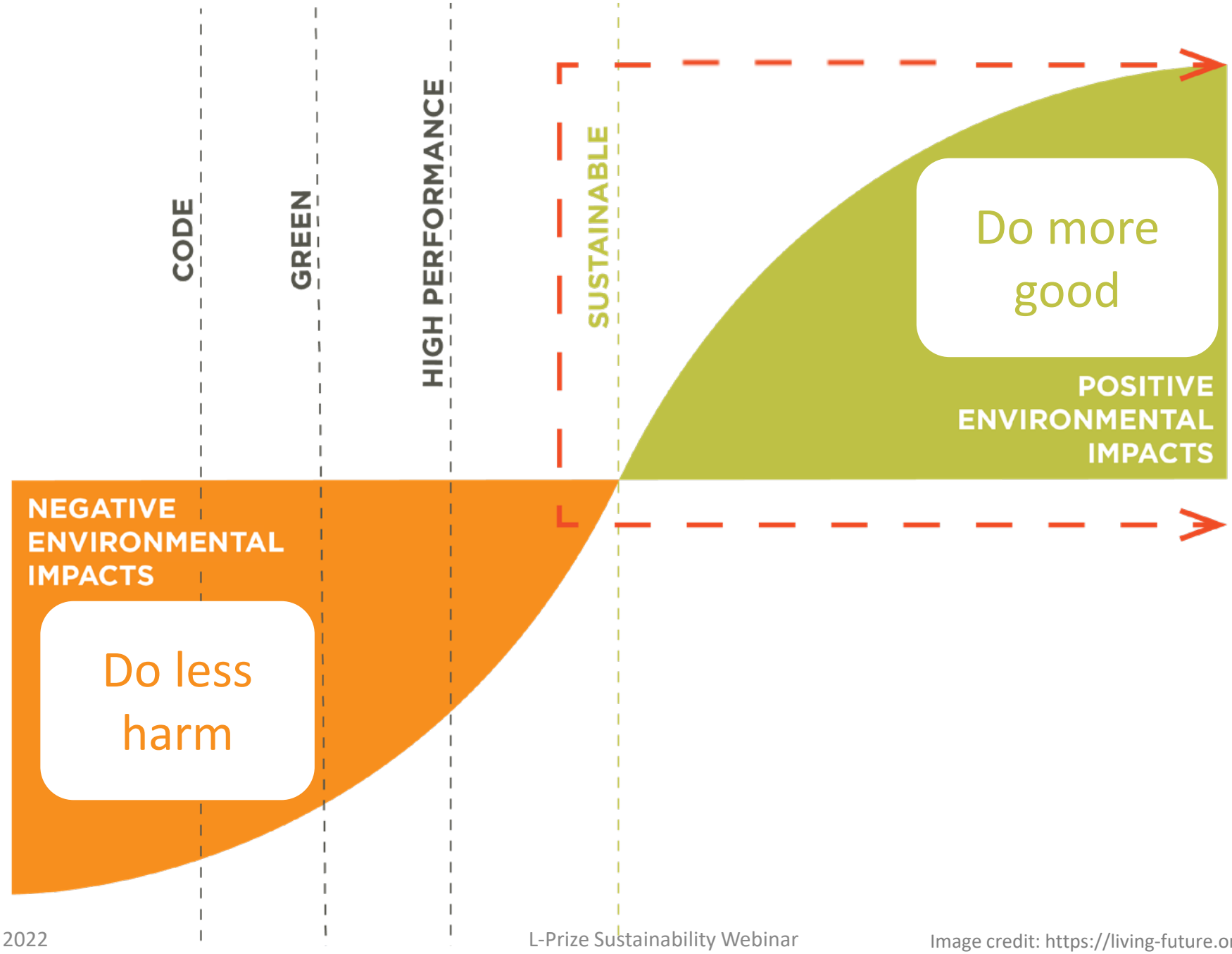


Image credit: https://living-future.org/lbc/basics4-0/

Many drivers to incorporate sustainability approaches

Building Standards

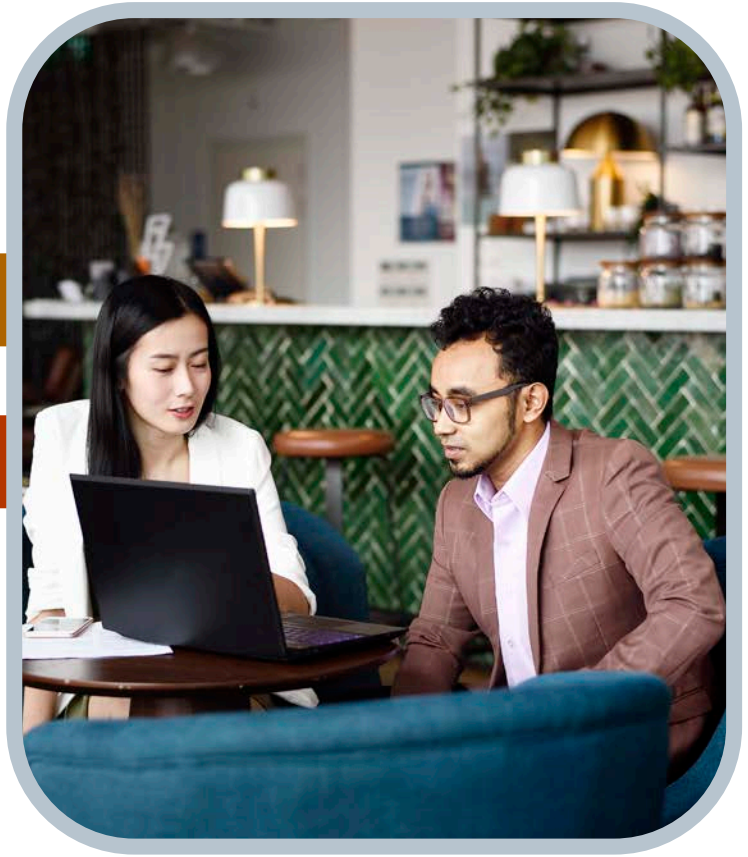
- LEED
- WELL
- BREEAM
- Green Globes
- Living Building Challenge

Regulations

- BuyClean

Corporate Pledges / Challenges

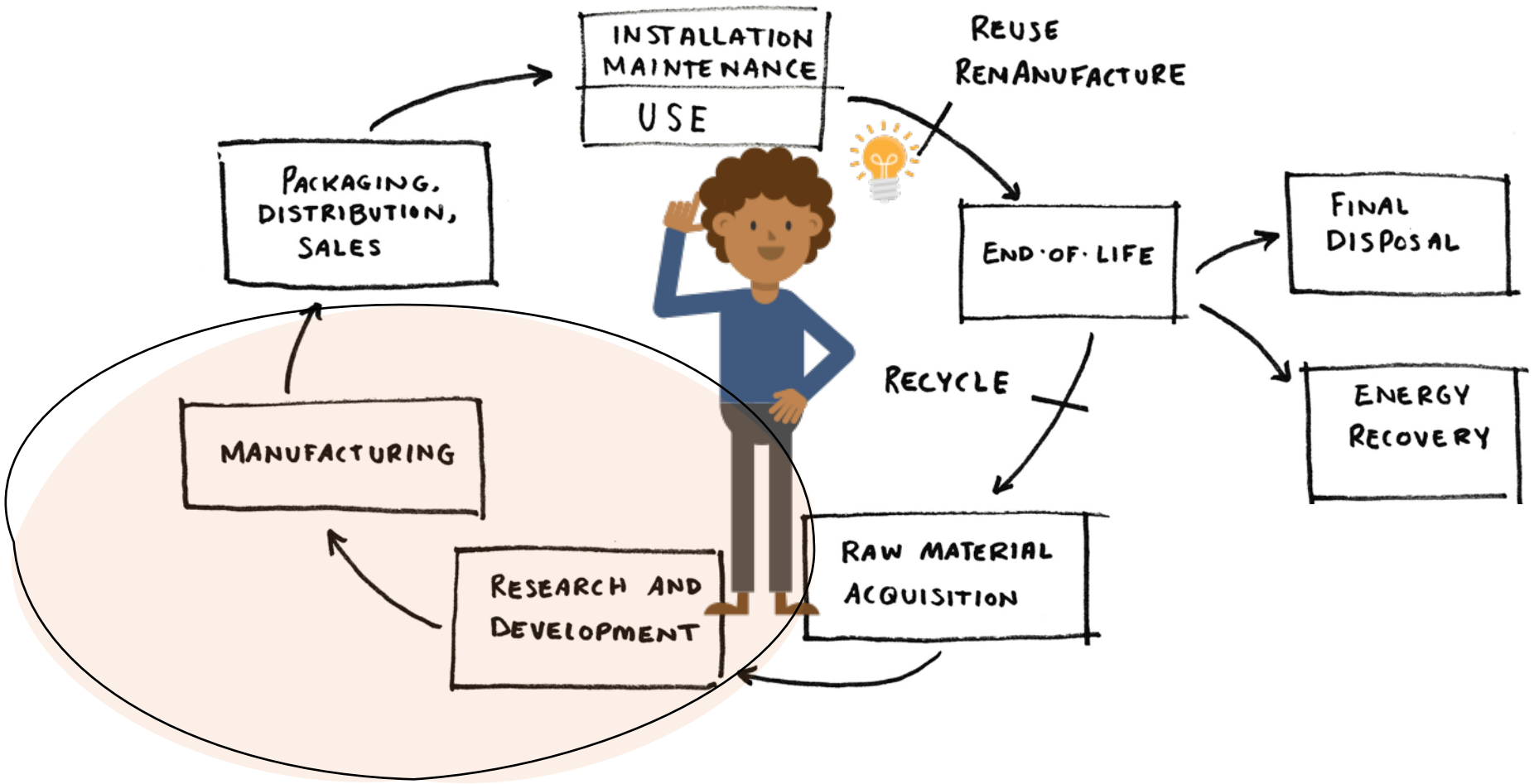
- AIA Materials Pledge
- Mindful Materials Lighting Advocacy Letter
- Living Product 50
- Carbon Leadership Forum MEP 2040
- AIA 2030
- B Corporations



Clients are also a driver

It’s critical to incorporate sustainability approaches early in the design process: including in the Prototype Phase

Lighting Life Cycle



Life Cycle Illustration by Kate Hickcox / idea image from Wikimedia Commons by Videoplasty.com, CC-BY-SA 4.0

L-Prize

Luminaire Track

Luminaire Track – Product Life Cycle

Up to 20 points possible

Product Life Cycle
✓ Driver lifetime
✓ Chromaticity maintenance
✓+❑ Lumen maintenance
✓+❑ Circular design
❑ Materials and sustainability innovation

- Driver lifetime ≥ 50,000 hrs
- Chromaticity maintenance ≤ 0.002 after 6,000 hrs
- L_{70} ≥ 50,000 hrs
  - Additional points: 2 points available for L_{90} ≥ 36,000 hrs
- Circular design: must score ≥ 1 using CIBSE TM66 Circular Assessment Tool
  - Additional points: 4 points available for score ≥ 2; 8 points available for score ≥ 3
- Materials and sustainability innovation:
  - Open invitation for innovations that support improved material transparency or material health
  - Additional points: up to 10 points as scored by Expert Reviewer Panel

Key
✓ = Mandatory
✓+❑ = Mandatory + Optional Points
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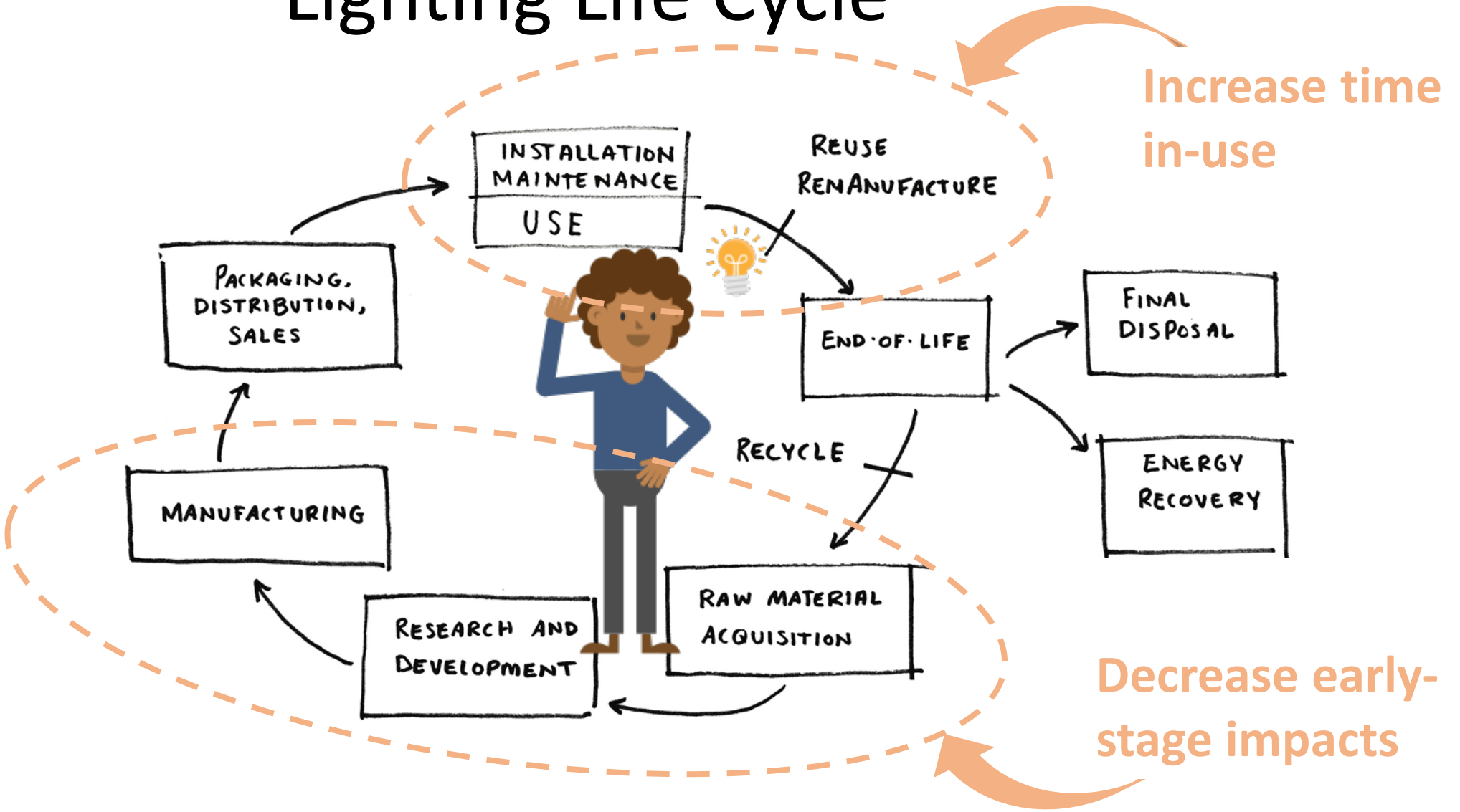
Please see Appendices A+B of Official Rules for all Prototype Phase requirement details: www.herox.com/LPrize/resources

Lighting Life Cycle



Life Cycle Illustration by Kate Hickcox / idea image from Wikimedia Commons by Videoplasty.com, CC-BY-SA 4.0

Luminaire Track – Product Life Cycle

Up to 20 points possible

Product Life Cycle
✓ Driver lifetime
✓ Chromaticity maintenance
✓+❑ Lumen maintenance
✓+❑ Circular design
❑ Materials and sustainability innovation

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Measuring Product Circularity:

CIBSE TM66: Circular Economy Assessment Tool and Technical Memorandum specifically for Lighting

Available at https://www.cibse.org/news-and-policy/november-2021/tm66-creating-a-circular-economy-in-the-lighting

Circular Economy Assessment Method - Make

(CIBSE TM66 digital tool)

Product design

Ref	Circular economy effect	Feature	Select evidence per action towards circular economy: 0 No evidence	1 Some positive evidence	2 Positive evidence	3 Excellent positive evidence	4 Outstanding evidence	Score
	Reusability (design for multiple life scenarios)	This box weights the results in the optics and accessories sections below, so that fittings not commonly featuring changeable optics are not unfairly penalised	Luminaire or luminaire family with inherently swappable components (such as interior track spot or exterior architectural projector)		All other types of interior or exterior luminaires or luminaire families			
		Choose Luminaire type	◉		○			
Prod 1	Keeps products and materials in use. The space a luminaire is used in is likely to change over time; for true life maximisation the fitting will need to respond	Range of optics	1 optic available ◉	Small range ○	Medium range ○	Very wide ra ○		
Prod 2		Optics: availability of parts	< 2 years ◉	2 to 5 years ○	5 to 10 years ○	> 10 year ○		
Prod 3		Range of accessories	No range ◉	Small range ○	Medium range ○	Very wide ra ○		

Cover & Publication Info | Introduction & Instructions | Product Design | Manufacturing | Materials | Ecosystem | Result | Resources

Circular Economy Assessment Method - Make

(CIBSE TM66 digital tool)

CIBSE

Result

Category	Points Scored	Maximum possible points	Assessment
Product design	19.0	134.0	0.6
Manufacturing	14.7	46.5	1.3
Materials	-4.0	24.0	-0.7
Ecosystem	-2.0	43.0	-0.2
Overall performance	27.7	247.5	0.2

How to analyse the score	
0 to 0.5	Very poor circular economy performance
0.5 to 1.5	Some circular economy functionality
1.5 to 2.5	Definite/substantial progress to circularity
2.5 to 4.0	Excellent circularity

How circular is a luminaire?

Luminaire Track – Product Life Cycle

Material transparency:
- the disclosure of the ingredients and processes used to create materials or products
- their potential human health effects, environmental impacts, or social equity

Up to 20 points possible

Product Life Cycle
✓ Driver lifetime
✓ Chromaticity maintenance
✓+❑ Lumen maintenance
✓+❑ Circular design
❑ Materials and sustainability innovation

- Driver lifetime ≥ 50,000 hrs
- Chromaticity maintenance ≤ 0.002 after 6,000 hrs
- L_{70} ≥ 50,000 hrs
  - Additional points: 2 points available for L_{90} ≥ 36,000 hrs
- Circular design: must score ≥ 1 using CIBSE TM66 Circular Assessment Tool
  - Additional points: 4 points available for score ≥ 2; 8 points available for score ≥ 3
- Materials and sustainability innovation:
  - Open invitation for innovations that support improved material transparency or material health
  - Additional points: up to 10 points as scored by Expert Reviewer Panel

Material health:
- the sustainability quality or "health" of materials themselves
- how these materials may affect humans and ecosystems

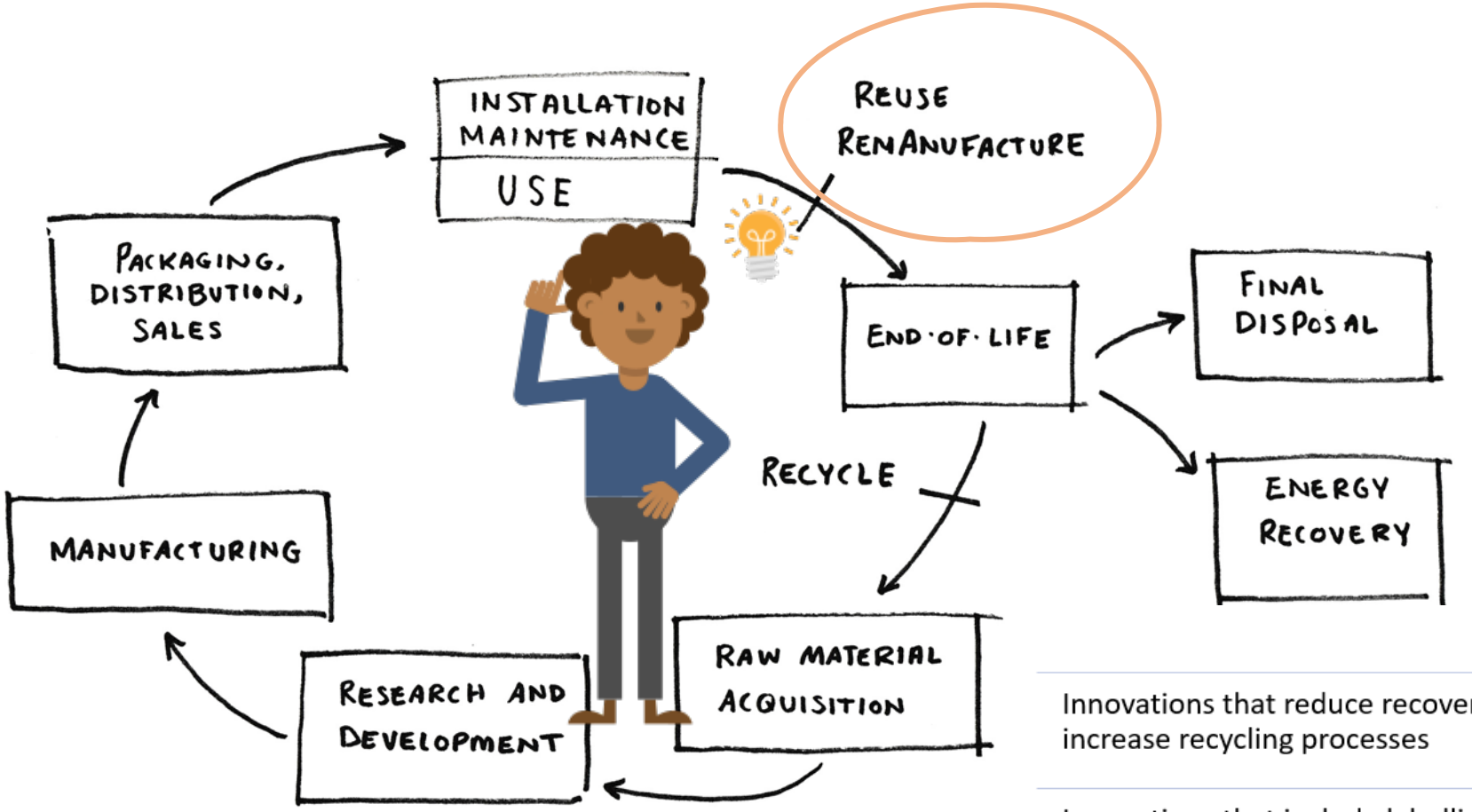
Key
✓ = Mandatory
✓+❑ = Mandatory + Optional Points
❑ = Optional Points Only

Please see Appendices A+B of Official Rules for all Prototype Phase requirement details: www.herox.com/LPrize/resources

Examples of innovations that support improved material transparency or material health

More can be found in the Rules Document…	Innovations that use recycled, bioderived, biodegradable, or low-toxicity materials
	Innovations that reduce the use of harmful materials such as polyvinyl chloride (PVC)
	Innovations that reduce recovery processes (shredding) and increase recycling processes
	Innovations that include labelling of parts or components or other information systems to communicate end-of-life strategies

Lighting Life Cycle

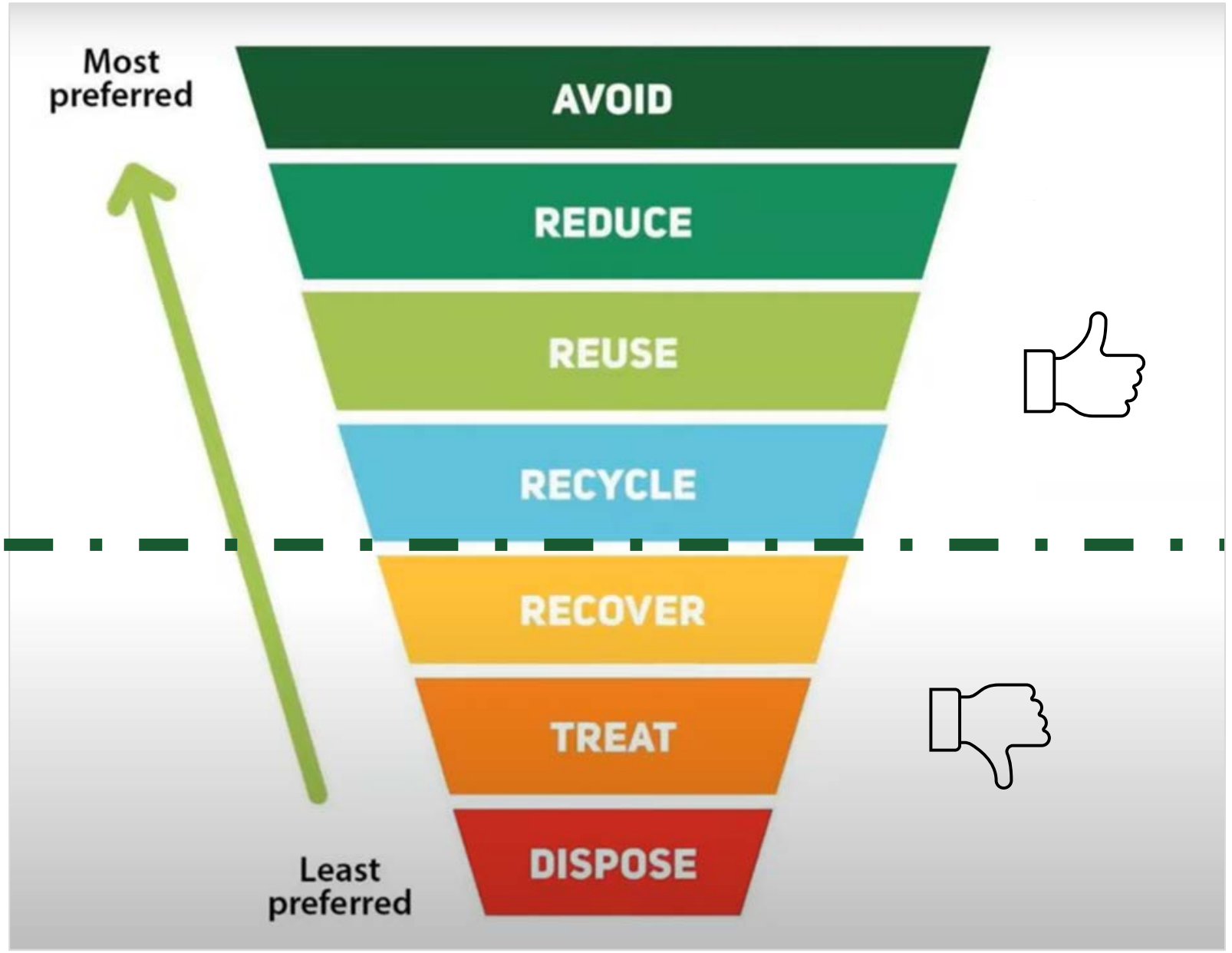


Innovations that reduce recovery processes (shredding) and increase recycling processes

Innovations that include labelling of parts or components or other information systems to communicate end-of-life strategies

Life Cycle Illustration by Kate Hickcox / idea image from Wikimedia Commons by Videoplasty.com, CC-BY-SA 4.0

Waste Hierarchy



Overview about Circular Economy Approaches in Lighting Designs and Projects by Mark Ridler, BDP, UK
https://www.youtube.com/watch?v=kWUAHhfW3V0

L-Prize

Connected Systems Track

Connected Systems Track – Product Life Cycle

Up to 10 points possible

Product Life Cycle
❑ Life cycle and sustainability innovation

- Life cycle and sustainability innovation:
  - Open invitation for innovations that support positive environmental impacts such as improve circularity, end-of-life outcomes, reduction in harmful materials, or improved material transparency
  - Additional points: up to 10 points as scored by Expert Reviewer Panel

Material transparency:
- the disclosure of the ingredients and processes used to create materials or products
- their potential human health effects, environmental impacts, or social equity

Key
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❑ = Optional Points Only

Please see Appendices A+B of Official Rules for all Prototype Phase requirement details: www.herox.com/LPrize/resources

Examples of innovations that support positive environmental impacts

More can be found in the L-Prize Official Rules Document…

Innovations that restore, renew, or revitalize their own sources of energy and materials

Innovative approaches to quantifying material sustainability impacts and/or communicating these to end-users

Innovations that allow the connected systems to better integrate with new installation models such as Energy-as-a-Service (EaaS) and Lighting-as-a-Service (LaaS)

Innovations that utilize design for disassembly rules or approaches, for example (not inclusive):

- Increasing material purity
- Reducing assembly and disassembly times

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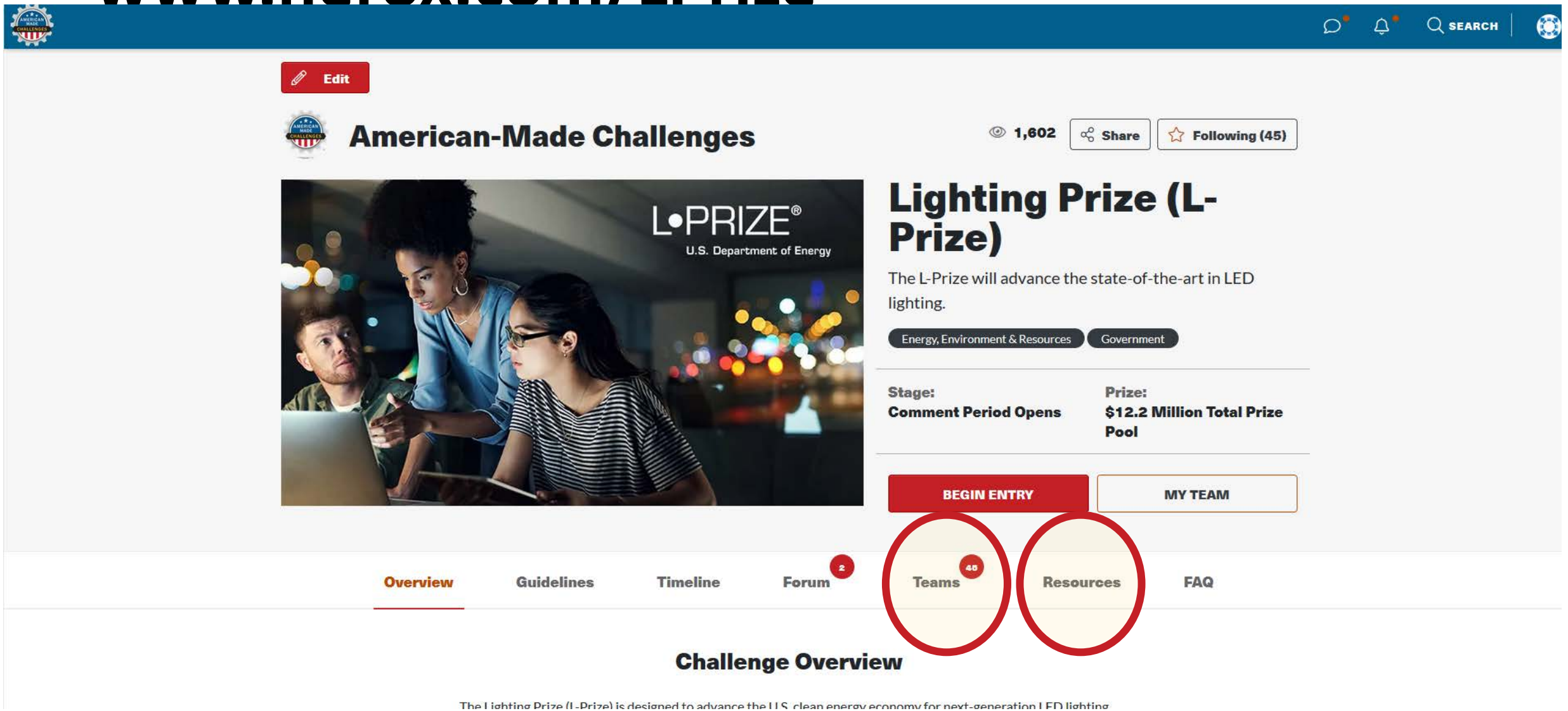

- The L-Prize Official Rules document has lots of suggestions, prompts and supplemental guidelines to support competitors (*see Resources link below*)
- If you have any questions, check out the HeroX Forum to see if there's a Q&A already on your topic: https://www.herox.com/LPrize/forum
- You can always email us at: Lprize@nrel.gov
- Full Prototype Phase Informational webinar with HeroX tour and tips is at: https://www.herox.com/LPrize/resources

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QUESTIONS?

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