L•PRIZE®

U.S. Department of Energy

Concept Phase Technical Performance and Scoring Form

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Instructions

1. Complete each requirement table with the estimated performance of your Concept
2. Enter the number of points that would be earned for each requirement, if applicable
3. Provide a written description or technical justification for the estimated performance
4. Forms must be completed digitally, handwritten forms will not be accepted.
5. Save the file as a pdf and submit as part of your Concept Phase submission at https://www.herox.com/LPrize

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. ***Your written justification should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***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.***	

Light Output	**The luminous flux output by a light source.**
Minimum Requirement(s) The initial luminous flux must be > 2,000 lumens.	**Possible Point(s)** n/a
Enter the expected light output that would be delivered by your concept:	
Points are not applicable for this requirement.	n/a
Provide a written technical justification for the expected light output. ***Your written justification should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***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.***	

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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 Point(s)** 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
Enter the expected color rendition performance of your concept:	
How many color rendition points would be earned based on this performance? (Enter 0 or 2)	
Provide a written technical justification for the expected color rendition performance. ***Your written justification should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***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.***	

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, where the range of CCT adjustment must be 2700K-5000K. The Duv must be between -0.006 and 0.000 as defined in ANSI C78.377-2017. For white-tunable products, the requirement is 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 Point(s)** n/a
Enter the expected CCT(s), Duv, and chromaticity consistency performance of your concept:	
Points are not applicable for this requirement.	n/a
Provide a written technical justification for the expected color rendition performance. ***Your written justification should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***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.***	

White-Tunable	**The capability to control the color temperature of a light source.**
Minimum Requirement(s) White-tunable capability is optional.	**Possible Point(s)** 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 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.
Is your concept white-tunable? (Enter Yes or No)	
How many white-tunable points would be earned? (Enter 0 or 4)	
Provide a written technical justification for how the concept will deliver high efficacy, quality of light, and life cycle performance across the tunable range. ***Your written justification should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***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.***	

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 Point(s)** n/a
Enter the expected UGR performance of the luminaire (e.g., <19, <16, etc.):	
Points are not applicable for this requirement.	n/a
Provide a written technical justification for how the concept controls glare to meet the UGR requirement. ***Your written justification should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***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.***	

Temporal Light Modulation (TLM, aka "flicker")	**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) 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.	**Possible Point(s)** Two points **(+2)** will be awarded for SVM ≤ 0.4 at dimming levels of 100%, 50%, and the minimum dimmed light output.
Enter the expected fundamental TLM frequency and SVM performance at 100%, 50%, and the minimum dimmed light output:	
How many TLM points would be earned? (Enter 0 or 2)	
Provide a written technical justification for how the concept would control TLM to meet the requirement. ***Your written justification should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***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.***	

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) 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.	**Possible Point(s)** n/a
Enter the expected dimming range of the concept in terms of percent light output (e.g., 1%–100%):	
Points are not applicable for this requirement.	n/a
Provide a written technical justification for how the claimed dimming range will be achieved and chromaticity will be maintained over the dimming range to meet the requirement. ***Your written justification should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***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.***	

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 Point(s)** n/a
What industry standard specification for basic physical network connectivity would the concept system comply with?	
Points are not applicable for this requirement.	n/a
For the industry standard specification proposed to be used by your system, describe any considerations you used and why you chose this specification. ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

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. 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 Point(s)** n/a
Will the proposed concept incorporate an API? (Enter Yes or No)	
Points are not applicable for this requirement.	n/a
Provide more information about the type of API that would be deployed and what data would be available from it. Include any best practices or certifications or standards your API would utilize, if applicable. ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

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 Point(s)** n/a
Will each system device be addressable? (Enter Yes or No)	
Points are not applicable for this requirement.	n/a
Describe the approach to addressing devices and which components of the proposed concept will be addressable. ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

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. 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 Point(s)** n/a
Will the proposed system have energy reporting capability? (Enter Yes or No)	
Points are not applicable for this requirement.	n/a
Describe the energy reporting capabilities of the proposed concept, including where and how energy measurement will be performed and for which components and any associated technical attributes. ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

Lighting Control Strategies	**Control strategies implemented by a lighting 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 Point(s)** n/a
Will the proposed concept provide task tuning, scheduling, occupancy sensing, daylight harvesting, and manual control? (Enter Yes or No)	
Points are not applicable for this requirement.	n/a
Describe how the proposed concept will implement the five required control strategies including how the control strategies would be applied in zoning of luminaires. ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

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 Point(s)** 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.
Does the proposed concept have the capability to maintain control strategy implementation upon loss of connection to the next higher element as described in possible point(s)? (Enter Yes or No)	
How many system resilience points would be earned? (Enter 0 or 1)	
Describe how the proposed concept will meet the minimum system resilience and/or possible point(s) requirements. How are the system architecture and components designed to provide this system resilience? If claiming point(s), your description must also address the possible point(s) requirement. ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

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 Point(s)** 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.
Does the proposed concept have the capability to diagnose faults (+1) and/or predict maintenance (+2) as described in the possible point(s) requirement? (Enter No, Diagnose Only, Predict Only, or Both)	
How many FDD points would be earned? (Enter 0, 1, 2, or 3)	
Describe which faults the proposed concept will be able to identify, diagnose, and/or predict and how the system will notify operators about them. ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

Luminaire Level Lighting Control	**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 Point(s)** n/a
Does the proposed concept have luminaire level lighting control? (Enter Yes or No)	
Points are not applicable for this requirement.	n/a
Describe the luminaire level lighting control of the concept in terms of system architecture, sensor type(s), and integration in the luminaire. ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

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 Point(s)** 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. 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.
Does the proposed concept have OpenADR 2.0b capability (+2) and/or advanced occupant acceptance configuration features (+2) as described under Possible Point(s)? (Enter No, OpenADR 2.0b Only, Advanced Configuration Only, or Both)	
How many grid services points would be earned? (Enter 0, 2, or 4)	
Describe how the concept will support any grid service capabilities and use of OpenADR. If applicable, describe what OpenADR signals the system will be able to respond to and what configuration options will be provided to repond to the signals. ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

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 Upgradeable Capability is optional.	**Possible Point(s)** One point **(+1)** will be awarded for luminaires/systems that include standardized power and data connectivity between sensor and driver/controller utilizing D4i or ANSI C137.4-202X (forthcoming) and a standardized sensor port and connector in compliance with Zhaga Book 20.
Does the proposed concept utilize D4i or ANSI C137.4 connections for sensors and a Zhaga Book 20-compliant sensor port as described under Possible Point(s)? (Enter Yes or No)	
How many points would be earned? (Enter 0 or 1)	
Describe the standards-based sensor upgradeability of the luminaire in meeting this requirement, if applicable. (If the concept design will not incorporate this optional capability, then no response is required.) ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

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 Point(s)** 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 for the Concept and Prototype Phases.
Does the proposed concept utilize Class 2 power and data wiring and connections as described under Possible Point(s)? (Enter Yes or No)	
How many points would be earned? (Enter 0 or 2)	
Describe which system components would connect using Class 2 power and data connections, and the specific type of connection, if applicable. Include information on wire types and voltage(s). (If the concept design will not incorporate this optional capability, then no response is required.) ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

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 Point(s)** 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)
Enter the expected lumen maintenance performance of your concept (estimated lumen maintenance value in percent at 50,000 hours and 36,000 hours):	
How many lumen maintenance points would be earned based on this performance? (Enter 0 or 1)	
Provide a written technical justification for the expected lumen maintenance performance. ***Your written justification should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***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.***	

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 Point(s)** n/a
Enter the expected change in chromaticity over the initial 6,000 hours of operation:	
Points are not applicable for this requirement.	n/a
Provide a written technical justification for the expected chromaticity maintenance performance. ***Your written justification should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***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.***	

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 Point(s)** n/a
Enter the estimated driver lifetime of your concept (in hours) based on the expected operating conditions:	
Points are not applicable for this requirement.	n/a
Provide a written technical justification for the expected driver lifetime. ***Your written justification should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***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.***	

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: • The 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. • 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).	**Possible Point(s)** 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.
How many replaceability points would be earned based on this design? (Enter 0 or 2)	
Provide a description of the luminaire replaceability labeling; reference the technical drawings if applicable. Provide a list of each replaceable electronic component; reference the technical drawings if applicable. Include any notes about component accessibility or innovative approaches to component replaceability if applicable. ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	

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 Point(s)** 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 (e.g., 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.
Enter the Design for Disassembly method that was used in your concept development, if any. If Option 3 was selected, provide details on the DfD protocol and why it was preferred over Options 1 and 2.	

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Continued from previous page	
How many DfD points would be earned? (Enter 0, 1, 3, or 4)	
Provide a description of the luminaire end-of-life labeling; reference the technical drawings if applicable. Describe the results of the DfD protocol, what lessons were learned, and/or what modifications were made during the design process to improve the ability of the product to be disassembled. ***Your written description should demonstrate to the Expert Reviewer Panel that you:*** • ***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*** ***As applicable, you should reference any analysis or engineering approach (e.g., performance modeling, simulation results) used. Your answer should be concise and must fit within the provided space.***	