



Bringing Efficiency to LightSM

SSL Version 5.0

Draft 1: Conceptual Specification

February 13, 2019

Presenters



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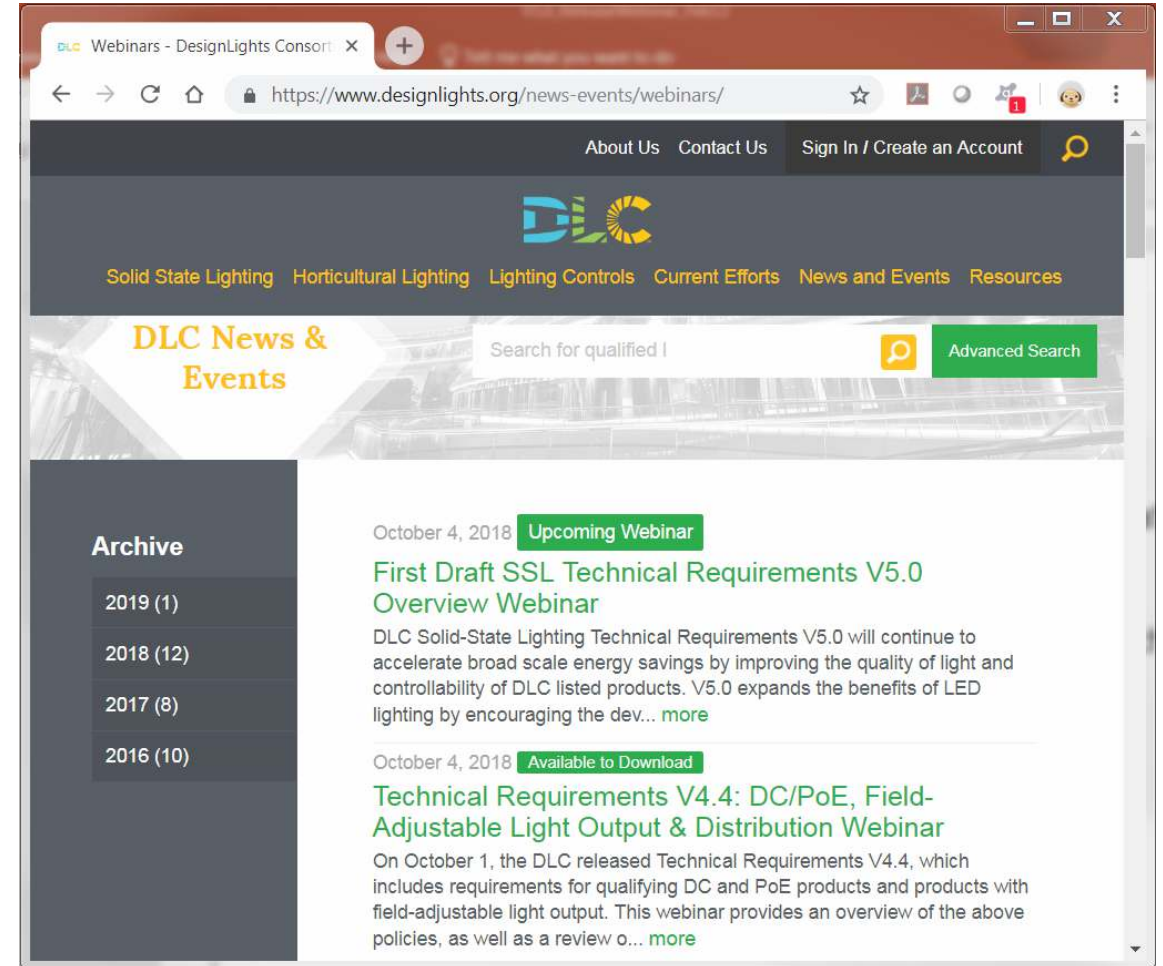
*Technical
Manager*

Agenda

- Introduction (20 mins)
- Efficacy (10 mins)
- Quality of Light (40 mins)
 - Spectral Quality
 - Glare
 - Distribution
 - Flicker
- Controllability (10 mins)
- Other Topics and Wrap up (5 mins)

Webinar Logistics

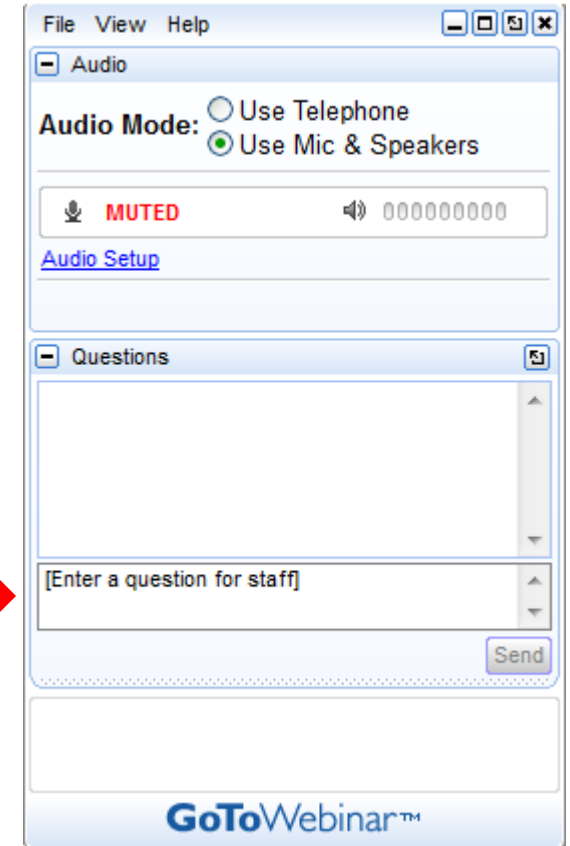
- Slides and recorded webinar will be posted on the *DLC News & Events* page at www.designlights.org shortly after today's presentation
- All attendees are automatically muted
 - If you experience technical issues, please use the chat feature to let us know using the chat function



Questions and Comments

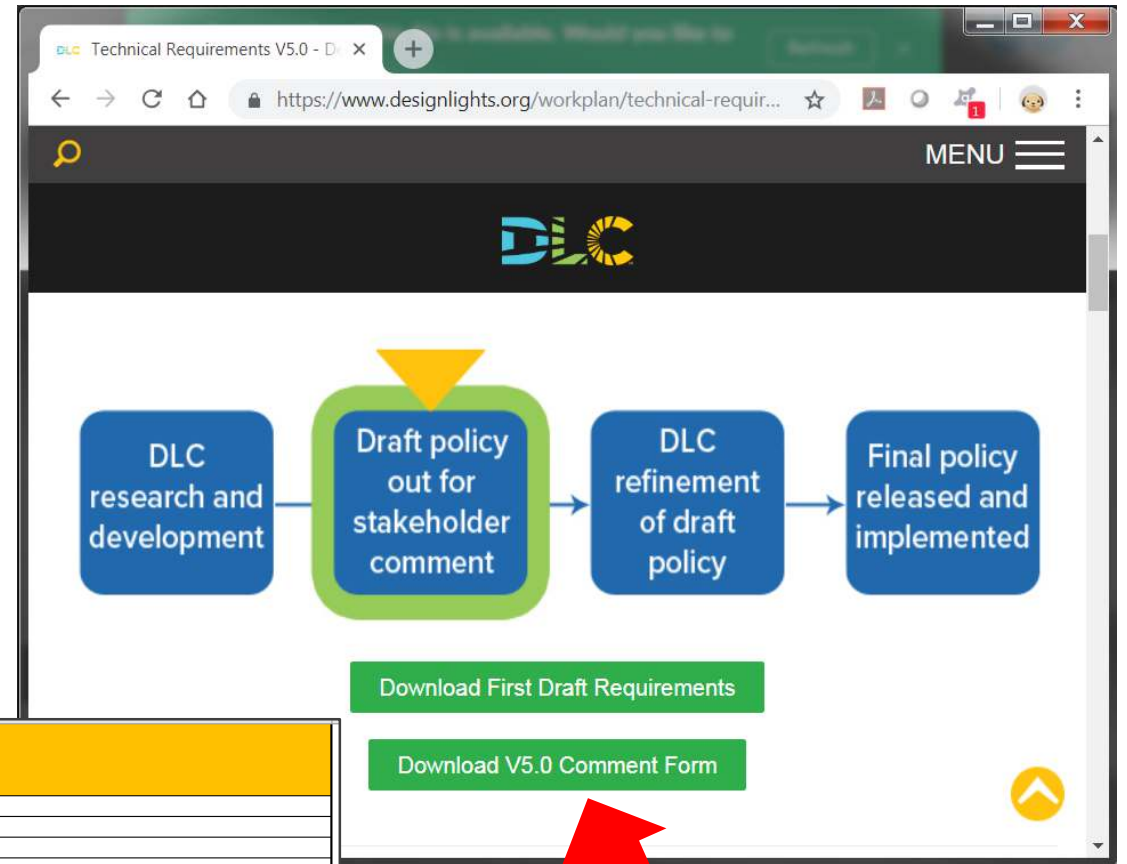
- Clarifying questions may be submitted via the Questions pane in GoToWebinar.
- Detailed technical questions and comments should be submitted through a [Comment Form](#) and sent to:

Comments@designlights.org



Comment Forms

All comments must be submitted using DLC Comment Forms. Please download the Comment Form and submit the completed forms to comments@designlights.org



DLC Comment Form Instructions			
Document:	Solid-State Lighting (SSL) Technical Requirements Version 5.0		
Version:	Draft 1 of SSL V5.0		
Comments Due:	Close of business, Tuesday March 12, 2019		
Instructions and Background:	Please follow these steps to ensure your comments are received and considered by the DesignLights Consortium:		
	1. Enter your Organization, Name, Email Address, and Phone Number in Row 8 of this worksheet.		
	2. Navigate to the tab at the bottom of this worksheet corresponding to the section of the V5.0 draft on which you'd like to comment.		
	3. After your review of the draft document, please consider each Key Question in Columns B, C, and D and submit your answer in Column E. Comments to the Technical Requirements that are not related to a specific Key Question may be added at the bottom of each worksheet. Please enter the line number of the draft corresponding to your comment into Column B starting on Row 16.		
	4. Comments to the Technical Requirements that are not related to a specific section or topic may be added at the "General Comments" tab.		
	5. Save this Excel file with your comments and include your organization name appended to the end of the filename (for example: "DLC_V5.0Draft1_CommentForm_ABCLightingCo").		
6. Email the file to comments@designlights.org by close of business, Tuesday March 12, 2019 .			
Reviewer Organization	Reviewer Name	Reviewer Email Address	Reviewer Phone #

Draft 1: Conceptual Specification

- This first draft of the V5.0 requirements is issued as a **conceptual level specification**
- What are your major questions and complicating issues with what is proposed in draft?
- What are your ideas, solutions, or preferences to address your questions and issues?

Example question the DLC has received:

- **What will be the transition for existing listed product?**
 - With this conceptual draft, the DLC has not proposed a specific transition plan
 - On your comment form, Commenters should identify question or issue, specific considerations, and proposed solution. As much detail as possible is appreciated.

Example how to address on Comment Form:

Topic / Description	Comment and Rationale	Proposed change / Potential solution to issue(s)
Transition Period	What is the transition process and period by which existing listed products must comply with the new standards? We have over 3,000 products already listed and in distribution where our customers are expecting them to be qualified. The DLC should allow time for existing inventory to be sold and for manufacturers to update their products and listings.	The DLC should allow at least X months from the time the final requirements are published before any products are delisted to allow time for existing inventory to be sold and for products to be modified to meet the new standard, new testing completed, and new applications submitted to DLC.

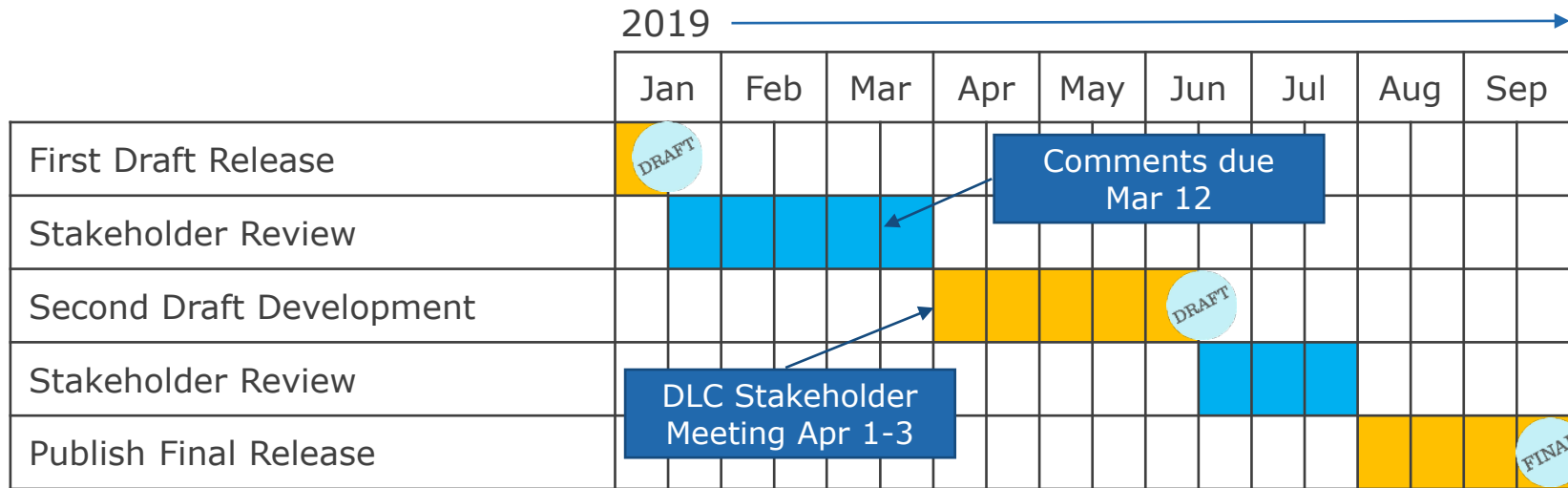
Example question the DLC has received:

- **Would the Flicker tests need to be performed by an LM79 approved lab, or can non-approved labs or manufacturers submit flicker test information?**
 - With this conceptual draft, the DLC has not proposed by whom flicker tests must be done and the level of accreditation required.
 - On your comment form, Commenters should identify question or issue, specific considerations, and proposed solution.

Example how to address on Comment Form:

Topic / Description	Comment and Rationale	Proposed change / Potential solution to issue(s)
Flicker Testing	Would the flicker tests need to be performed by an LM79 approved lab, or can non-approved labs (or manufacturers) submit reports to DLC? Flicker testing costs if required from an approved laboratory would be cost prohibitive, estimated at XX\$ per product.	The DLC should allow for flicker tests from the manufacturer as long as tests show appropriate results based on the standards. The DLC can audit the manufacturer or surveil products to verify the manufacturer submitted data is accurate.

V5.0 Timeline



Target Effective Date: January 1, 2020*

* Subject to change.
Likely to be a delisting grace period beyond the effective date.

DLC SSL V5.0 Overview

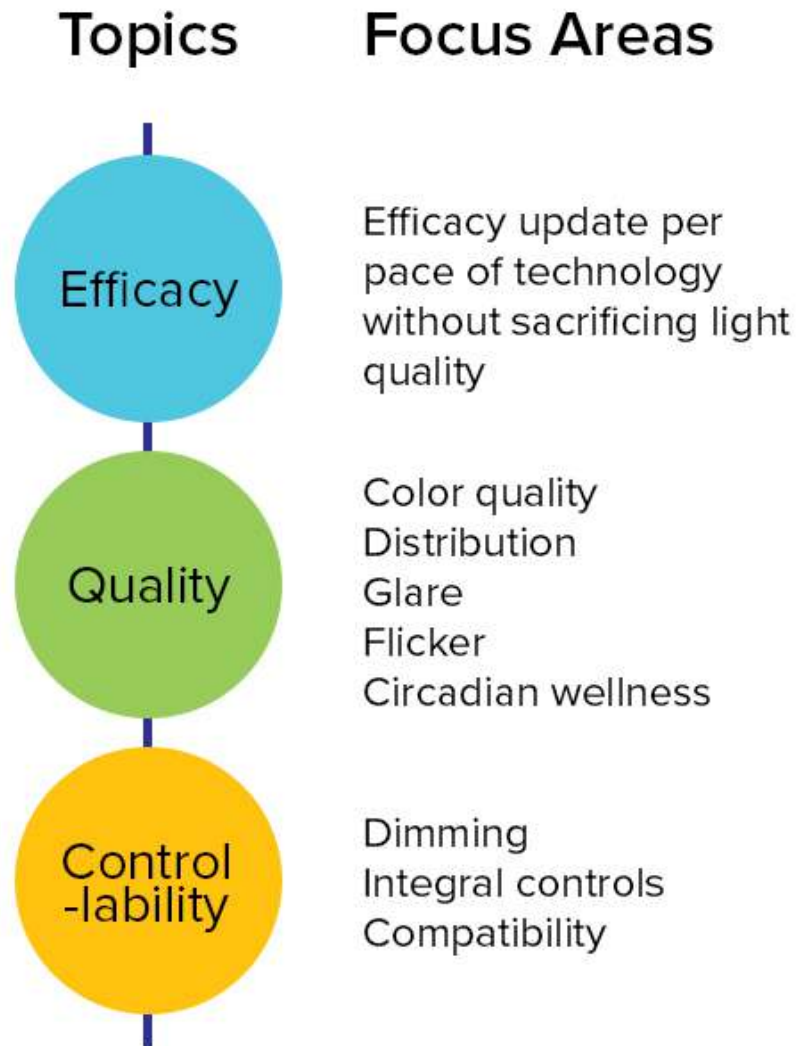
Purpose

Accelerate broad-scale **energy savings** by improving the **quality of light** and **controllability** of DLC listed products

Objectives

1. Differentiate lighting with a focus on health and wellness that provides comfortable, safe environments for people
2. Increase lighting controls adoption
3. Ensure persistent energy savings through enhanced user experience with DLC Qualified lighting
4. Make the QPL a more effective tool for lighting decision-makers to choose products that align with customer needs

V5.0 Focus Areas



Quality of Light

The aspects of light that impact:

- **Productivity**
- **Performance**
- **Comfort**
- **Aesthetics**
- **Mood**
- **Safety**
- **Health**
- **Wellbeing**

Includes:

- **Color Quality**
- **Flicker**
- **Glare**
- **Lighting for Alertness and Circadian Wellbeing**
- **Optical Distribution**

Why Quality of Light?

Opportunities:

Provide more value to customers

Mitigate potential negative impacts



Why Quality of Light?

Opportunities:

Counteract trend of efficacy at expense of quality

Enable differentiation of products with better quality performance



Why Controllability?

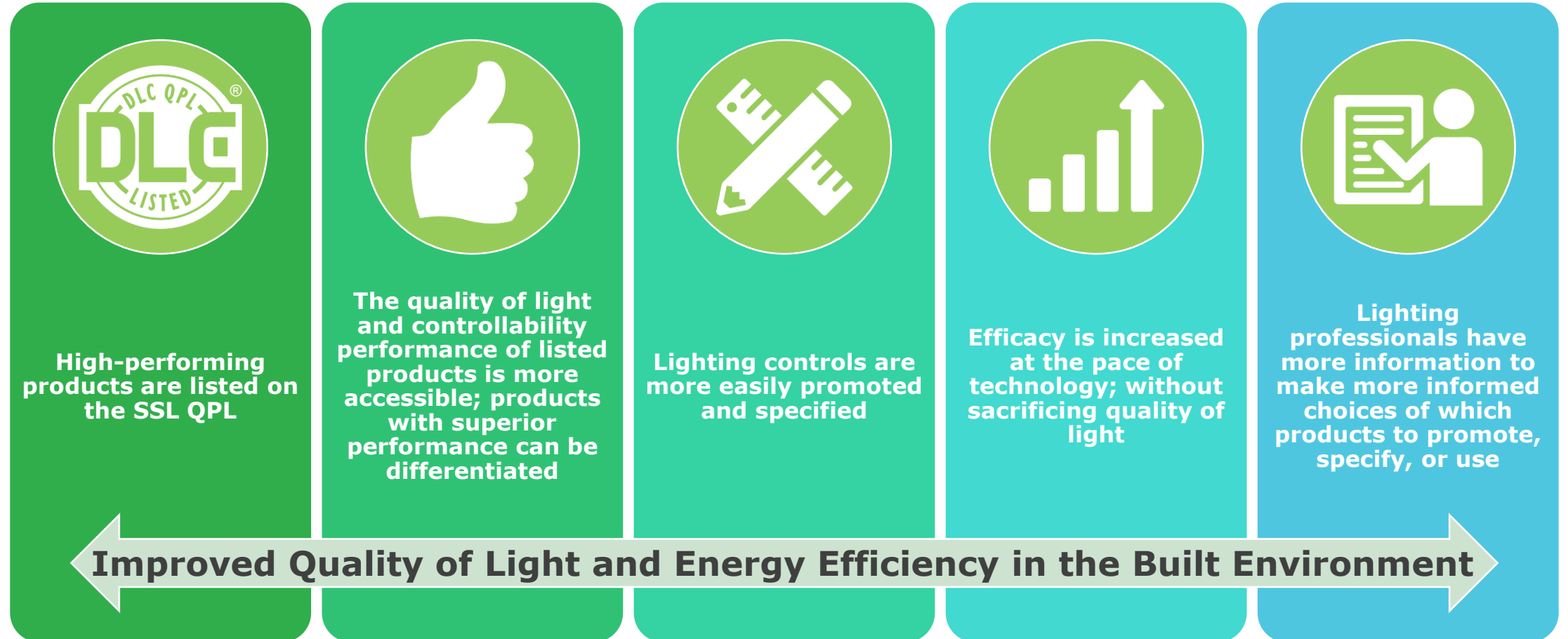
Opportunities:

Energy Savings

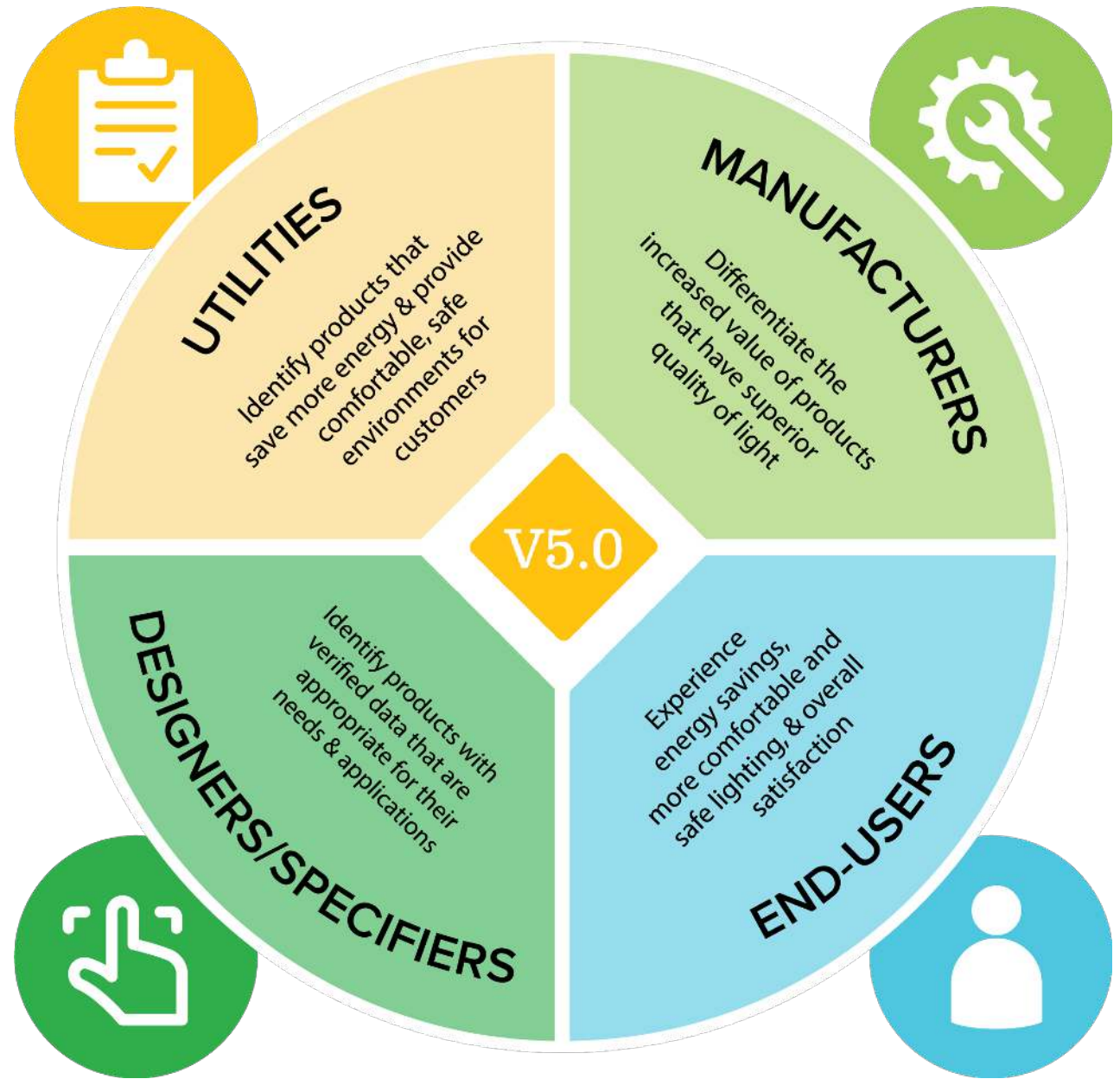
Quality of Light



Desired Outcomes



Version 5.0 Stakeholder Outcomes



Efficacy

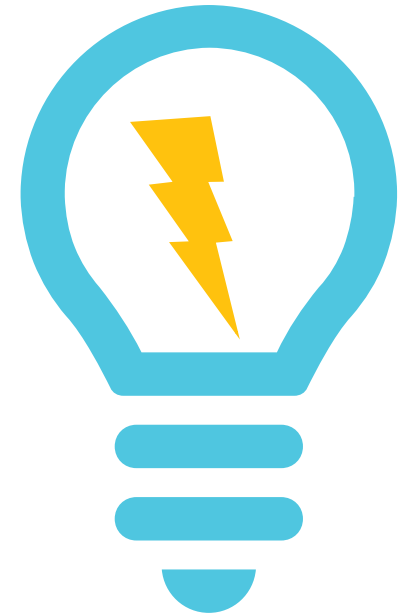
Revision History

- Relative to previous Versions, the DLC is proposing a smaller efficacy increase, due to two primary factors:
 - Efficacy improvements are happening at a slower pace than in the past
 - Continuing large increases in efficacy can have impacts on quality and cost

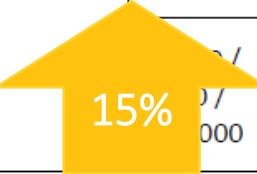
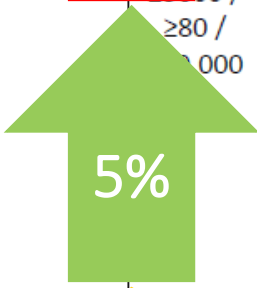
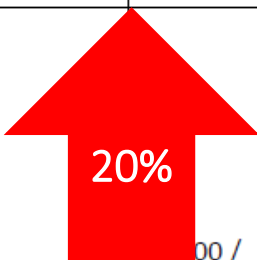
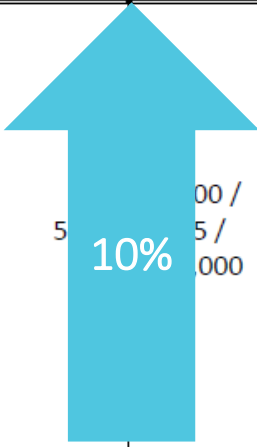
Year	SSL Version	Average Efficacy Increase
2011	1.6	25%
2013	2.0	17%
2015	3.0	n/a
2016	4.0	27%
2019	5.0	9.6% (proposed)

Efficacy Increase Bins

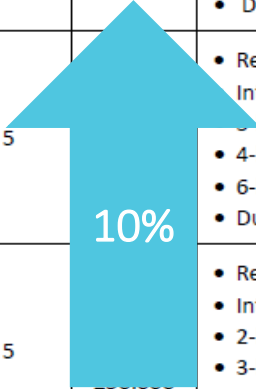
- The DLC conducted extensive analysis and research to understand the relationship between efficacy, product cost, and quality of light
- As a result, each General Application was grouped into four categories of increase bins:
 - \approx 5% increase
 - \approx 10% increase
 - \approx 15% increase
 - \approx 20% increase
- Draft values represent a DLC Standard classified product-weighted **average increase of 9.6%**



#	Category	General Application	Minimum Light Output (lm)	Requirements						Primary Use***	Distribution
				DLC Standard			DLC Premium**				
				Minimum Efficacy (lm/W)	Minimum Warranty (years)	CCT / CRI / L70	Minimum Efficacy (lm/W)	Minimum Warranty (years)	CCT / CRI / L90 / L70		
1	Outdoor	Outdoor – Low Output	250-5,000	90	5	100 / 5 / 1000	110	5	≤5700 / ≥65 / ≥36,000 / ≥50,000	<ul style="list-style-type: none"> • Outdoor Pole/Arm-Mounted Area and Roadway Luminaires • Outdoor Pole/Arm-Mounted Decorative Luminaires • Outdoor Full-Cutoff Wall-Mounted Area Luminaires • Outdoor Non-Cutoff and Semi-Cutoff Wall-Mounted Area Luminaires • Bollards • Parking Garage Luminaires • Fuel Pump Canopy Luminaires • Landscape/Accent Flood and Spot Luminaires • Architectural Flood and Spot Luminaires • Stairwell and Passageway Luminaires • Specialty: _____ 	
2		Outdoor – Mid Output	5,000-10,000	95			115				
3		Outdoor – High Output	10,000-30,000	100			120				
4		Outdoor – Very High Output*	≥30,000	100			120				
5	Indoor	Interior Directional	250-4,500	65	5	≥80 / 1000	90	5	≤5000 / ≥80 / ≥36,000 / ≥50,000	<ul style="list-style-type: none"> • Wall Wash Luminaires • Track or Mono-Point Luminaires • Specialty: _____ • Display Case Luminaires • Horizontal Refrigerated Case Luminaires • Vertical Refrigerated Case Luminaires • Specialty: _____ • 2x2 Luminaires for Ambient Lighting of Interior Commercial Spaces • 1x4 Luminaires for Ambient Lighting of Interior Commercial Spaces • 2x4 Luminaires for Ambient Lighting of Interior Commercial Spaces • Specialty: _____ • Direct Linear Ambient Luminaires • Linear Ambient Luminaires w/ Indirect component • Specialty: _____ • High Bay Luminaires for Commercial and Industrial Buildings • Low Bay Luminaires for Commercial and Industrial Buildings • High Bay Aisle Luminaires • Specialty: _____ 	See Primary Use Zonal Lumen Density Requirements in Table 4, below
6		Case Lighting	≥50 lm/ft	80			125				
7		Troffer	≥1,500	100			125				
8		Linear Ambient	≥375 lm/ft	105			130				
9		High Bay	≥5,000	105			130				



#	Category	General Application	Minimum Light Output (lm)	DLC Standard			Primary Use	Distribution
				Minimum Efficacy (lm/W)	Minimum Warranty (years)	CCT / CRI / L70		
17	Linear Replacement Lamps	T8 Four-Foot Linear Replacement Lamps	In luminaire: 2 lamps: 3,000 3 lamps: 4,500 4 lamps: 6,000 Bare lamp: 1,600	In luminaire: 100 Bare lamp: 110	5	≤5000 / ≥80 / ≥50,000	<ul style="list-style-type: none"> • Replacement Lamps ("Plug and Play") (UL Type A) • Internal Driver/Line Voltage (UL Type B) Lamps • 2-lamp External Driver (UL Type C) Lamps • 3-lamp External Driver (UL Type C) Lamps • 4-lamp External Driver (UL Type C) Lamps • Dual Mode Internal Driver (UL Type A or B) 	
18		T5 Four-Foot Linear Replacement Lamps	In luminaire: 2 lamps: 3,000 3 lamps: 4,500 4 lamps: 6,000 Bare lamp: 1,600	In luminaire: 100 Bare lamp: 110	5	≤5000 / ≥80 / ≥50,000	<ul style="list-style-type: none"> • Replacement Lamps ("Plug and Play") (UL Type A) • Internal Driver/Line Voltage (UL Type B) Lamps • 2-lamp External Driver (UL Type C) Lamps • 3-lamp External Driver (UL Type C) Lamps • 4-lamp External Driver (UL Type C) Lamps • Dual Mode Internal Driver (UL Type A or B) 	
19		T5HO Four-Foot Linear Replacement Lamps	In luminaire: 3 lamps: 7,500 4 lamps: 10,000 6 lamps: 15,000 Bare lamp: 3,200	In luminaire: 105 Bare lamp: 110	5	≤5000 / ≥80 / ≥50,000	<ul style="list-style-type: none"> • Replacement Lamps ("Plug and Play") (UL Type A) • Internal Driver/Line Voltage (UL Type B) Lamps • 2-lamp External Driver (UL Type C) Lamps • 3-lamp External Driver (UL Type C) Lamps • 4-lamp External Driver (UL Type C) Lamps • 6-lamp External Driver (UL Type C) Lamps • Dual Mode Internal Driver (UL Type A or B) 	
20		T8 Two-Foot Linear Replacement Lamps	In luminaire: 2 lamps: 1,350 3 lamps: 2,000 4 lamps: 2,700 Bare lamp: 800	In luminaire: 100 Bare lamp: 110	5	≤5000 / ≥80 / ≥50,000	<ul style="list-style-type: none"> • Replacement Lamps ("Plug and Play") (UL Type A) • Internal Driver/Line Voltage (UL Type B) Lamps • 2-lamp External Driver (UL Type C) Lamps • 3-lamp External Driver (UL Type C) Lamps • 4-lamp External Driver (UL Type C) Lamps • Dual Mode Internal Driver (UL Type A or B) 	
21		U-Bend Replacement Lamps	In luminaire: 2 lamps: 2,500 3 lamps: 3,750 Bare lamp: 1,400	In luminaire: 100 Bare lamp: 110	5	≤5000 / ≥80 / ≥50,000	<ul style="list-style-type: none"> • Replacement Lamps ("Plug and Play") (UL Type A) • Internal Driver/Line Voltage (UL Type B) Lamps • 2-lamp External Driver (UL Type C) Lamps • 3-lamp External Driver (UL Type C) Lamps • Dual Mode Internal Driver (UL Type A or B) 	
22		T8 Three-Foot Linear Replacement Lamps	In luminaire: 2 lamps: 2,200 Bare lamp: 1,200	In luminaire: 100 Bare lamp: 110	5	≤5000 / ≥80 / ≥50,000	<ul style="list-style-type: none"> • Replacement Lamps ("Plug and Play") (UL Type A) • Internal Driver/Line Voltage (UL Type B) Lamps • 2-lamp External Driver (UL Type C) Lamps • Dual Mode Internal Driver (UL Type A or B) 	



Please note:

- As this is a conceptual draft, we haven't proposed specific level for DLC Premium or additional allowances. This will be proposed in the second draft.



Open Questions & Request for Comment

- Please review the [Draft Policy](#) for more information and to provide your feedback.
- Included are **three key questions** on efficacy, for example:
 - The DLC is interested in further understanding the cost implication of the proposed efficacy increases. Can you provide any specific information or data as to how the cost of a product may or may not increase with the proposed efficacy levels?
- We look forward to your help answering the key questions in the draft document!

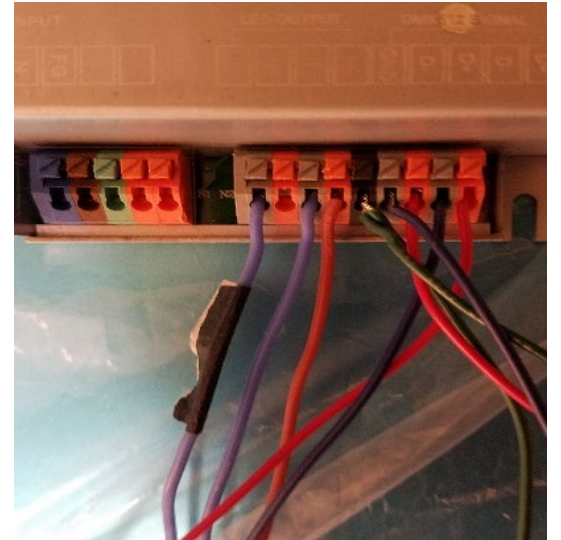
Quality of Light

Spectral Quality:

- Color of Light
- Color Rendering of Objects

Rationale

- Color quality directly influences **task performance**.
 - Recognizing differences quickly and accurately.
- Color quality is related to occupant **safety**.
 - Distinguishing color coded messaging and information.
- Color quality is a major factor in **aesthetics**.
 - Appreciating art and design.
- Color quality is a critical for **wellbeing**.
 - Experiencing visual comfort and supportive atmosphere.



Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	V5.0 Draft Requirements		Method of Evaluation
		Tier 1	Tier 2	
Color Rendering (of objects)	CRI (CIE 13.3-1995): <ul style="list-style-type: none"> • $R_a \geq 80$ (indoor) • $R_a \geq 65$ (outdoor) • $R_a \geq 70$ (high bay) 	ANSI/IES TM-30-18: <ul style="list-style-type: none"> • IES $R_f \geq 78$ • IES $R_g \geq 95$ • $-1\% \leq \text{IES } R_{cs,h1} \leq +15\%$ CIE 13.3-1995: <ul style="list-style-type: none"> • $R_a \geq 90$ and $R_9 \geq 50$ 	ANSI/IES TM-30-18: <ul style="list-style-type: none"> • IES $R_f \geq 70$ • IES $R_g \geq 89$ • $-12\% \leq \text{IES } R_{cs,h1} \leq +23\%$ CIE 13.3-1995: <ul style="list-style-type: none"> • $R_a \geq 80$ and $R_9 \geq 0$ 	IES LM-79-08 ANSI C78.377-2017 (ANSI/IES TM-30-18 Full Report and CIE 13.3-1995 complete CRI Detail)

Color Rendering (of Objects):

- Two tiers of requirements
- Qualification path for TM-30 or CRI
- Both TM-30 and CRI to be reported



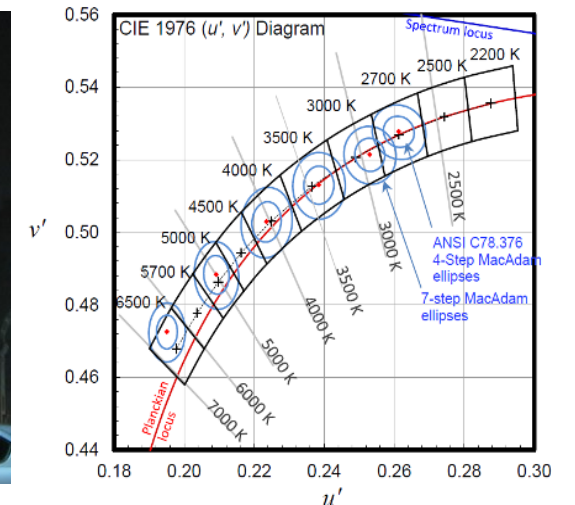
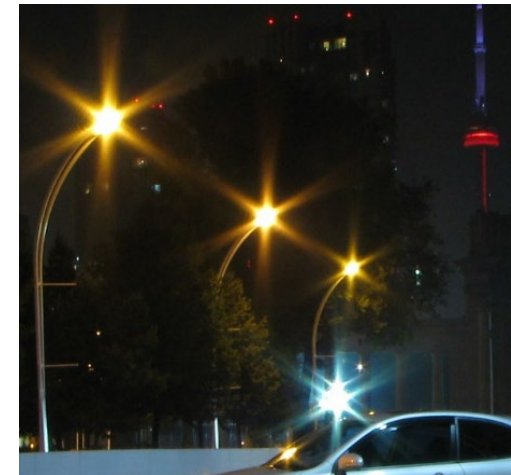
Source: Don Slater, NightTime Design

Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	V5.0 Draft Requirements		Method of Evaluation
		Tier 1	Tier 2	
Color of Light Chromaticity (CCT & D_{uv})	7-step ANSI quadrangle CCTs ≤ 5000 K (indoor) CCT ≤ 5700 K (outdoor & high bay)	4-step ANSI quadrangle CCTs 2200 K – 6500 K	7-step quadrangle CCTs 2200 K – 6500 K	IES LM-79-08 ANSI C78.377-2017

Color of Light (Chromaticity, D_{uv} , CCT):

- Two tiers of requirements
- Expanding CCT definitions to 2200 – 6500 K as per ANSI C78.377-2017



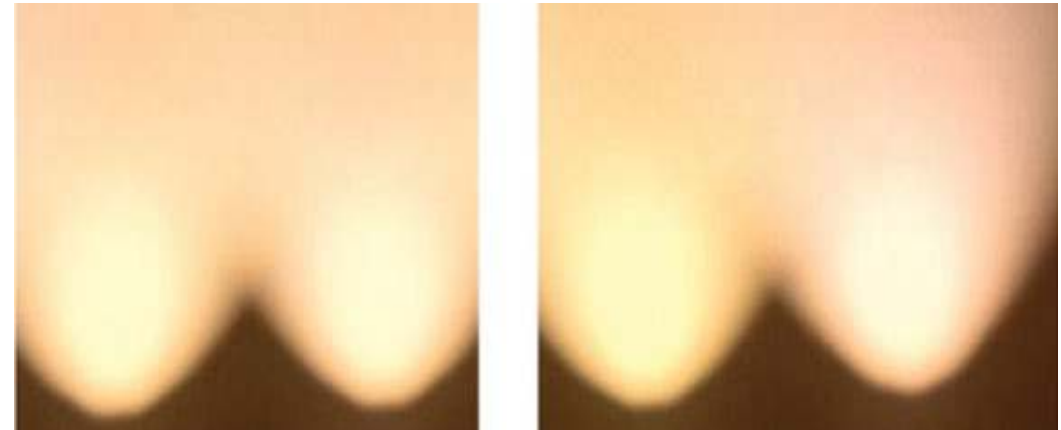
Source: ANSI C78.377-2017

Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	V5.0 Draft Requirements		Method of Evaluation
		Tier 1	Tier 2	
Color Maintenance	n/a	Chromaticity shift (0-hour to ≥ 6000 hours) within a distance of $\Delta u'v' \leq 0.002$ (CIE 1976)	Chromaticity shift (0-hour to ≥ 6000 hours) within a distance of $\Delta u'v' \leq 0.004$ (CIE 1976)	ANSI IES LM-80-15 and/or IES LM-84-14

Color Maintenance:

- Two tiers of requirements
- Chromaticity shift at ≥ 6000 hours



Source: IES DG-1-16 (Figure 50, Maria Thompson)

Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	V5.0 Draft Requirements		Method of Evaluation
		Tier 1	Tier 2	
Consistency (of chromaticity)	n/a	Chromaticity of 3 tested samples shall fall within a circle of diameter of 0.003 (CIE 1976)	Chromaticity of 3 tested samples shall fall within a circle of diameter of 0.006 (CIE 1976)	IES LM-79-08 ANSI C78.377-2017
Angular Color Uniformity	n/a	Optional reporting: Chromaticity variance ($\Delta u'v'$) throughout the beam and/or field angle (resolution: 1° on the 0° and 90° vertical planes)		IES LM-79-08

Color Consistency:

- Two tiers of requirements
- Three product units shall provide close to the same chromaticity

Angular Color Uniformity:

- Optional reporting for manufacturers to enable differentiation
- Relevant only for certain PUDs

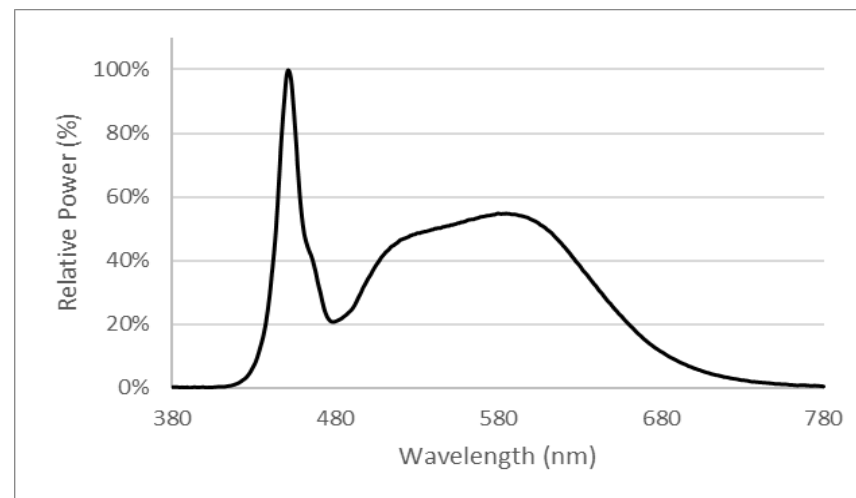


Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	V5.0 Draft Requirements		Method of Evaluation
		Tier 1	Tier 2	
Spectral Power Distribution (SPD)	n/a	Spectral range of 380 – 780 nm at 1 nm increments must be reported.		IES LM-79-08 (per IES TM-27-14 and/or ANSI IES TM-33-18)

Spectral Power Distribution (SPD):

- Reporting of the SPD derived from sphere testing
- Enabling calculation of other (future) metrics



Considerations

The DLC seeks spectral requirements that:

- Align with industry organizations, practices and guidelines
- Distinguish products that meet a minimum acceptable level of performance
- Enable differentiation of products that provide superior color quality performance for applications and projects that require it
- Don't place excessive burden or expense on applicants

Open Questions & Request for Comment

- Please review the [Draft Policy](#) for more information and to provide your feedback.
- Included are **six key questions**, for example:
 - The DLC has proposed defining two tiers of color quality, one for baseline quality, the other for projects requiring higher color quality. Are two tiers appropriate?
- We look forward to your help answering the key questions in the draft document!

Quality of Light

Spectral Quality:

Support for Alertness, Sleep, and
Circadian Wellbeing

Rationale

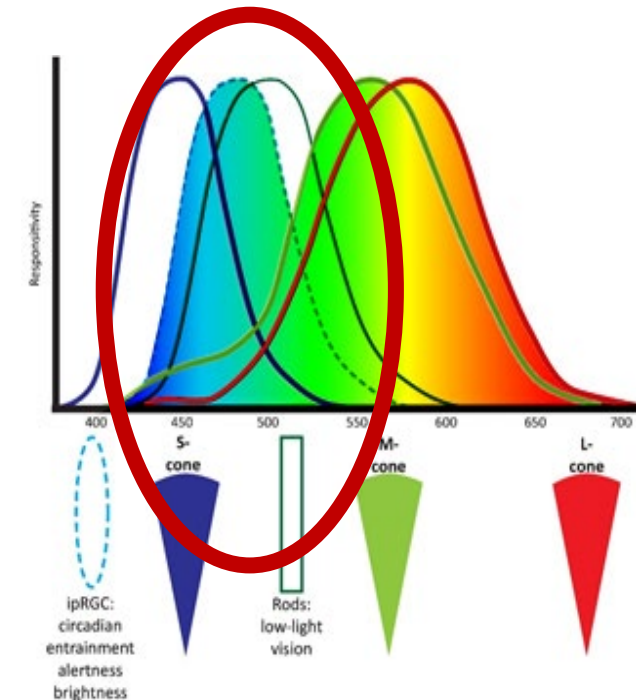
- To encourage the use of lighting products that can support human wellbeing by modulating the light spectrum
- To provide information as to a lighting product's spectral properties around 460-520 nanometers :
 - (Daytime) Alertness
 - Circadian Wellbeing (lighting to support daily rhythms)
- To enable product differentiation to meet needs of applications with specific demands on human performance and wellbeing
 - (e.g. work environments, health care, educational facilities)

Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	V5.0 Draft Requirements	Method of Evaluation
Melanopic Flux	n/a	Required to report.	As per CIE S 026/E:2018
M/P Ratio	n/a	Required to report.	As per Lucas et al., 2014, and WELL™ v2, Appendix L1
Melanopic Daylight (D65) Efficacy Ratio	n/a	Required to report.	As per CIE S 026/E:2018

Reporting of additional information easily derived from the SPD:

- Information for spectral properties around 460-520 nm (ipRGC / melanopsin sensitivity)
- Melanopic Flux of luminaire
- Melanopic/Photopic Ratio (M/P Ratio)
- Melanopic Daylight (D65) Efficacy Ratio

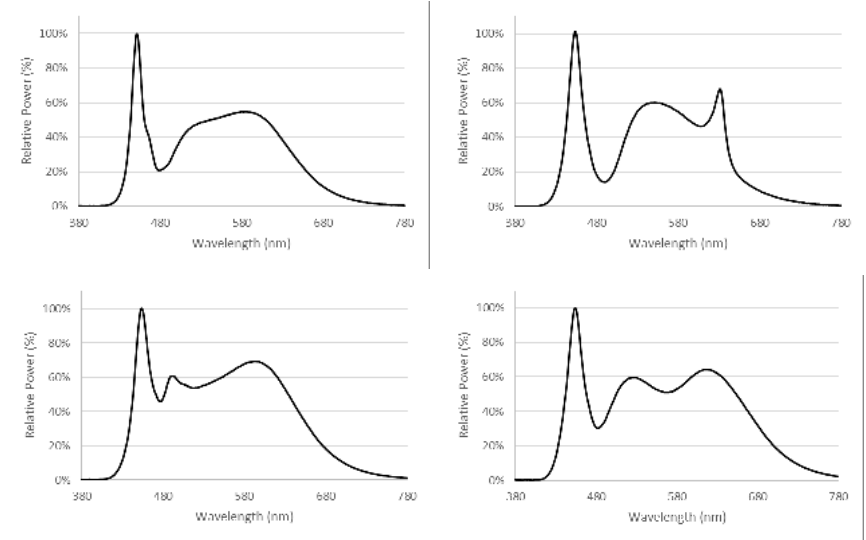


Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	V5.0 Draft Requirements	Method of Evaluation
Spectral Power Distribution (SPD)	n/a	Spectral range of 380 – 780 nm at 1 nm increments must be reported.	IES LM-79-08 (per IES TM-27-14 and/or ANSI IES TM-33-18)

Spectral Power Distribution (SPD):

- Reporting of the SPD derived from sphere testing
- Enabling calculation of other metrics
 - Use with the **Circadian Stimulus (CS)** calculator (Lighting Research Center) to estimate the lighting impact in application
 - Use with metrics still in development



Considerations

- The DLC seeks spectral requirements that:
 - Support industry efforts that address health-conscious design
 - Inform product selection for applications and projects that require it
 - Encourage education and innovation
- V5.0 is based on metrics that can be reported at the product level; site conditions such as timing, room finishes, light level, and others are important additional factors
- Ongoing research efforts to refine metrics and guidelines; current lack of alignment within the industry on most appropriate metric

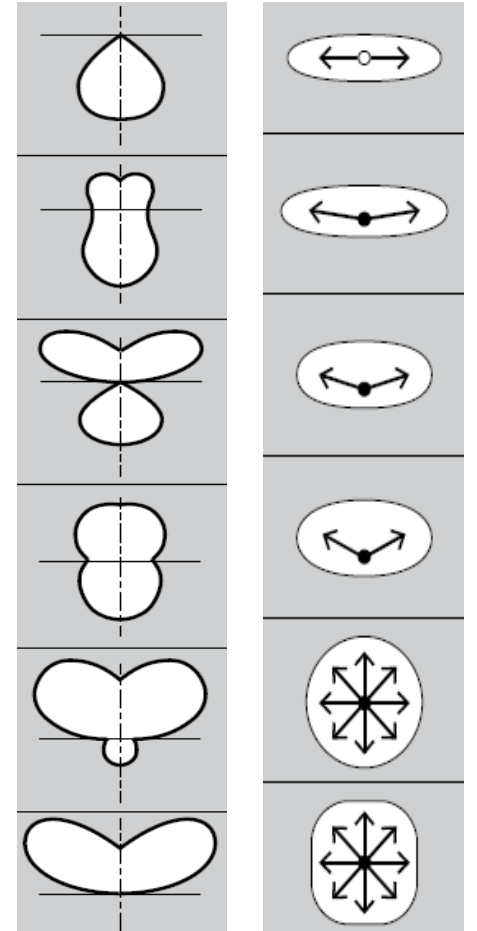
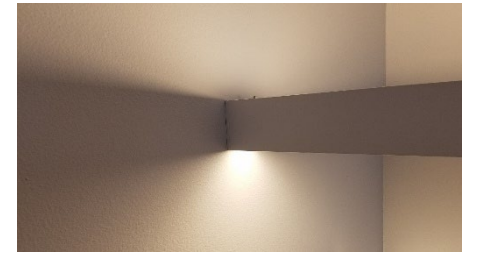
Open Questions & Request for Comment

- Please review the [Draft Policy](#) for more information and to provide your feedback.
- Included are **three key questions**, for example:
 - The DLC has proposed reporting of the SPD to enable calculation of current and future metrics. What are the major questions or complicating issues you have with this proposal and what are your suggestions to address them?
- We look forward to your help answering the key questions in the draft document!

Quality of Light Distribution

Rationale

- Light Distribution is important for **energy consumption**.
 - minimizing wasted light
- Light Distribution directly influences **task performance**.
 - quantity and uniformity of light to optimize visual performance
- Light Distribution is related to occupant **safety**.
 - visibility for navigation and detecting obstacles
- Light Distribution is a major factor in **aesthetics**.
 - shaping and enhancing the architectural environment
- Light Distribution is a critical for **wellbeing**.
 - Experiencing visual comfort and supportive atmosphere.



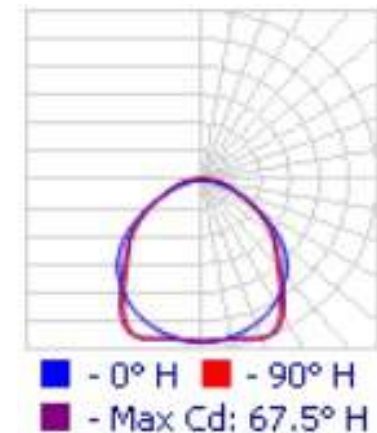
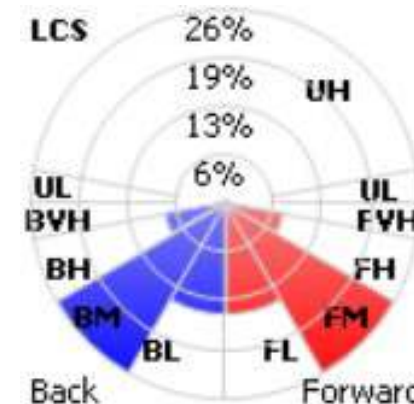
Source: IES HB-10-11 (Figure 8.1, 8.4, Indoor and Outdoor Classification Systems)

Draft Testing and Reporting Requirements

Metric and/or Data set	Current V4.4 Requirement	V5.0 Draft Requirements		Method of Measurement	Applies to
		Threshold	Reported		
.ies file	.ies file for each optical variation	None	.ies files for each variation	IES LM-79-08, ANSI/IES LM-63-02, ANSI/IES TM-33-18	All products
Zonal Lumen Distributions & Spacing Criteria	PUD-specific requirements	PUD-specific requirements, identical to V4.4		Produced by photometric analysis from .ies file	All PUDs
Polar Plot of Distribution	No related requirement	None	Polar plots for 0°, 90°, and Maximum Intensity angle	Produced by photometric analysis of .ies file	All PUDs

Distribution:

- Reporting of distribution data (.ies file)
- ZLD requirements stay the same
- Reporting of polar plot (from .ies file)

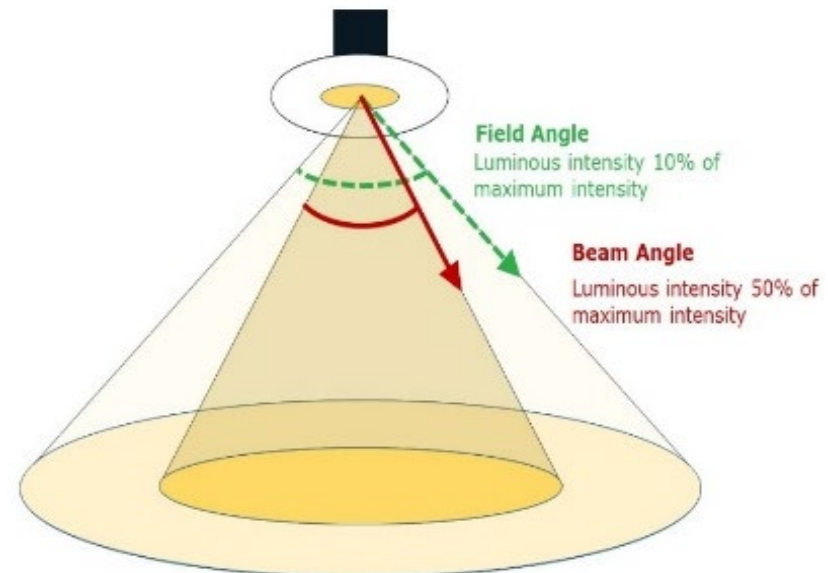


Draft Testing and Reporting Requirements

Metric and/or Data set	Current V4.4 Requirement	V5.0 Draft Requirements		Method of Measurement	Applies to
		Threshold	Reported		
Beam Angle	No related requirement	None	Angle from 0 - 180°	Values produced by photometric analysis from .ies file	<ul style="list-style-type: none"> • Landscape/ Accent Flood and Spot Luminaires • Architectural Flood and Spot Luminaires • Track or Mono-Point Luminaires • Wall Wash Luminaires
Field Angle	No related requirement		Angle from 0 - 180°		

Additional Distribution Information (for certain PUDs):

- Reporting of beam angle (from .ies file)
- Reporting of field angle (from .ies file)



Draft Testing and Reporting Requirements

Metric and/or Data set	Current V4.4 Requirement	V5.0 Draft Requirements		Method of Measurement	Applies to
		Threshold	Reported		
Backlight, Uplight and Glare (BUG) Rating	No related requirement	None	BUG values from 0 to 5	IES TM-15-11, Addendum A: Luminaire Classification System for Outdoor Luminaires	All QPL outdoor products, except: <ul style="list-style-type: none"> • Landscape/ Accent Flood and Spot Luminaires • Architectural Flood and Spot Luminaires

BUG (Backlight, Uplight and Glare / Forward light):

- Reporting of B U G values (based on lumen output of the fixture within predefined solid angles)

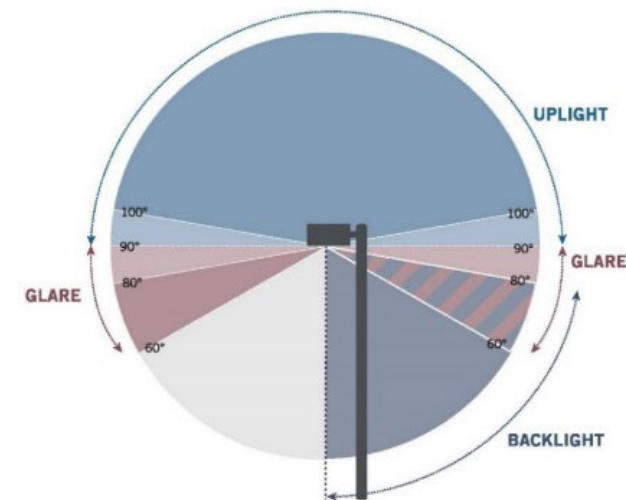


Image Credit: California Lighting Technology Center, UC Davis

Considerations

- The DLC seeks distribution requirements that:
 - Align with other industry organizations, practices and guidelines
 - Distinguish products that meet a minimum acceptable level of performance
 - Enable differentiation of products that provide superior quality for applications and projects that require it
 - Don't place excessive burden or expense on applicants
- No metric for task-plane efficacy is ready for implementation
- BUG: Type V luminaires distribute light onto the ground in all directions (here, a high B value does not indicate poor performance)

Open Questions & Request for Comment

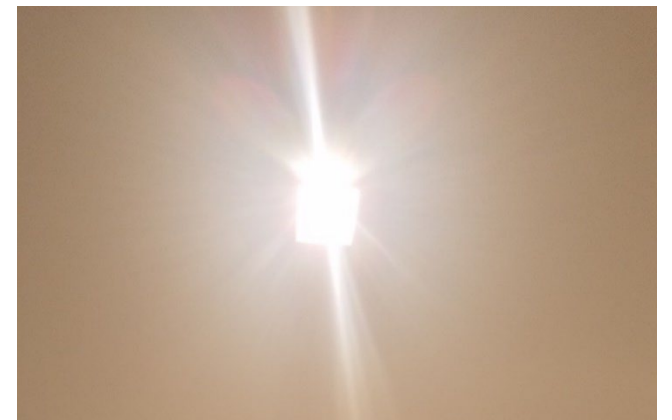
- Please review the [Draft Policy](#) for more information and to provide your feedback.
- Included are **four key questions** on distribution, for example:
 - The DLC has proposed reporting of the photometric distribution, beam and field angle. Is this information more useful as a visual diagram, or a set of numbers? What are your suggestions to make this information most useful?
- We look forward to your help answering the key questions in the draft document!

Quality of Light

Glare

Rationale

- Glare directly influences **task performance**.
 - Can hinder visibility and/or distract attention and focus
- Glare is related to occupant **safety**.
 - Can hinder visibility for navigation and obstacle detecting
- Glare is a critical for **wellbeing**.
 - Can create annoyance, eye strain, and discomfort
- **Discomfort glare factors:**
 - Luminance of the glare source, size of the glare source, position of the source in the field of view, luminance of the background

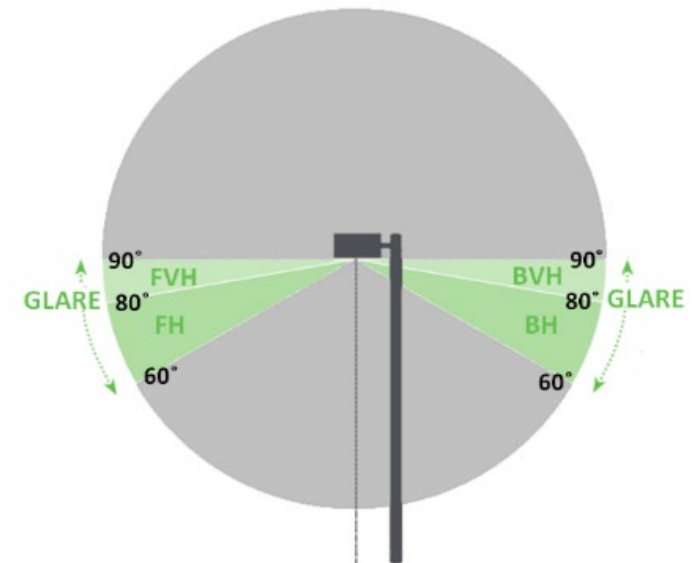


Draft Testing and Reporting Requirements

Metric and/or Data Set	Current V4.4 Requirements	V5.0 Draft Requirements			Method of Evaluation
		Threshold	Reported	Listing	
.ies file	.ies file for each optic variation	None	.ies files for each variation	N/A	IES LM-79-08, ANSI/IES LM-63-02 and/or ANSI/IES TM-33-18
Backlight, Uplight, and Glare (BUG) <i>Applicable to outdoor luminaires and outdoor retrofit kits only</i>	No related requirement	None	BUG values from 0 to 5	G rating (BU listed as part of Distribution policy)	IES TM-15-11, Addendum A: Luminaire Classification System for Outdoor Luminaires

Glare:

- Distribution data (.ies) and BUG information as covered in Distribution section



Draft Testing and Reporting Requirements

Metric and/or Data Set	Current V4.4 Requirements	V5.0 Draft Requirements			Method of Evaluation
		Threshold	Reported	Listing	
Unified Glare Rating (UGR) <i>Applicable to indoor luminaires and indoor retrofit kits only</i>	No related requirement	None	Uncorrected UGR Table (1000 lm) and Corrected UGR Table (product lm)	Designation of glare potential: <ul style="list-style-type: none"> • Low • Medium • High (to be defined in a later draft)	UGR tables as per CIE 117-1995, CIE 190-2010

Unified Glare Rating (UGR):

- Reporting of the UGR tables
- Calculated using distribution data and software

Room Dimensions		Viewed crosswise					Viewed endwise					
X=2H	Y=2H	8.9	10.5	9.3	10.8	11.1	10.7	12.2	11.0	12.5	12.9	
	3H	10.5	11.9	10.8	12.2	12.6	12.4	13.8	12.8	14.2	14.5	
	4H	11.0	12.3	11.4	12.6	13.0	13.1	14.5	13.5	14.8	15.2	
	6H	11.5	12.7	11.9	13.1	13.5	13.6	14.8	14.0	15.2	15.6	
	8H	11.7	12.9	12.2	13.3	13.7	13.8	14.9	14.2	15.3	15.7	
	12H	12.0	13.2	12.5	13.5	14.0	13.8	15.0	14.3	15.3	15.8	
	4H	2H	9.6	11.0	10.0	11.3	11.7	11.0	12.4	11.4	12.7	13.1
		3H	11.4	12.5	11.8	12.9	13.3	13.0	14.1	13.4	14.5	14.9
		4H	12.0	13.0	12.4	13.4	13.9	13.9	14.9	14.3	15.3	15.7
		6H	12.7	13.5	13.1	14.0	14.4	14.5	15.4	15.0	15.8	16.3
		8H	13.0	13.8	13.5	14.2	14.7	14.7	15.5	15.2	16.0	16.4
		12H	13.4	14.1	13.8	14.6	15.0	14.8	15.6	15.3	16.0	16.5
	8H	4H	12.4	13.2	12.8	13.6	14.1	14.0	14.8	14.5	15.3	15.8
		6H	13.2	13.8	13.7	14.3	14.8	14.8	15.4	15.3	15.9	16.4
		8H	13.6	14.2	14.1	14.7	15.2	15.0	15.6	15.5	16.1	16.6
		12H	14.1	14.7	14.6	15.1	15.7	15.2	15.7	15.7	16.2	16.8
	12H	4H	12.4	13.1	12.9	13.6	14.1	14.0	14.8	14.5	15.2	15.7
		6H	13.2	13.8	13.8	14.3	14.8	14.8	15.4	15.3	15.9	16.4
		8H	13.7	14.3	14.3	14.8	15.3	15.1	15.6	15.6	16.1	16.7

Considerations

- The DLC seeks glare requirements that:
 - Align with other industry organizations, practices and guidelines
 - Provide basic indications on the likelihood of causing performance concerns in the field
 - Enable differentiation of products that provide superior quality for applications and projects that require it
 - Don't place excessive burden or expense on applicants
- UGR is more widely used in Europe than the US; research into glare metrics is still ongoing
- Glare in the BUG system relates mainly to driver glare, not pedestrian glare (where angles from 0 to 60° can more easily cause discomfort)

Open Questions & Request for Comment

- Please review the [Draft Policy](#) for more information and to provide your feedback.
- Included are **six key questions** on glare, for example:
 - The DLC has proposed reporting of the UGR tables for indoor luminaires using the luminaire .ies file. What are the major questions or complicating issues you have with this proposal and what are your suggestions to address them?
- We look forward to your help answering the key questions in the draft document!

Quality of Light

Flicker

Rationale

- Flicker free operation is a critical component of **visual comfort**
 - Can cause annoyance, loss in productivity
- Flicker has **health impacts**
 - Can lead to eye strain, migraines, anxiety, photo epilepsy, exacerbate undesirable behaviors among persons with autism
- Flicker can cause **dangerous industrial working environments**
 - Rotating machinery can appear still
- Flicker can **interfere** with machine vision and imaging devices
 - E.g. barcode scanners, sensors, video feeds

Definitions

- DLC uses the term “Flicker” to generally describe Temporal Light Artifacts (TLA), which includes 3 categories of light modulation over time:
 - Flicker (<80 Hz)
 - Stroboscopic Effect (80 Hz – 2,000 Hz)
 - Phantom Array Effect (80 Hz – 2,500 Hz)



Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	V5.0 Draft Requirements		Method of Evaluation	
		Threshold			Reported
		Tier 1	Tier 2		
Short Term Flicker (P_{st})	n/a	≤ 1.0 at 100% and 20% light output		ANSI/IES LM-xx-19 Approved Method: Measuring Optical Waveforms for use in Temporal Light Artifact (TLA) Calculations	
Stroboscopic Visibility Measure (SVM)	n/a	≤ 0.4 at 100% and 20% light output	≤ 0.9 at 100% and 20% light output		SVM at 100%, 20%, and minimum fraction of light output

- $P_{st} \leq 1.0$ is the recommended limit for short term flicker in NEMA 77
- The two tier threshold for SVM reflects recent research that an SVM of 0.9 means 25% of the population will detect the flicker 63% of the time and an SVM of 0.4 means that just 10% of people will detect the stroboscopic flicker

Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	V5.0 Draft Requirements		Method of Evaluation	
		Threshold			Reported
		Tier 1	Tier 2		
Percent Flicker	n/a	No required threshold		ANSI/IES LM-xx-19 Approved Method: Measuring Optical Waveforms for use in Temporal Light Artifact (TLA) Calculations	
Flicker Index	n/a				

- Reporting Percent Flicker at these various light outputs and frequency cutoffs allow users to compare a product's flicker performance according to IEEE PAR 1789 and determine if their product meets California's Title 24 levels
- Flicker Index accounts for average peak-to-peak amplitude, wave-form shape, and duty cycle of the flicker

Considerations

- Little alignment within the industry around proper metrics and appropriate thresholds
- The DLC wants a flicker requirement that is:
 - Clearly understood
 - Easy to compare between products
- Draft Technical Requirements are based on two dominant perspectives on flicker:
 - IEEE PAR 1789
 - NEMA 77

Open Questions & Request for Comment

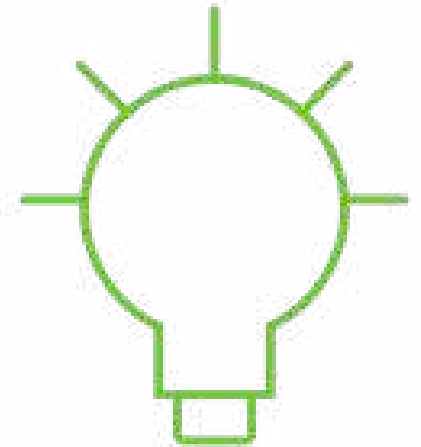
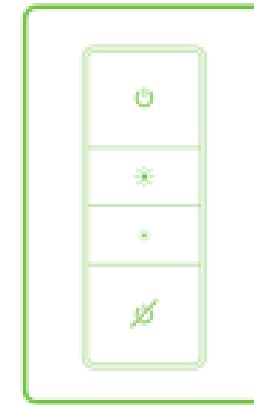
- Please review the [Draft Policy](#) for more information and to provide your feedback.
- Included are **three key questions** on flicker, for example:
 - The DLC understands the current family grouping structure of the QPL may not support the reporting of flicker metrics and testing each product may be overly burdensome. How can the DLC ensure that products meet the flicker requirements without testing each product?
- We look forward to your help answering the key questions!

Controllability

Rationale

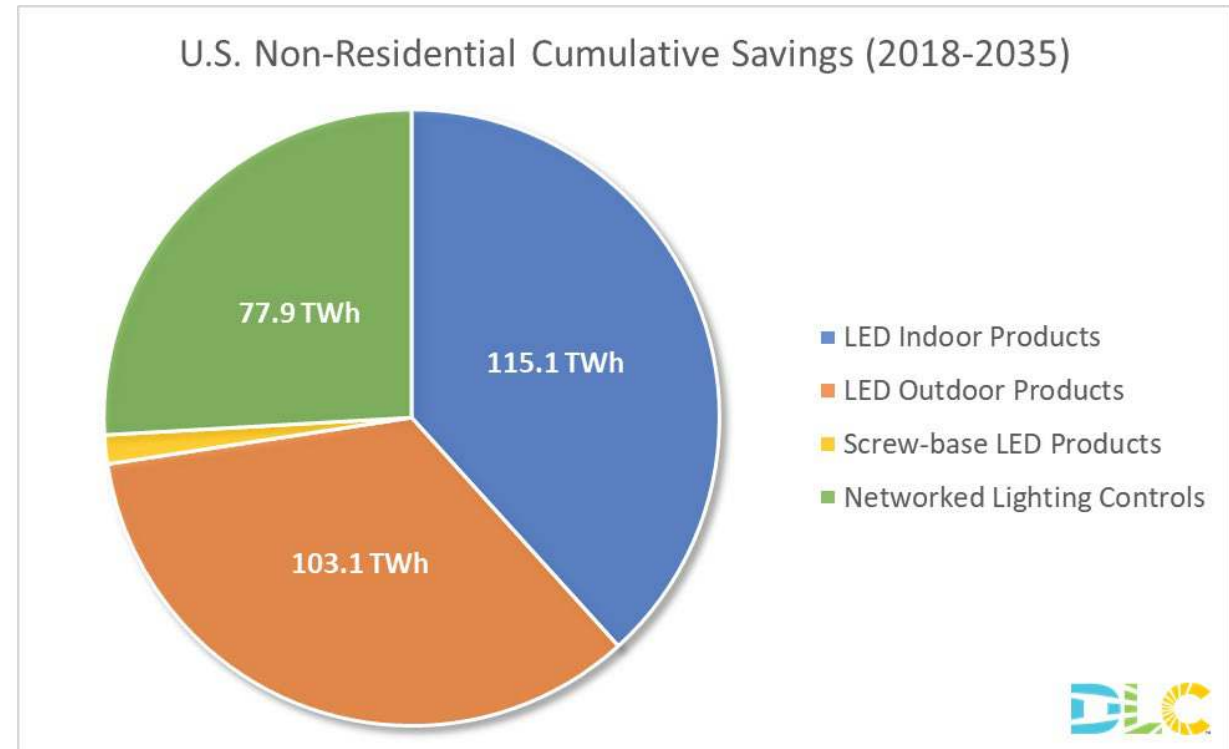
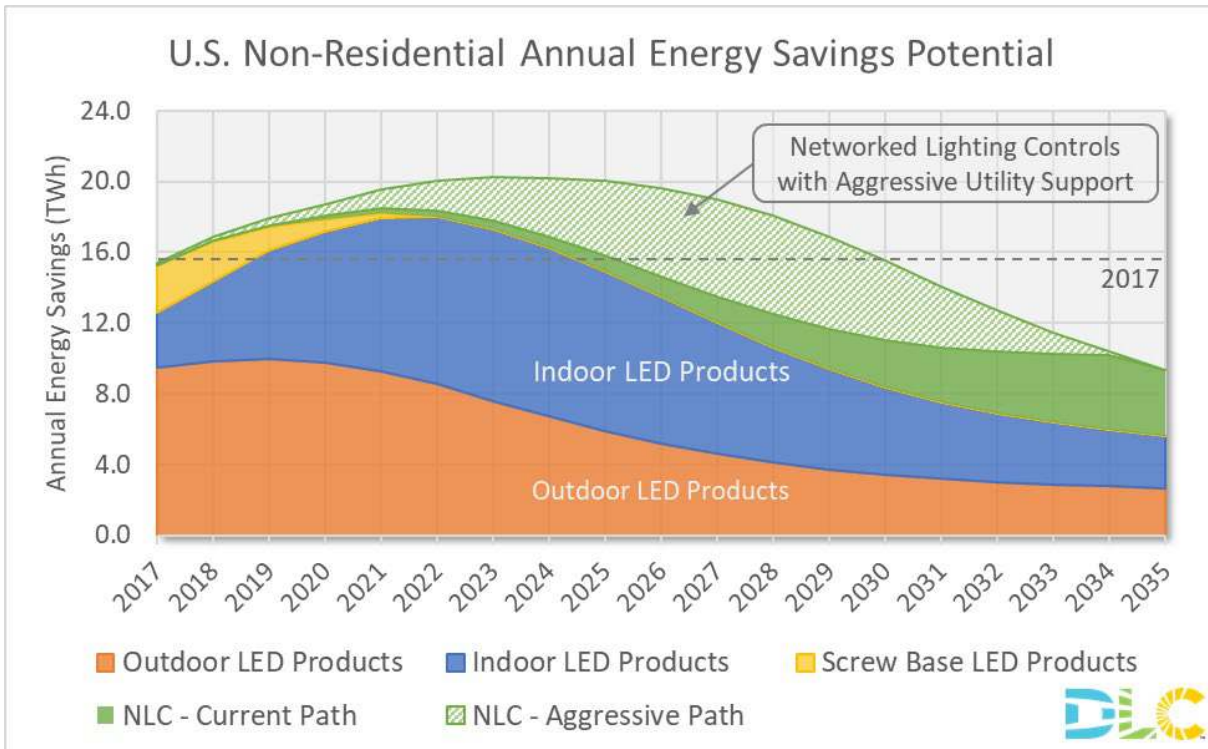
Make it easier to do the right thing.

1. Reduce uncontrolled installs. They'll stay that way for a decade.
2. Reduce friction in the "how do I control this?" product decision and purchase chain.
3. If something does get installed without controls, at least make it *controllable* for later.



Controllability Motivation

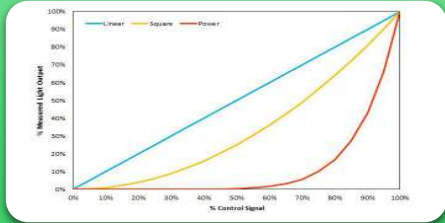
This future can't be realized without products that are controllable



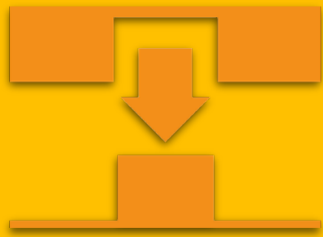
How Might We Do It?



Integral Controls



Dimming Required*

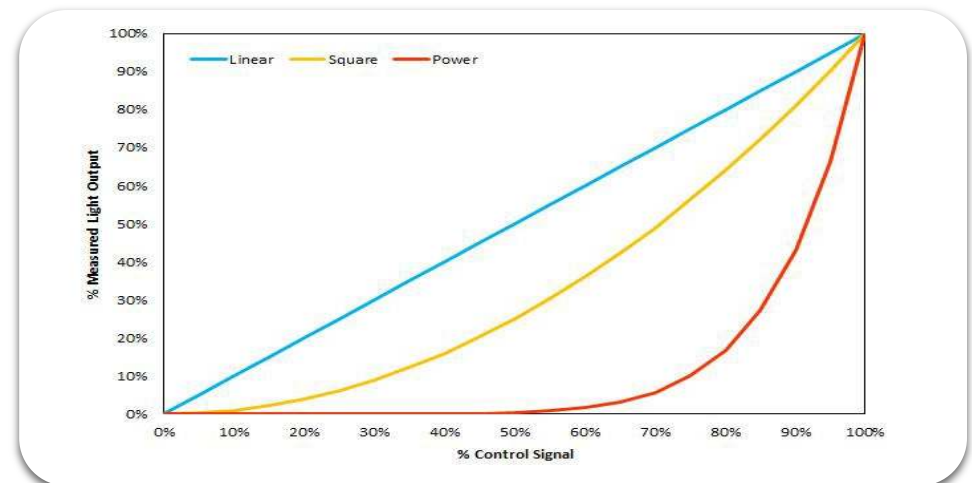


Controls Compatibility

Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	Draft Requirement	Method of Evaluation
Dimming	Reporting of dimming capability required for all products	Dimming capability required for all products, with category exceptions. Continuous dimming required for indoor, stepped dimming for outdoor.	Product documentation

- Dimming section on QPL may show:
 - Continuous
 - Stepped
 - Exempt



Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	Draft Requirement	Method of Evaluation
Integral Controls	Reporting optional, with Yes/No answers of whether product has integral controls (Reporting required for Premium).	Required to report, with additional information provided	Product documentation

- Integral Controls section on QPL may show:
 - Daylight harvesting
 - Occupancy sensing
 - Energy metering
 - Temperature
 - ?



Draft Testing and Reporting Requirements

Metric	Current V4.4 Requirements	Draft Requirement	Method of Evaluation
Controls Compatibility	None	Required to report method of inducing dimming in the product.	Product documentation

- Controls Compatibility section on QPL may show:
 - Dimming signal type
 - Dimming signal communication method



Open Questions & Request for Comment

- Please review the [Draft Policy](#) for more information and to provide your feedback.
- Included are **five key questions** on controllability, for example:
 - What capability information for integral controls should the DLC collect and report?
- We look forward to your help answering the key questions!

Other Topics Under Consideration

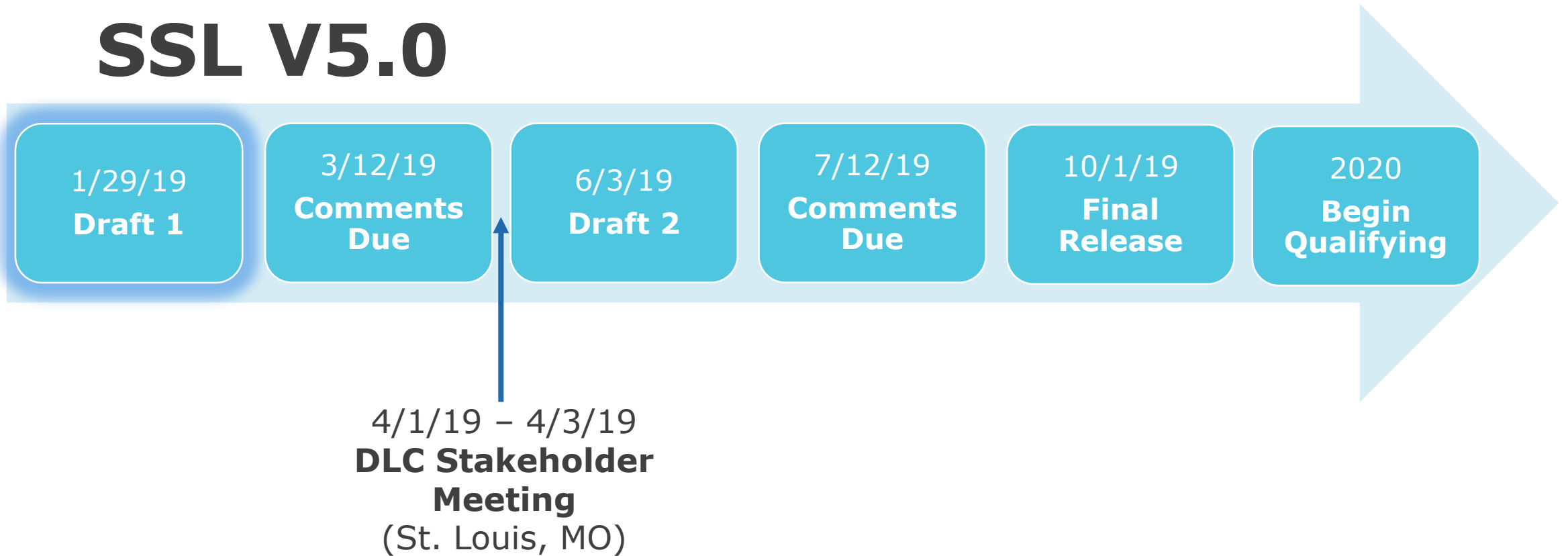
Other Topics Under Consideration

- The DLC is considering a number of other topics to include in the next draft of V5.0 and requests comment from stakeholders on the following:
 - DLC Premium
 - DLC Product Information Sheet
 - Non-Standard Form Factors
 - Platform Qualification
 - Reference Housings
 - Dark-Sky Friendly Luminaires

Next Steps

Important Dates

SSL V5.0



2019



April 1 - 3 • St. Louis, MO

STAKEHOLDER MEETING



Thank You!

Gabe Arnold
Ute Besenecker
Damon Bosetti
Axel Pearson

Please send questions and comments to:
Comments@designlights.org

DesignLights Consortium®
www.designlights.org