



Stakeholder MEETING

2017

Color Tuning: Assessing Performance

Facilitator



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DLC



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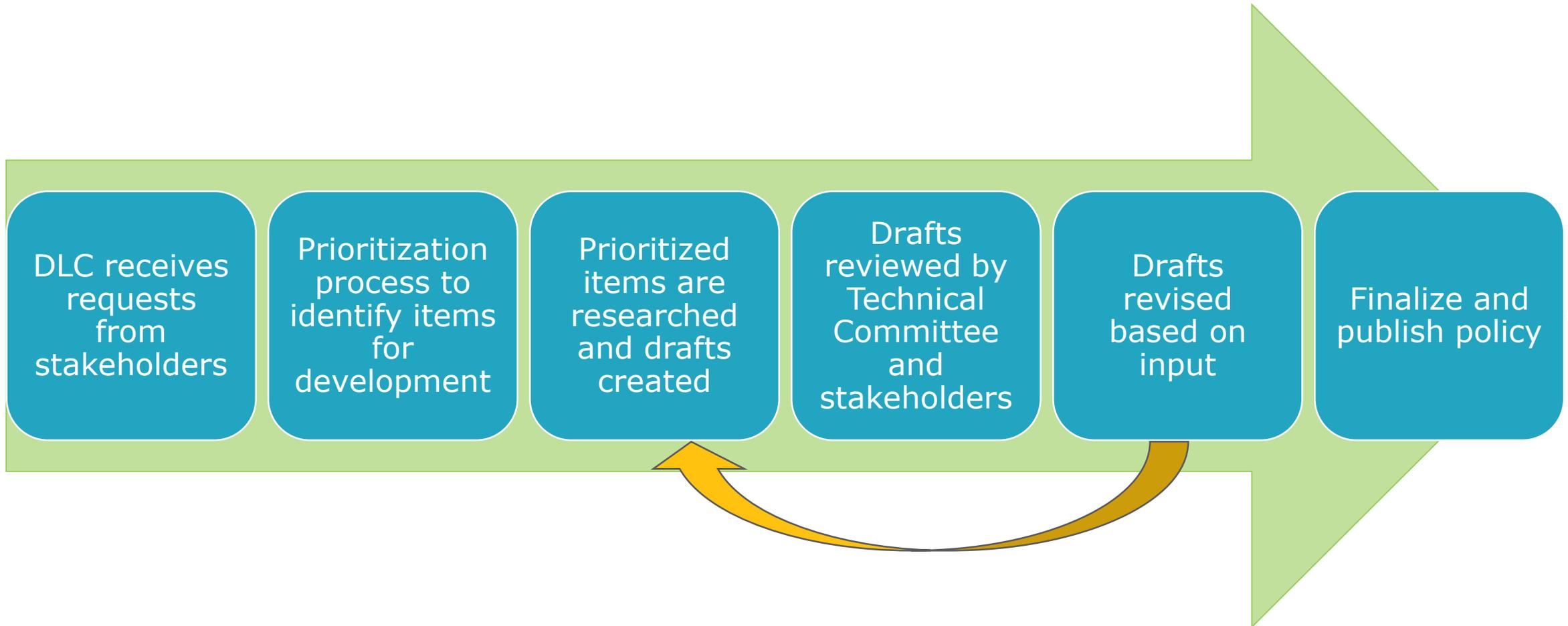
Discussion Session Ground Rules

- Please sign in on the Roster
- Please state your name and organization
 - At least the first two times you speak
 - Allows us take more detailed notes
- Self-police (and speak up) on any areas where you feel anti-trust issues may become problematic
- Be courteous to others!
- Don't be afraid to speak up
- Presentations will be posted on the website (no need for photos)

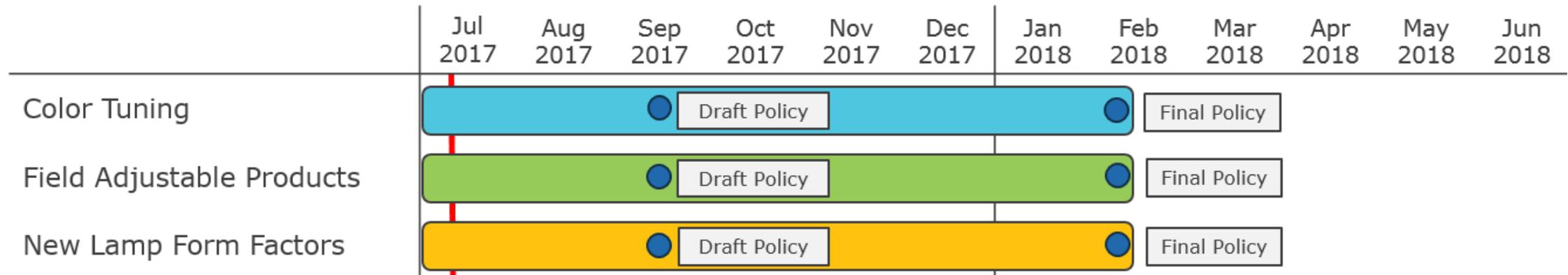
Agenda

- Stakeholder Input Process
- Color Tuning: Background & Goal
- Product Descriptions
- Proposed Approach
- Questions for Development Effort
- Discussion!

Stakeholder Input Process



Stakeholder Input Process



Technical Roadmap

- Goal of providing greater transparency and predictability to DLC activities, policies, and future plans
- Field Adjustability policy targeted for Q1 of 2018

Why Color Tuning?

- Not currently eligible on the DLC QPL
- Color tuning lighting is a growing trend
- Offers potential health and productivity benefits that can help drive adoption



The new tunable LED lighting in the ACC Care Center corridor, shown at the morning setting (specified as 6500K at 66% output, left), the afternoon setting (specified as 4000K at 66% output, center), and the nighttime setting (specified as 2700K at 20% output, right).

Photo: Sacramento Municipal Utility District

Previous Color Tuning Efforts

- Draft policy issued late 2016
 - Came out of 2016 Stakeholder Discussion Session
 - Settable, non-dynamic, white/white color tuning
- Stakeholder comments:
 - Draft was too limited
 - Interest in dynamic color tuning products



Goal for this session:



- Get stakeholder input on technical requirements to develop new broader color-tuning policy

DLC Scope: Color Tunable Products

1. White-tunable: usually independent controls for CCT and dimming
 - A. 2 LED Primaries (linear tuning, white-white)
 - B. 3+ LED Primaries (White/RGB)
2. Dim-to-warm
 - A. Single control for dimming automatically adjusts CCT
3. Full-color-tunable (saturated) outside of the white space

Color Tuning Resources & Groups

1. IES Test Procedure Committee
 - PIF had been created, must go to ballot
 - Proposed test lumen output, efficacy, and CCT and CRI
 - Test at low end, high end and several points in between at full output
2. CALiPER Report 23: Photometric Testing of White-Tunable LED Luminaires
3. Other resources?

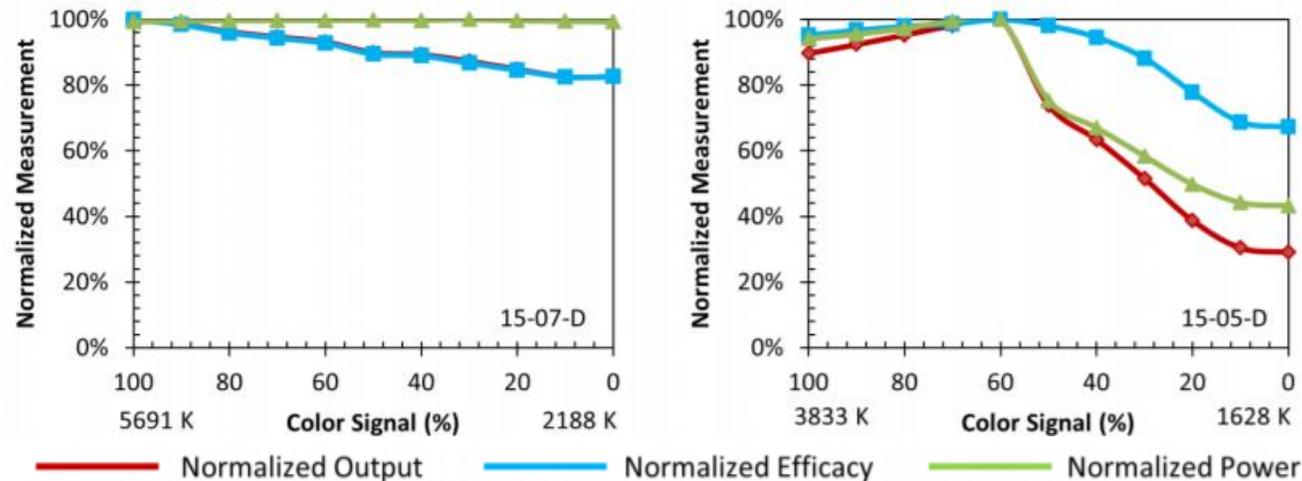
DLC Proposed Approach

- Simple, straightforward
- Align with IES TPC direction
- Address products with a single control for color
 - 0-10V, DMX, DALI, Proprietary
 - Separate control for intensity
- Testing approach
 - Test lumen output, efficacy, and CCT and CRI
 - Test at low end, high end and several points in between at full output
 - Are there other metrics we should test for? (Power Quality?)

Testing across the CCT Range

1. At how many points on the CCT range is it appropriate to require independent testing? How should the points be selected?

A. Should it depend on the CCT range?

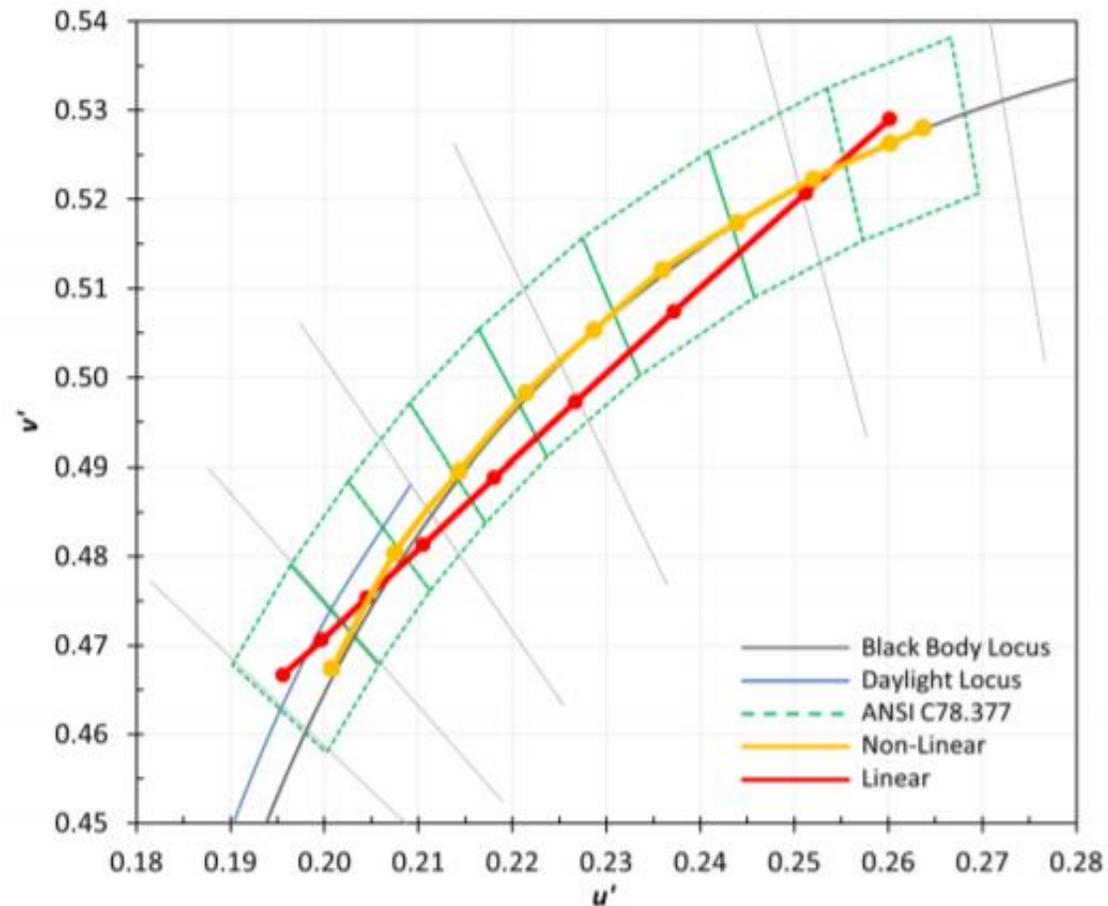


B. Should it depend on Control signal/type?

C. What else should it depend on?

Linear vs. blackbody-following tuning

2. What are the implications for policy in the different system types?
- Should the number of test points vary?
 - Should this determine how test points are selected?



From CALiPER
Report 23

Figure 1. Examples of linear and nonlinear (blackbody) white tuning. The exact curves will vary from product to product, but the key difference is that linear (two-primary) systems can only mix to chromaticities that are directly between the two primaries, whereas products with more than two primaries can be used to create mixes that approximately follow the blackbody locus.

For Dim to Warm

3. Do we need to test at the Dimmed/Warm state?

- Different LED

 - Need LM80?

- Where to test on low end?

A. Allow manufacturer reported?

B. What other considerations?

C. If not included in CT policy, make it reportable metric like dimming?

Controls

4. How should DLC handle the diversity of control protocols?
 - CALiPER identified 0-10V, DMX, DALI, and proprietary systems
 - A. Should there be any restriction on the control input types permitted?

Ways to reduce testing burden?

5. Could DLC expedite the LM-79 testing in any way?
 - A. Shorter intermediate stabilization period between CCT measurement points?
 - B. If stabilized for first measurement, does it need to be stabilized again?
 - C. Deviates from LM79 testing procedure, labs would need to modify process

In-house testing

6. Should DLC allow in-house data?
 - For all points?
 - Worst case at independent lab?

Allow beyond CCT caps?

7. Should policy include products beyond CCT caps
 - For color-tunable products only
 - Beyond 5000K indoor, 5700K outdoor

Additional requirements for CT?

8. Additional Requirements?

- Require TM 30 data?
- Duv?
- Others?

Dimming

9. How important is it to include dimmed performance in the Technical Requirements?
 - A. Should efficacy minimums over the dimmed range be required? Or is any energy consumption below full power acceptable?
 - B. Should dimming level (e.g. down to < 15% of full output) be specified?
 - C. Should there be any requirement on light output as a function of dimming input control signal: e.g. square law-dimming vs. linear dimming?

10. What are we missing?

Discussions will continue!

- Early in Development cycle
- Gathering info before creating draft proposal
- Development Leads:
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 - Greg Barker gbarker@energysolution.com

Thank You!



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