Q&A for Lighting University - Are your Buildings WELL?
APRIL 24TH 2018

Q: Did you experiment with different colour temperature to measure the impact on the screens brightness?
A>> We are running on-going research and experimentation with the variations in color temperature as pertaining to the ambient environment. We have not experimented with the screen brightness settings specifically.

Q: How different were the calculated EML values from the field measured values? How did you determine placement and quantity of field measurement points?
A>> We saw consistency between the calculated and measured values. The measured values were assessed based on the WELL criteria, and represent the light at eye level of an occupant at a work station.

Q: Do you have any information on workplace productivity and profitability increases owing to lighting plan?
A>> In surveys, people in the office have responded favourably to the lighting. Specific data to productivity and profitability are not available.

Q: Where did you locate the vertical surfaces or points while calculating EML, if daylight and artificial light is calculated together, which dates and what time of the day is taken into consideration?
A>> Measurement points for EML were based on the direction in the WELL standard. For calculation purposes, the daylighting was considered for an overcast condition in December at 9AM as a conservative design approach.

Q: How is ROI factored into well?
A>> I prefer to talk about value on investment. This approach allows you to evaluate the overall value received on the financial investment, including the simple return as well as related positive impacts on related investments such as talent attraction and retention, reduced absenteeism, and financial savings on healthcare costs

Q: Could you please let us know if there is a BMS that can interconnect the smart lightning system to other systems e.g HVAC, AV, shading systems?
A>> If you are using an open platform such as I described, you should be able to achieve integration between the lighting and the other building management systems, if they are also using open protocols. Otherwise you would need to use a software platform designed to control diverse systems and devices.

Q: How do I design for a system where one set of occupants arrives at say 7:00 am, but another set in the adjacent space start at 9:00 am?
A>> That sort of diversity is why I prefer to provide control of as much of the lighting output on the individual level using task lighting. The ambient light a common background, providing shared luminous environment shared luminous environment and lighting for safety.

Q: What lighting standards outside of Philips will be impacted by your research?
A>> The light and health research conducted by academic and industrial research informs standards written by standards organizations such as the CIE Division 3 and IESNA Recommend Practices.

Q: What data do you have on flicker, I see it everywhere and nobody has hard standards?
A>> Unfortunately, there is no globally accepted standard for flicker currently. The short answer: In the US one document being widely used is the National Electrical Manufacturer Association's NEMA 77-2017 Standard on Test Methods for Temporal Light Artifacts
Or follw this link to a DOE SSL Lighting fact sheet:
https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/flicker_fact-sheet.pdf
For a more comprehensive answer, you might want to follow this link to a presentation made at this year's DOE SSL R&D Annual Conference:
https://www.energy.gov/sites/prod/files/2018/02/f48/abrahamse_artifacts_nashville18_0.pd

Q: Does the shade fabric at 60 State control the glare of the solar orb?
A>> The shade fabric reduces the brightness, but it is not a black-out shade, thus some visibility of the sun can be seen through the shade.

Q: For Residential street lights being turned over to LED, how important is the colour temp?
A>> Colour appearance and colour rendering effects many things, not the least of which are the appearance of the area, the perceived brightness, and historical/aesthetic context. All of which can be satisfied by appropriately selected source (CCT/CRI) , style and controlled (cut off) LED street lights.
Other, and complex considerations would include the physiological impacts on wildlife migration and nesting, agriculture effecting growth (more related to roadway lighting) and humans. Spectral power distribution is the key in these cases, along with intensity and cut off. Most residential lighting is designed to light levels tha are unlikely to have impact on human circadian systems. My personal concern for humans is that we risk losing the wonder of the star-studded night.

Q: How is it decided what CCTs are chosen during specific times during the day? How do you transition from one CCT to another?
A>> We are continually learning and adapting the times of day for the variation of CCT, and the specific values based on internal research and published data. Transitions use smooth fades to minimize the perception of the change in light color temperature/intensity.

Q: Is the color temperature change throughout the day truly helpful, or is it distracting?
A>> One of the most significant benefits of dynamic tuneable lighting is that it can give cues as to time of day, which are missing in the typical indoor space. In healthcare, tuneable lighting can prevent ICU delirium. In daylight deprived workplaces, tuneable systems can provide a subtle nudge that it is time to break for a meal, a stretch, or its time to catch that train! Its important to transition slowly and gradually modulating both intensity and the channel outputs (colour appearance)

Q: Are there any tool to understand the human response to the lighting?

- **A>>** https://www.youtube.com/watch?v=Puln_h1CB24&feature=youtu.be
- https://www.youtube.com/watch?v=Cwq20f5PlVY&feature=youtu.be&list=PL_X9RKGy9RIbWM_7Tm-xR3PvfiAXD5Hvp
- http://standard.wellcertified.com/tables#melanopicRatio

Q: Why is it important to lighten vertical surfaces first?

A>> You want to use your watts both efficiently and effectively:

- **A system designed solely on horizontal task lighting levels, tends to aim more light directly towards a task, thus producing more potential for glare and reduces visual acuity. ("Perceptions and Performance", The IES Lighting Handbook, Chapter 4, Tenth Edition (New York: The Illuminating Engineering Society of North America, 2011), p. 4.9.)**
- **Circadian impact is a measure of the amount of light delivered to your eye, not a horizontal task plane. Lighting the vertical surfaces is the most efficient way of providing circadian impactful lighting.**
- **Lighting the verticals makes it easier to meet best practices such as IES RP1-12 and European Norms EN12464-1 regarding luminance balance, glare and contrast ratios.**

- **The "task plane" very often in today's workplace is not the horizontal plane 30" AFF. It often on the walls. (posters, brainstorming walls, whiteboards for example)**

- **After you light the vertical planes, you can add in the horizontal illuminance "as required".**

Q: How was the LPD calculated with tuneable white fixtures which have a higher input wattage than non-tuneable?

A>> It isn't easy…which is the point. "Energy Codes" in the US need to move faster towards developing metrics based on systems and energy use rather than the static component-based metrics.

We simulated the design and then calculated LPD at each CCT for the 15-hour day. Then we assigned the time of use at each CCT and then applied a control factor based on vacancy response. The control factor is an estimate of hourly distribution of open office occupancy based on National Renewable Energy Laboratory's "Energy Savings Modeling and Inspection Guidelines for Commercial Building Federal Tax Deductions, Second Ed." May 2007, Table N2-5, "% People" is commonly used. According to these guidelines occupancy, depending on the time of day and day of week, ranges from 0-65%. Therefore, using smaller control zones allow us to capture greater savings. In my experience, granular occupancy response delivers 30-35% energy savings. The result is what I call "effective LPD's. This approach is not meant to satisfy code (they won't accept it), but to assure me that the system rated at its lowest efficacy could satisfy code LPD's and achieve the energy usage targets that we had set for the project. Using this method we estimated the effective LPD for the system to be .45 LPD.

CCT	WATTS	Duration	LPD
4000	7 (100%)	15	.403 Average no vacancy profile applied
			.1 Average LPD task over 15- hour day assuming 60% usage
Low Ambient			
2700	21.41	4	.325
3000	24	6	.364
3500	23.26	1	.353
4000	23.43	3	.356
5000	22.77	1	.346
65000	20.52	0	-
			.35 Average LPD over 15-hour day no vacancy profile applied
Combined Low Ambient/ Task Lighting			
			.45 Average LPD over 15-hour day assuming 60% usage of task lighting

Q: Are there any FDA requirements or implications with respect to wellness or health claims for lighting/well buildings?

A>> No.

Think of it as analogous to "fortified milk" products. Adding calcium and Vitamin D supplements to milk may provide benefit. The labelling on cartons provide nutritional guidance. The language addresses the role of dietary patterns and categories of food. It does not make a health claim such as "drinking this milk will prevent rickets". Health claims have two components, a substance and a disease or health related condition.