TASK AMBIENT LIGHTING

ESPECIALLY WITH DIMMING & KELVIN CHANGING TASK LIGHTS

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Principal of Lighting Wizards

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EXECUTIVE SUMMARY

Task ambient lighting, which is using relatively low ambient lighting together with task lights when more light is required, is one of the best strategies for energy efficiency and good lighting. But it is often not specified optimally, and it is significantly under utilized.

We now have a new generation of cost effective dimming and CCT or Kelvin changing LED task lights, which are also good for what can be called human centric lighting, human factors in lighting, biophilia or other names. This humanistic lighting can improve circadian rhythms, mood – preferences, visual acuity, performance and energy savings – sustainability.

FOLLOW THE MONEY

Before I read an article or a white paper, I want to know who the writer is and who paid for it, because that helps understanding the credibility and any slant of the document. I am an independent lighting consultant, who has written several white papers. I thank PlanLED for paying for most of my time on this one, so it can be offered for free, instead of me having to charge people for it. Please be aware, that my major message would be the same if I was not paid.

Additional manufacturers are listed.
GENERAL DISCUSSION

Task ambient lighting is one of the best strategies in many applications. Troffers, ceiling surface mount or suspended fixtures provide a relatively low amount of ambient light and people can use good task lights when they need more light.

There are several reasons why this is so good, and let’s focus on offices.

With people mainly doing computer work, less light is usually better than more light. This is because computer screens are self illuminated and excess ambient light often causes glare. When people read paper documents or do other tasks that require more lighting, they can use task lights.

Recommended light levels are based on the combination of ambient and task lighting, not just ambient. I often consider open office spaces glorified hallways, with enough ambient light to walk around and do computer work, and recommend about 20 footcandles on desks. Often each ambient light fixture only needs to consume 20 – 28W to provide these footcandles. When office workers do paper or other tasks that require more light, they can turn on task lights, which may consume 8 – 12W in full mode. Ambient and task lights together can often provide up to 100 footcandles or more.

From a single source, light on a target is lost exponentially as distance increases. For example, if the distance is doubled between source and task, there will be one-fourth the footcandles. So if 75 footcandles is needed to read old paper prints or a book, much less wattage will be required from an efficient task light that is two feet above the desk than from an efficient ambient light that is six feet above the desk.

With well-designed new or retrofitted fluorescent or LED ambient lighting and dimming LED task lights, power density can be .5 or less watts per square foot. At 3000 annual hours and $.15/KWH electric rate, that is less than $.23 per square foot per year. For a hundred square foot office space that is only $23 for a whole year.

Workers often do not have that much control of their space in open office modules. Giving them task lights that they can at least turn on and off can give them some control, which can increase worker satisfaction and productivity. Dimming is even better.

Even though many existing office modules and even individual desks already have undercabinet and/or desk mount task lights, most of these are not very good. Under cabinet linear fluorescent task lights are usually overlit and glare bombs, especially if the desk is shiny. Some of the ballasts for T8 lamps are magnetic, and even if the ballasts are electronic, they are usually not that efficient. Although many of the desk mount task lights are CFL, which are fairly good, way too many are still incandescent or halogen.

There are some very good dimming fixed Kelvin LED desk mount and undercabinet task lights.

The following table shows how including one or two of these in a private office can help save wattage and improve worker productivity. Since payback does not include any benefit after payback period, payback is not a good financial tool. The best listed financial tool is long term benefit comprehensive, which is at the far right.
Please be aware that improving worker productivity just 1% is $500 per year, year after year, for somebody making $50,000 per year. 1% is just wasting 5 minutes less per 8 hour shift.

PlanLED, Finelite, Koncept, Luxo, Philips, Steelcase and numerous others offer good fixed Kelvin LED desk mount and undercabinet task lights.

Another good fixed Kelvin option is a furniture integrated one piece system that provides both ambient and task lighting. An example is Tambient.

**DIMMING AND KELVIN CHANGING LEDS**

There is a new generation of dimming and warm to cool white color tone, CCT or Kelvin changing LED task lights, which office workers usually love. Not only do these cost about the same and have about the same lumens per watt efficacy as fixed Kelvin equivalent task lights, the Kelvin changing and dimming can be so good for Human Centric Lighting.

I firmly believe that Human Centric Lighting and dimming & Kelvin changing LED products will be the most significant step in lighting since Edison created the light bulb.

Dimming and Kelvin changing desk mount LED task lights are often the easiest introduction to Human Centric Lighting. They have about the same lumens per watt efficacy and cost about equivalent fixed Kelvin LED task lights, so dimming and Kelvin LED task lights are cost effective just based on energy savings. If the soft savings of improved worker satisfaction and productivity are included, they are pretty much a slam dunk.

People can turn on and off, aim, dim and adjust color tone these task lights. Here are some videos on PlanLED - Prism models, which show dimming and Kelvin changing.

www.youtube.com/watch?v=ULc50FSMCPE&feature=em-share_video_user
www.youtube.com/watch?v=XMM66hdD168&feature=plcp

There are some other manufacturers, including Softech. However, it is important to check if they are Energy Star approved, which is often a requirement for rebates. Even many people, that do not know scientifically which light levels and color tones are best for which parts of the day and task, seem to have an innate sense of what should be used when. Dimming and Kelvin changing undercabinet LED task lights are also being developed. Occupancy sensors can control both types.

THE NEXT STEP

In applications where task lighting, especially dimming and Kelvin changing one, are well suited, the next step is to also have dimming and Kelvin changing LED ambient lighting. There are already some very good dimming and Kelvin changing LED troffers. At this time, probably the best example is from PlanLED - Galaxia, which won a 2012 Next Generation Luminaires Design Recognized Award.

www.ngldc.org/12/indoor/winners/recessed_modular_lighting_GalaxiaSmart.stm

Here are some videos showing dimming and Kelvin changing LED troffers.

www.youtube.com/watch?v=OPaKuOeuMg8
www.youtube.com/watch?v=oJKf3kah15E

By end of 2012 or early 2013, there should be some good hard-wired LED troffer kits that also dim and Kelvin change.

*Picture on the right shows a private office space that replaced 2 2x4 Troffers with one 2x2 Galaxia Kelvin changing troffer and a Prism TL-4000 Desk Lamp at Mission Produce Sumner Distribution Center in Washington. While achieving over 70% of energy reduction, user comfort level also improved significantly.
Following is a similar feasibility table as before, but this one has some dimming and Kelvin changing LED task lights and some dimming and Kelvin changing LED ambient lights. With those, worker productivity dollar amounts are significantly increased.

<table>
<thead>
<tr>
<th>Retrofit option description</th>
<th>rated temp (C)</th>
<th>watts</th>
<th>% reduction</th>
<th>annual cost</th>
<th>comp cost savings</th>
<th>installed cost</th>
<th>rebates</th>
<th>per year maintain-</th>
<th>Savings</th>
<th>per year</th>
<th>per year</th>
<th>per year</th>
<th>payback in</th>
<th>payback ( \text{in years just electricity} )</th>
<th>payback ( \text{in years comprehensive} )</th>
<th>long term \text{benefit electricity}</th>
<th>long term \text{benefit comprehensive}</th>
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</thead>
<tbody>
<tr>
<td>retrofit each troffer with 3 25W F32T8 5000K lamps &amp; .71 BF extra efficient program start PAR-38 led bulb</td>
<td>36.00 - 38.00</td>
<td>112</td>
<td>93</td>
<td>38%</td>
<td>$31</td>
<td>$29</td>
<td>$2</td>
<td>$2</td>
<td>$4</td>
<td>3.6</td>
<td>3.5</td>
<td>3.2</td>
<td>$349</td>
<td>$360</td>
<td>$390</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retrofit each troffer with 3 25W F32T8 5000K lamps &amp; .71 BF extra efficient program start PAR-38 led bulb</td>
<td>36.00 - 38.00</td>
<td>78</td>
<td>65</td>
<td>67%</td>
<td>$46</td>
<td>$39</td>
<td>$5</td>
<td>$6</td>
<td>$250</td>
<td>4.7</td>
<td>4.5</td>
<td>0.7</td>
<td>$474</td>
<td>$490</td>
<td>$4,299</td>
<td></td>
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</tr>
<tr>
<td>Retrofit each troffer with upscale kit which eliminates parabolic louvers. 1 high lumen F32T8 5000K lamp &amp; .89 BF extra efficient program start ballast. Also include 8W Kelvin &amp; Dimming hardwired led task light.</td>
<td>36.00 - 38.00</td>
<td>67</td>
<td>56</td>
<td>63%</td>
<td>$51</td>
<td>$36</td>
<td>$17</td>
<td>$8</td>
<td>$400</td>
<td>5.6</td>
<td>5.6</td>
<td>0.6</td>
<td>$470</td>
<td>$534</td>
<td>$6,543</td>
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<td>36.00 - 38.00</td>
<td>62</td>
<td>52</td>
<td>98%</td>
<td>$53</td>
<td>$38</td>
<td>$18</td>
<td>$6</td>
<td>$450</td>
<td>6.5</td>
<td>6.7</td>
<td>0.7</td>
<td>$434</td>
<td>$517</td>
<td>$7,257</td>
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</tr>
<tr>
<td>Remove both troffers. Install 6' suspended indirect/direct fixture that has 2 high lumen F32T8 5000K lamps &amp; .76 BF extra efficient program start ballast.</td>
<td>36.00 - 38.00</td>
<td>70</td>
<td>58</td>
<td>100%</td>
<td>$50</td>
<td>$41</td>
<td>$17</td>
<td>$9</td>
<td>$350</td>
<td>7.9</td>
<td>7.8</td>
<td>1.0</td>
<td>$349</td>
<td>$423</td>
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<td>53</td>
<td>117%</td>
<td>$53</td>
<td>$49</td>
<td>$18</td>
<td>$9</td>
<td>$500</td>
<td>9.0</td>
<td>8.9</td>
<td>0.8</td>
<td>$317</td>
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<td>36.00 - 38.00</td>
<td>60</td>
<td>50</td>
<td>120%</td>
<td>$54</td>
<td>$50</td>
<td>$18</td>
<td>$6</td>
<td>$550</td>
<td>10.0</td>
<td>9.9</td>
<td>0.9</td>
<td>$298</td>
<td>$340</td>
<td>$6,590</td>
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<tr>
<td>Retrofit each troffer with high performance hardwired LED troffer kit with ballasting distribution, set at 35W, so sufficient light at end of life.</td>
<td>55.00 H</td>
<td>70</td>
<td>58</td>
<td>110%</td>
<td>$50</td>
<td>$27</td>
<td>$17</td>
<td>$12</td>
<td>$250</td>
<td>5.1</td>
<td>4.9</td>
<td>0.8</td>
<td>$489</td>
<td>$653</td>
<td>$4,403</td>
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<td>50</td>
<td>120%</td>
<td>$54</td>
<td>$34</td>
<td>$18</td>
<td>$12</td>
<td>$400</td>
<td>6.1</td>
<td>5.7</td>
<td>0.7</td>
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<td>55.00 H</td>
<td>55</td>
<td>46</td>
<td>125%</td>
<td>$56</td>
<td>$43</td>
<td>$19</td>
<td>$12</td>
<td>$450</td>
<td>7.3</td>
<td>6.9</td>
<td>0.8</td>
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<td>$604</td>
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**CHALLENGES WITH TASK AMBIENT LIGHTING**

But there are challenges with task ambient lighting. Owners own the ambient lights and tenants usually own their own office furniture and task lights. If an owner reduces ambient light levels and wattage, and buys task lights for the existing tenants, those tenants may take the task lights with them when they leave.

Many offices are way overlit, and ownership or management may not want to reduce the ambient light levels. So there is very little need for task lights.

Owner-occupied and government buildings may be best for task ambient lighting.
LOOKING AT THE BIG PICTURE

Hopefully there will be good dimming and Kelvin changing LED suspended indirect/direct fixtures in the not too distant future. Although not task ambient systems, Philips and Osram have done considerable research and product development with Kelvin changing lighting.

Here are some videos on Philips’ HealWell and SchoolVision systems.

www.lighting.philips.co.uk/application_areas/healthcare/healwell.wpd
www.lighting.philips.com/main/application_areas/school/schoolvision/
www.lighting.philips.com/main/application_areas/school/schoolvision/schoolvision_solution.wpd

Osram developed pendant fixtures with higher Kelvin uplight and lower Kelvin downlight for a school research project in Europe.


PLANLED INFORMATION & SAMPLE PROGRAM

PlanLED manages a consortium of South Korean LED product manufacturers in North America and other areas.

Website: http://planled.com/
Email: info@planled.com
Phone: 425-306-4812

Although reading about and watching videos on dimming and Kelvin changing LED products are beneficial, nothing is as valuable as personal experience with the lighting and controls. So PlanLED has several ways to provide samples of dimming and Kelvin changing LED task lights and troffers. After similar technology hard-wired LED troffer kits, drum fixtures and other products are developed, they could be sampled too.
ABOUT THE AUTHOR

Stan Walerczyk is principal of Lighting Wizards, an independent energy efficiency consulting firm. His 24 years lighting experience includes distribution, maintenance, retrofit contracting, 3rd party review, consulting, design and research. He has been assisting on DOE research on spectrally/scotopically enhanced lighting. He is chair of the Human Centric Lighting Committee. He is a DOE CALiPER Guidance Committee member on LED products. He has written over 40 published papers and presented over 700 seminars, including in 2011 speaking twice at Lightfair and ArchLED and all day at WEEC. He is a Certified Lighting Energy Professional by the Association of Energy Engineers and is Lighting Certified by the National Council on Qualifications for the Lighting Professions. He was a member of the Illuminating Engineering Society from 1995 to 2008 and is currently on its Visual Effects of Lamp Spectral Distribution and Energy Management Committees. Complete bio, seminar schedule, testimonials and other information are available at www.lightingwizards.com.

These are all of his free white papers, which are downloadable at www.lightingwizards.com.

• Are LED T8s Ready For Prime Time
• Delamp or Lamp for Lamp
• EHID & LED For Exterior, Hibays, Etc.
• High Bay Occupancy Sensors: A Comparison
• How to Retrofit Parabolic Troffers
• LED vs. Induction – Full Cut-Off Streetlights, Etc.

EXCELLENT WHITE PAPER FROM SOMEBODY ELSE

The Economics of Biophilia by Terrapin Bright Green