**Cambridge Streetlight Conversion Fact Sheet**
Nov. 19, 2014

Summary of the new LED light installation program with Steve Lenkauskas (Cambridge Electrical Department), Glenn Heinmiller (Lam Partners), and Paul Lutkevich (Parsons Brinckerhoff).

- The City is replacing about 7,000 lights (4,900 on street, 2,100 specialty and park fixtures) with energy-efficient LED fixtures.

- Test installations were installed in 2010 on Inman Street and Rindge Avenue, and on small sections of several others streets in 2013.

- A system of street classification was developed to determine appropriate light levels for each street. Streets were evaluated for width, light pole spacing, and vehicular and pedestrian activity and were assigned to categories corresponding to lighting criteria. These criteria are in accordance with guidelines used by the Federal Highway Administration, MassDOT, and the Illuminating Engineering Society.

- A wireless control system has been installed. This allows dimming of the streetlights. When a new streetlight is installed it will be much brighter than normal until it communicates with the dimming system. This can take up to a few weeks' time. By now, most of the new streetlights are under control of the dimming system.

- Once a streetlight is communicating with the dimming system, the light will turn on to only 70% of its initial brightness, and later in the evening it will dim even further to about 35% of its initial brightness. This dimming program is unique among mid-to-large sized cities in the US and it reflects the sophisticated approach Cambridge has taken.

- The new streetlighting system will consume less than 25% of the energy of the existing streetlights, saving the city estimated $500,000 per year in electricity costs and allowing us to meet "carbon footprint" reduction goals that we have set for ourselves.

- The new streetlights distribute light in a pattern similar to the old streetlights, but the amount of light crossing property lines from the public way will typically be half as much as with the existing lights, and even lower late at night.

- The new streetlights can be shielded to control unwanted light when further restriction is needed.

- The new streetlights make colors look brighter and more "true" or faithful to the natural color. Trees look green instead of brown, a blue car looks blue instead of grey.

- Because of this improved color rendition, everything appears brighter and sharper under the new streetlights, even when the amount of light is the less than the old lights.

- The "color temperature" (warm-cool) of the streetlights is 4000K, which is in the middle of the warm-cool range. This color temperature closely matches moonlight.

- This color temperature of the new lights is the same as the quarter-of-a-million LED streetlights that have been or are being installed in Boston, Los Angeles, San Francisco, Oakland, and New York. The color of the new streetlights is the "warmest" typically available for LED streetlights.

## Street Lights and Circadian Sleep Cycles

*Dr. Steven Lockley (Harvard Medical School, Division of Sleep and Circadian Disorders) and Sam Lipson (Director of Environmental Health, Cambridge Public Health) contributing.*

Our "circadian clock" is sensitive to all visible light, and any exposure to light after dusk moves us away from a natural cycle. The circadian system is more sensitive to blue light, but the intensity of light is at least as important when considering the impact of light. Just because a light source appears "bluish" does **not** mean it is necessarily disruptive and just because it appears "warm" does not mean that it is not disruptive. Light wavelength and intensity interact to determine the effect of light on circadian rhythms and sleep-wake cycles.

- When considering the effects of light at night, indoor lighting is typically of more concern given the intensity and proximity of the light sources to the eyes, which detect the light. The quantity of light emitted by streetlights, both High-Pressure Sodium (HPS) and LED, is many times lower than that emitted by typical interior lights, TVs, tablets, or PC screens.

- Studies on the effect of blue light and recent articles that warn about health issues associated with light exposure at night refer primarily to device screens and interior light sources as having possible negative impacts. These risks are primarily based on lighting associated with night-shift work.

- Research suggests that the light levels from streetlights (both HPS and LED) are simply **too low** to cause significant negative circadian or sleep health problems, especially if the light reaching the eye is further reduced by curtains, eye masks or closing the eyes to sleep. There is no evidence that typical exposure to street lights of any color is disruptive to the human circadian system.

- These new LEDs are slightly "bluer" than the old HPS lights light source and are estimated to have about 20% more of the stimulatory blue wavelengths **before the dimming program is implemented.**

- **After dimming (at 8 p.m. or 10 p.m. in most areas), the stimulatory effects of the lights on non-visual responses (associated with alerting the brain or circadian disruption) are estimated to fall below that of the old HPS light by about 40%, reducing the risk of light disruption of sleep and circadian rhythms.**

- It is important to emphasize when interpreting these percentages that the absolute amount of light generated by the new LED street lights (or the old HPS street lights for that matter) and that reaches the inside of residences is **very low** and would not be expected to have a meaningful impact on alertness or sleep.

- For those wishing to further limit the effects of light exposure after dusk, we advise individuals to:
    - Avoid bright light in the evening and gradually dim or reduce light exposure through the evening as you approach bedtime
    - Limit use of electronic devices in the evening, and certainly within 30-60 minutes of bedtime (read a real book, not an electronic one before bed!)
    - Remove the TV and electronic devices from the bedroom
    - Try and use lower CCT sources in the evening (4000K or less)
    - Install dark, thick curtains or black-out curtains, particularly in the bedrooms
    - Consider using an eye mask during sleep
    - It is estimated that simply closing your eyes during sleep stops about 95% of all light sources from getting through the eyelids.
    - Try and keep as regular a schedule as possible
    - Make sure you get as much daylight exposure as possible during the day

Again, these measures will help reduce the impact of light sources commonly used in the evening at home, which is of much greater concern than the much lower levels of light emitted by street lights. The health concerns of indoor light sources will easily override any effects of street lighting.

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