

CITY OF SEBASTOPOL
CITY COUNCIL
STAFF REPORT

Meeting Date: February 16, 2016

To: Honorable Mayor and City Councilmembers

From: Public Works Superintendent Richard Emig

Subject: Technical Presentation on LED Street Light Retrofit for City Council

Recommendation: City Council Receive Technical Presentation on LED Street Light Retrofit and provide direction to staff on the decision whether or not to opt in on the LED street light retrofit program offered by PG&E.

Funding: Currently Budgeted: Yes No N/A

Net General Fund Cost: \$0

If Cost to Other Fund(s):
Fund:
Amount:

Introduction: This item is to request that the City Council Receive the Technical Presentation on LED Street Light Retrofit and provide direction to staff on the decision whether or not to opt in on the LED street light retrofit program offered by PG&E.

Background:

In July of 2015, PG&E contacted the City of Sebastopol regarding an upgrade of 595 PG&E owned street lights in Sebastopol from high pressure sodium vapor (HPSV) lights to more energy efficient light emitting diode (LED) fixtures by the end of the calendar year, to be performed by PG&E. This is part of PG&E's effort to upgrade approximately 160,000 HPSV street lights throughout their service territory. This program will have no upfront costs to the City. The capital costs are paid for up front by PG&E and recouped in the first three years of energy savings, thereafter future savings beyond the payback will be realized by the City.

This program is voluntary and requires cities to opt in to participate, requiring written confirmation from each city expressing their interest in participating in the program, so at the September 15 City Council meeting staff presented this program to the City Council for approval to change out the PG&E owned street lights to LED.

Prior to making a decision to approve a conversion of street lights to LEDs, the City Council expressed an interest in receiving more information on LED street lights. The City Council directed staff to return at a future meeting date with technical presentations by both PG&E and an independent source on LED street lights, regarding potential health concerns and color emitted from the lights. The concerns included flicker from the lights and glare that could have adverse health effects, the color emitted from the lights such as bright white lights vs. softer yellow lights, shielding of the lights, and dimmer options for the lights.

Discussion :

After contacting several electrical engineering consultants, staff has been unable to secure an independent source on LED street lights to be present at the City Council meeting for a technical presentation, or to answer technical questions about LED street lights.

Therefore, staff is returning to the City Council at this meeting with PG&E representatives for their technical presentation (attached) offering information in answer to the questions that arose at the September 15 City Council meeting. Additionally for your information, attached is correspondence received by the City since September regarding LED street lights., “A Municipal Guide for Converting to LED Street Lighting” which includes a partial list of LED street lighting installations, and the City Council meeting minutes of September 15, 2015.

Staff contacted several local cities in Sonoma, Marin, and Napa Counties who have installed LED street lighting and asked their experience with the lights. Their responses were generally favorable, with complaints limited to lighting color and brightness. They informed me that in the past six months major manufacturers of the lights are offering both 3,000K or 4,000K temperature colors, as the demand for 3,000K (softer/warmer light) has grown enough for the manufacturers to make it available at no additional cost. Some responses from the cities were via email and are attached to this report.

Recommendation:

Staff recommends the City Council receive the technical presentation offered by PG&E and correspondence received by the City in order to make a decision on whether or not to opt in on the LED street light retrofit program offered by PG&E.

- Attachments:
1. Presentation from PG&E regarding LED street lights
 2. Correspondence received by the City regarding LED street lights
 3. “A Municipal Guide for Converting to LED Street Lighting”
 4. City Council Meeting Minutes of September 15, 2015
 5. Email responses from cities who have converted to LED street lights

LED Streetlight Upgrade City of Sebastopol

February 16, 2016





Program Overview

- CPUC approved Program to replace 160,000 PG&E owned, High Pressure Sodium (HPS), non-decorative fixtures with LED fixtures
- Voluntary Program – Customer of Record must opt-in to participate
- 50,000,000 kWh estimated annual energy savings across PG&E Territory
- Program funded through temporary charge (see chart)

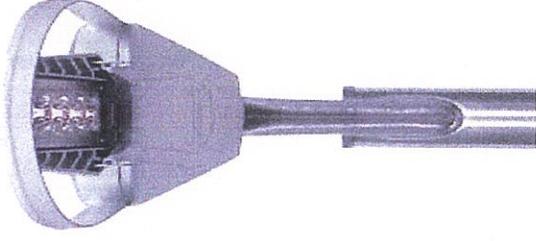


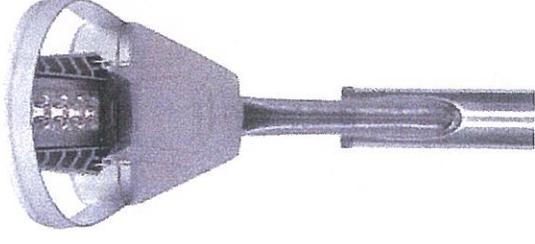
Illustration of Monthly Savings Per Lamp using PG&E's Proposed LED Replacement Program for Non-Decorative LED Fixtures.
1/1/2016 Street Light Energy Rates

LS1-A Existing	Current Monthly Facility Charge	Current Monthly Energy Charge	Current Monthly Total Charge	Proposed LED Size	Current Monthly Facility Charge	LED Program Incremental Facility Charge*	Current Monthly Energy Charge	Proposed Monthly Total Charge	Per Fixture Monthly Savings	Per Fixture Annual Savings
70 Watt HPS	\$6.37	\$4.44	\$10.81	29 Watt	\$6.37	\$2.81	\$1.44	\$10.62	\$0.19	\$2.33
100 Watt HPS	\$6.37	\$6.28	\$12.65	34 Watt	\$6.37	\$2.81	\$1.70	\$10.88	\$1.77	\$21.26
150 Watt HPS	\$6.37	\$9.19	\$15.56	56 Watt	\$6.37	\$2.81	\$3.00	\$12.18	\$3.38	\$40.56
200 Watt HPS	\$6.37	\$12.26	\$18.63	73 Watt	\$6.37	\$2.81	\$3.80	\$12.98	\$5.65	\$67.79
250 Watt HPS	\$6.37	\$15.32	\$21.69	101 Watt	\$6.37	\$2.81	\$5.36	\$14.54	\$7.15	\$85.81
400 Watt HPS	\$6.37	\$23.60	\$29.97	139 Watt	\$6.37	\$2.81	\$7.20	\$16.38	\$13.59	\$163.04

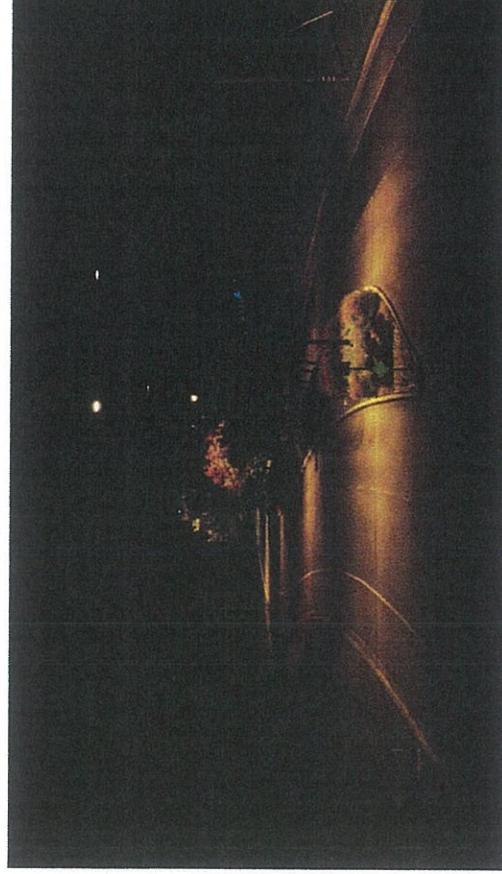
*Facility charge reviewable by CPUC after 2017

Fixtures

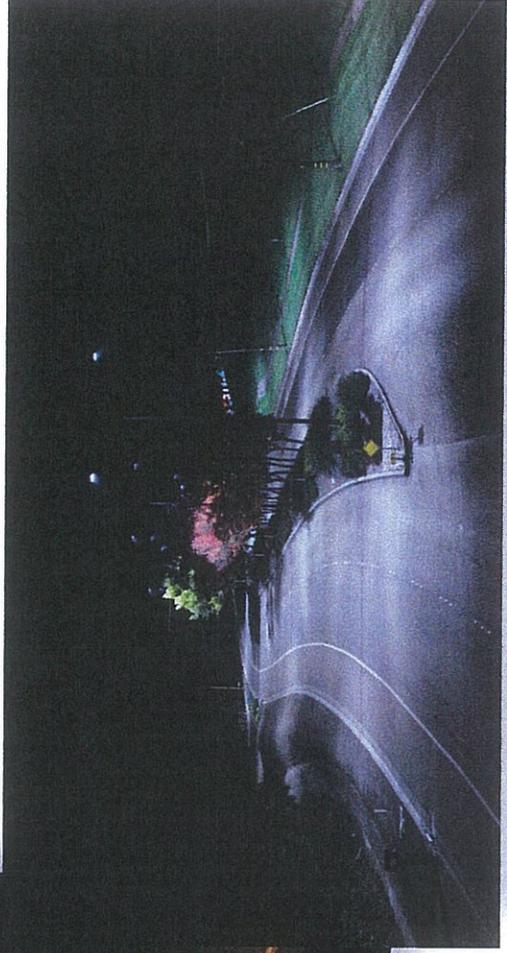
- Manufactured by CREE
- Substantial energy & GHG reductions
- Long product warranties expected to result in lower maintenance costs
- Stable light output
- 4,000 Kelvin CCT, CRI 70
- 29, 34, 56, 73, 101 & 139 Watt fixtures



Before



After



PG&E Installation

- Schedule to be mutually determined
- Approximately 600 Lights
- Does not include 25 City owned lights (LS2)
- Bucket trucks with 1 or 2 man crews
- Less than 10 minutes per lamp fixture
- Parking and traffic should not be impacted
- Completion within 2-3 weeks (weather pending)





Outreach Strategy

Medium	Audience	Timing
Pre-installation letter & fact sheet	Direct to customer	Mailed 1 to 3 weeks in advance of work
Website	Self Service	Ongoing at: pge.com/streetlightupgrade
Videos	Self Service	Ongoing at: pge.com/streetlightupgrade
Social Media – Facebook, Twitter, Instagram	Broad	Content Available
Joint Press Release	Broad	As Desired
Post-installation post card	Direct to customer	2 weeks post completion
Post-installation survey	Direct to customer	2-4 weeks post completion

Thank you



Attachment 2

From: Mary Gourley <mgourley@cityofsebastopol.org>
Subject: Fwd: PG&E LED streetlights
Date: September 10, 2015 7:03:37 PM PDT
To: Richard Emig <remig@cityofsebastopol.org>

2 Attachments, 607 KB

FYI

Mary C. Gourley, CMC, City Clerk
City of Sebastopol
Office of the City Manager/City Clerk
7120 Bodega Avenue
Sebastopol, California. 95472
(707) 823-1153 - phone
(707) 823-1135 - fax
Email: mgourley@cityofsebastopol.org

Begin forwarded message:

From: "Sandi Maurer" <EMFSafe@sonic.net>
To: "Mary Gourley" <mgourley@cityofsebastopol.org>, "John Eder" <johneder@comcast.net>, "Una Glass" <unaglass@coastwalk.org>, "Sarah Glade Gurney" <sarahcouncil@yahoo.com>, "Larry McLaughlin" <lwmclaughlin@juno.com>, "Patrick Slater" <ps.sebcc@gmail.com>, "Robert Jacob" <robertjacobcc@sonic.net>
Subject: PG&E LED streetlights

City Council and staff,

On the 9/15 City Council consent agenda is an approval for PG&E to change the streetlights to LED's I am concerned about the quality of light these LED's emit, the potential flicker and it's health risks, and the radio frequencies (RF), including "unintentional RF" which they emit.

The streetlights we now have are a warm light. I suspect the LED's are bright white. The flicker can cause biological effects, such as headaches and seizures. Please see attached study by IEEE on the health risks of flicker, and one by the DOE.

Can we trust PG&E to tell the truth about the RF the LED's emit? In 2010 their representative told the council and public their smart meters transmitted RF once an hour. However, when a law judge ordered them to disclose how often, they admitted one meter transmitted on average 10,000 times a day, and up to 190,000 times a day.

I support the city saving energy, but can this item be taken off consent so the public and the council can be better informed about the benefits vs the risks?



[LED-Lightin...pdf \(422 KB\)](#)



[US DOE - A...pdf \(185 KB\)](#)

Thank you for your consideration,

Sandi Maurer
200 Frankel Lane
707-829-9403

LED Lighting Flicker and Potential Health Concerns: IEEE Standard PAR1789 Update

Arnold Wilkins
Dept. of Psychology
University of Essex; UK

Jennifer Veitch
National Research Council Canada
Ottawa; Canada

Brad Lehman
Dept. Elect. & Comp. Eng
Northeastern University; USA

Abstract – The IEEE Standards Working Group, IEEE PAR1789 "Recommending practices for modulating current in High Brightness LEDs for mitigating health risks to viewers" has been formed to advise the lighting industry, ANSI/NEMA, IEC, EnergyStar and other standards groups about the emerging concern of flicker in LED lighting. This paper introduces power electronic designers for LED lighting to health concerns relating to flicker, demonstrates that existing technologies in LED lighting sometimes provide flicker at frequencies that may induce biological human response, and discusses a few methods to consider when trying to mitigate unintentional biological effects of LED lighting. The paper represents on-going work in IEEE PAR1789 that is vital to designing safe LED lamp drivers.

Index Terms– LED, health risk, flicker, lighting, power electronics, ergonomics, drivers, headache, seizure, standards

I. NOMENCLATURE

Flicker: a rapid and repeated change over time in the brightness of light.

Modulation: a measure of light variation that is often applied to periodic oscillations. This report refers to modulation as variation in luminance as a proportion of the average luminance (commonly referred to as Percent Flicker, Peak-to-Peak Contrast, Michelson Contrast, or Depth of Modulation). For a time-varying luminance with maximum and minimum values:

$$\text{Modulation} = (L_{\max} - L_{\min}) / (L_{\max} + L_{\min})$$

(Lighting Design Glossary)

Visible Flicker: Flicker that is consciously perceivable by a human viewer.

Invisible or Imperceptible Flicker: Flicker that is not consciously perceivable by a human viewer.

The effects of flicker can range from decreased visual performance to non-specific malaise to the onset of some forms of epilepsy.

II. INTRODUCTION

This paper summarizes a public report created by the IEEE Standards PAR1789 group on LED lighting that is examining biological effects of flicker in emerging LED lighting technologies. (The full length version of the report can be found at <http://grouper.ieee.org/groups/1789/>) The intention of this document is to provide an objective summary of the effects on human health for both visible and invisible flicker and to draw attention to implications for the design of LED lighting. Specifically, contributions of this paper include

making the reader aware of

1. Risks of seizures due to flicker at frequencies within the range ~3- ~70Hz;
2. Human biological effects due to invisible flicker at frequencies below ~165Hz;
3. The differences between "visible" flicker and "invisible" flicker and any relation to health risks;
4. A few, typical driving approaches in LED lighting that may produce flicker.

This report does not attempt to make recommendations on safe flicker frequencies or modulation depths for LED lighting. Its purpose is to describe possible health implications of flicker. By bringing these issues to the power electronic and lamp designers now, it will permit better ethical discussions and decisions to be made on development of future LED lamps as the market continues to have explosive growth. This report endorses no technology for driving LED lamps. Specifically, Section III of the report gives tutorial surveys on health effects of flicker. Section IV introduces a few typical LED driving methods that introduce flicker in frequency ranges of interest.

III. FLICKER

The health effects of flicker can be divided into those that are the immediate result of a few seconds' exposure, such as epileptic seizures, and those that are the less obvious result of long-term exposure, such as malaise, headaches and impaired visual performance. The former are associated with visible flicker, typically within the range ~3- ~70Hz, and the latter with invisible modulation of light at frequencies above those at which flicker is perceptible (invisible flicker). Human biological effects are a function of flicker frequency, modulation depth, brightness, lighting application, and several other factors.

A. Photosensitive Epilepsy

About one in 4000 individuals is recognized as having photosensitive epilepsy. Repetitive flashing lights and static repetitive geometric patterns may induce seizures in these individuals, and in perhaps as many again who have not been diagnosed and may be unaware that they are at risk.

The seizures reflect the transient abnormal synchronized activity of brain cells, affecting consciousness, body movements and/or sensation. The onset of photosensitive epilepsy occurs typically at around the time of puberty; in the age group 7 to 20 years the condition is five times as common

as in the general population. Three quarters of patients remain photosensitive for life (Harding and Jeavons, 1994; Wilkins, 1995; Fisher et al. 2005). Many factors [see Fisher et al., 2005 for extensive reference list] may combine to affect the likelihood of seizures including:

- **Flash Frequency.** Any repetitive change in a visual stimulus within the frequency range 3 Hz to 70 Hz, is potentially a risk and the greatest likelihood of seizures is for frequencies in the range 15 Hz to 20 Hz, see Fig. 1. The flashes do not have to be rhythmic.

- **Brightness.** Stimulation in the scotopic or low mesopic range (below about 1 cd/m²) has a low risk and the risk increases monotonically with log luminance in the high mesopic and photopic range.

- **Contrast** with background lighting. Contrasts above 10% are potentially a risk.

- **Distance** between the viewer and the light source and its location which determine

- **Total area** of the retina receiving stimulation. The likelihood of seizures increases according to the representation of the visual field within the visual cortex of the brain. The cortical representation of central vision is greater than that of the visual periphery, and so

- **Location** of stimulation within the visual field is important: Stimuli presented in central vision pose more of a risk than those that are viewed in the periphery, even though flicker in the periphery may be more noticeable.

- **Wavelength** of the light. Deep red flicker and alternating red and blue flashes may be particularly hazardous.

- **Open or closed eyes.** Bright flicker can be more hazardous when the eyes are closed, partly because the entire retina is then stimulated. However, if flickering light is prevented from reaching the retina of one eye by placing the palm of a hand over that eye, the effects of the flicker are very greatly reduced in most patients.

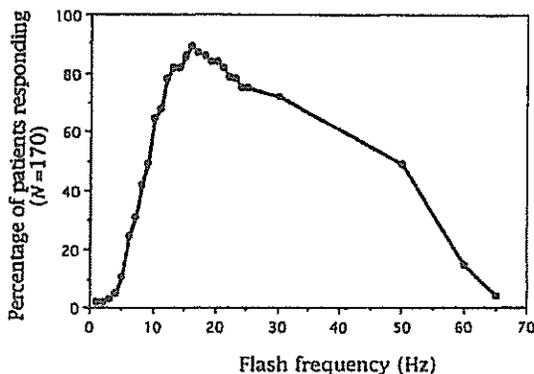


Figure 1 Percentage of patients with photosensitive epilepsy exhibiting epileptiform EEG responses to the flicker from a xenon gas discharge lamp shown as a function of flash frequency After Harding and Jeavons (1994)

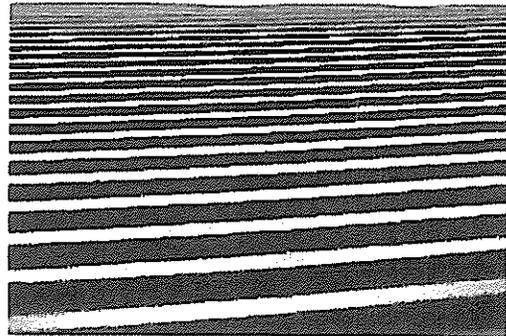


Figure 2 Escalator stair tread

In addition, a substantial minority of patients (usually those who are sensitive to flicker) are sensitive also to spatial patterns; see Fig. 2 for an example. About one third of patients are sensitive to patterns even when there is no flicker, and most are more sensitive to flicker if it is patterned (Harding and Jeavons, 1994; Wilkins, 1995; Fisher et al., 2005; Wilkins et al. 1979). The worst patterns are those of stripes in which one cycle of the pattern (one pair of stripes) subtends at the eye an angle of about 15 minutes of arc.

B. Imperceptible Flicker

The frequency of the alternating current electricity supply is 60Hz in America and 50Hz in Europe; in Japan, both 50Hz and 60Hz are used in different regions. The circuitry in older fluorescent lamps with magnetic ballasts operate so as to flash the lamps at twice the supply frequency (100Hz or 120Hz). However, as the lamps age, the flashes that occur with one direction of current may not equal those that occur with the other direction, and the lamps may emit flicker with components at the frequency of the electricity supply. It has been determined that photosensitive seizures should not occur if fluorescent lamps are operating properly. However, when the lamps malfunction giving flicker below 70Hz, electroencephalographic recordings indicate a risk of seizures (Binnie et al., 1979). Nevertheless some photosensitive patients do complain of normally functioning (older) fluorescent lighting (with magnetic ballasts).

Measurements of the electroretinogram have indicated that modulation of light in the frequency range 100-160Hz and even up to 200 Hz is resolved by the human retina although the flicker is too rapid to be seen (Burns et al. 1992, Berman et al., 1991). In an animal (cat), 100Hz and 120Hz modulation of light from fluorescent lamps has been shown to cause the phase-locked firing of cells in the lateral geniculate nucleus of the thalamus, part of the brain with short neural chains to the superior colliculus, a body that controls eye movements (Eysel and Burandt, 1984). There are several studies showing that the characteristics of human eye movements across text are affected by modulation from fluorescent lamps and cathode ray tube displays (see work of

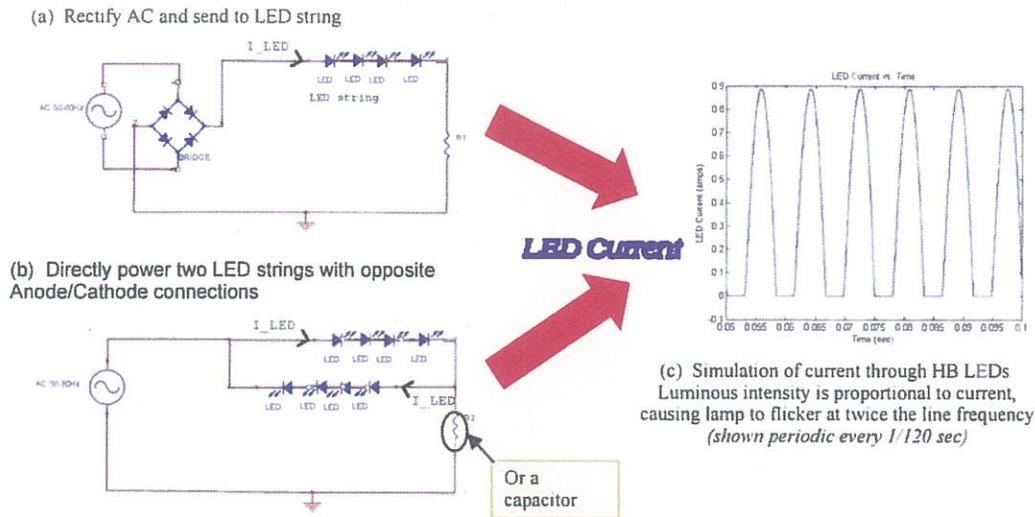


Figure 3. Two methods to drive LEDs at twice line frequency (a) Full bridge rectification, (b) Oppositely connected parallel strings, and (c) Current/Luminous Output in

Wilkins, 1986; Kennedy and Murray, 1991), and two studies have shown impairment of visual performance in tasks involving visual search as a result of flicker from fluorescent lamps (e.g. Jaen et al., 2005). Under double-masked conditions the 100Hz modulation of light from fluorescent lamps has been shown to double the average incidence of headaches in office workers, although this effect is attributable to a minority that is particularly affected (Wilkins et al., 1989).

Sensitivity effects due to flicker at frequencies above perception have also been observed in normal people with good vision and health. A substantial decrement in sensitivity to visible flicker at 30 Hz, used as a testing condition, occurs in normal observers when there is a prior exposure of only 2 minutes duration with flicker frequencies about 20% above the observers critical fusion frequency (CFF) (Shady et al. 2004).

Computer monitors and backlights

When making a rapid jerk (saccade), for example when reading, the eyes move at a velocity of about 180 degrees per second. As a result, any intermittently lit contour is displaced at a succession of retinal positions during the flight of the eye and can sometimes be seen as a set of repetitive targets. The LED rear lamps of motor vehicles can produce such an effect. Some displays on netbook computers have LED backlights and exhibit significant flicker at 60Hz. Their flicker also results in the perception of multiple images during a saccade. It is possible that this effect is responsible for the known disturbance of ocular motor control by high frequency flicker, a disturbance which, in its turn, may be responsible for the known impairments in visual performance.

Modulation depth and the Fourier fundamental.

The effects of flicker depend not only on the frequency of the flicker but also on the modulation depth. For visible flicker, the amplitude of the Fourier fundamental predicts flicker fusion (de Lange Dzn, 1961). For imperceptible flicker the effects of different waveforms have not been studied in detail. The peak-trough modulation depth of the 100-120Hz flicker from older fluorescent lamps with magnetic ballasts varies with the component phosphors, some of which exhibit persistence, varying the chromaticity of the light through its cycle (Wilkins and Clark, 1990). The peak-trough modulation depth known to induce headaches from fluorescent lighting at 100Hz is about 35% (Wilkins et al., 1989). The IEEE Standards PAR1789 working group is developing new measures/definitions of flicker that rely on Fourier series of the flicker. The present definitions for modulation do not distinguish the difference between low frequency and high frequency modulation. But for sufficiently high flicker frequencies, there are limited human biological effects.

C. Summary of Biological Effects

The obvious biological effects occur: 1) immediately from 2) flicker that is visible. The risks include seizures, and less specific neurological symptoms including malaise and headache. Seizures can be triggered by flicker in individuals with no previous history or diagnosis of epilepsy.

The less obvious biological effects occur: 1) from flicker that is invisible 2) after exposure of several minutes. Invisible flicker health effects have been reported to include headaches and eye-strain.

The table in the Appendix summarizes and categorizes the types of flicker and the biological effects they cause.

D. A Few General Implications for Practice

Visual flicker is an undesirable attribute of any lighting system. The Appendix Table summarizes research suggesting that, for both visible and invisible flicker (in the mentioned frequency ranges), there may be a special at-risk population for which flicker is more than just annoying and can be a potential health hazard. Any hazard will, however, depend on modulation depth, ergonomics, flicker parameters and their relation to perception and the ability to measure/determine the influence of these parameters with human diagnostics. These topics are beyond the scope of this paper and will be covered in future IEEE PAR1789 documents. However, it is possible to make general comments about the research cited in the Appendix Table:

1. **Frequency.** Normally functioning fluorescent lighting controlled by magnetic ballasts has been associated with headaches due to the flicker produced. LEDs driven so that they flicker at a frequency twice that of the AC supply may have a depth of modulation greater than that from most fluorescent lamps. The effects of the flicker are therefore likely to be more pronounced in these cases.

2. **Field of view.** Point sources of light are less likely to induce seizures and headaches than a diffuse source of light that covers most of a person's field of vision. Flicker from LEDs used for general lighting is therefore more likely to be a health hazard than that from LEDs used in instrument panels.

3. **Visual task.** The invisible flicker described in the Appendix Table is more likely to cause problems when the visual task demands precise positioning of the eyes, as when reading.

4. **Spatial distribution** of point sources of light. Spatial arrays of continuously illuminated point sources of light have the potential to induce seizures in patients with photosensitive epilepsy when the field of view is large and when the arrays provide a spatial frequency close to 3 cycles/degree (e.g. large LED public display boards viewed from close proximity).

IV. TYPICAL LED DRIVING METHODS IN LOW FLICKER FREQUENCY RANGE

There are several common methods that are used to drive LEDs that can operate with frequency of modulation in the ranges discussed in the above table (below 120Hz, including frequencies in the vicinity of 15Hz.) For example, commercially available LED lamps have been reported (Rand et al., 2007; Rand, 2005) to malfunction and produce visual flicker in the 15Hz range when connected to a conventional residential dimmer.

Below, we present only a few driving approaches that modulate in frequency ranges from zero to 120Hz. The list is not exhaustive, and the discussions are only meant to demonstrate typical driving LED currents with frequencies in this range.

A. LED Driving Current Frequencies in Range: ~100Hz-120Hz

(1) Full Wave Rectifier Connected to LED String

In this approach, the AC input source is sent into a full wave rectifier, causing the (approximate) absolute value of the input voltage to be sent to the load. In this case, the current through the LEDs has a waveform shape similar to a scaled absolute value of a sine wave. That is, the rectified sine wave may be of the $|V_p \sin(\omega t)|$ form, where V_p is the amplitude of the sine wave and ω is the angular frequency in radians $\omega = 2\pi f$. In this case, the LED current is of similar shape, as Fig. 3 shows. In a first approximation, the LED current is equal to a scaled rectified voltage, with the additional deadtime (zero current) caused by the LED bias voltage. Thus, when properly functioning, the direct full wave rectifier driving approach modulates the LEDs at twice the line frequency, which in North America leads to 120Hz modulation and in Europe leads to 100 Hz modulation. As Fig. 3(a) shows, often a resistor is added in series with the LED string for current limiting protection.

(2) Directly Drive Two Parallel LED Strings with Opposite Anode/Cathode Connections

A second LED driving method that doubles line frequency is shown in Fig. 3(b). Two strings of LEDs are powered in parallel, with anode of one paralleled string connected to the cathode of the other parallel string. When the AC line voltage is positive, energy drives one of the LED strings. When the AC line voltage is negative, the other paralleled LED string is driven. At most, one of the LED strings has current through it. The net effect is that the effective LED driving current is modulating at 120 Hz in North America or 100 Hz in Europe.

Thus, for both driving methods illustrated in Fig. 3, the LED current modulates at twice the line frequency. Since the intensity of the LEDs is (ideally) proportional to the current through the LEDs, this causes the LEDs to flicker at frequency equal to twice the AC line frequency, i.e. 100Hz-120Hz. There are many variations of the approach in Fig. 3 that are not shown here.

(3) Simple Dimming Pulse Width Modulated (PWM) Circuits

It is common to dim LEDs by pulsing the current through them intentionally. The luminous intensity of the LED can be adjusted by varying the length of time that the LED current is High or Low. Thus, PWM dimming circuits may be designed to operate at any frequency, whether the input is DC or AC. (It should be noted that it is not uncommon for LED drivers using AC residential phase modulated dimmer circuits to attempt to "emulate" PWM type signals with frequency 120Hz. That is, when the AC dimmer shuts off, no current is sent to the LEDs.)

It should be mentioned that there are alternative approaches to dimming, such as amplitude dimming, in which the current through the LED is continuous and not

pulsing. By reducing the value of this continuous current (amplitude), the brightness is dimmed. This approach does not use flicker to adjust brightness and therefore, should not induce flicker related health risks.

(4) Power Factor Correction Circuitry

Even when sophisticated high frequency switching power supplies with power factor correction circuits are used to drive LEDs from AC mains, there is commonly a frequency component in the current (and luminous intensity) of the LEDs at twice the line frequency. Depending on the design of the circuitry, the harmonic content of this flicker may vary from being small and unnoticeable to being significant in magnitude.

B. LED Driving Current Frequencies in Range: 3Hz~70Hz

(1) Failures in rectification or LED strings: 50Hz ~ 60 Hz Modulation

In either of the two methods of Fig. 3, there is risk of failure that can cause LED current modulation at AC line frequency, thereby entering the range of frequencies that may induce photosensitive epilepsy. For example, if one of the legs of the full wave rectifier bridge fails, then it is common that the leg becomes an open circuit. Open circuits prevent current flow, and therefore, the LED modulation frequency may change. This single diode failure in the rectifier will cause the output voltage for the full wave rectifier to become the input voltage for half the AC line cycle, and then 0 volts for the remaining half line cycle. This means that if the AC Mains line frequency is f and the period is $T=1/f$, then non-zero voltage is applied to the LEDs for $0.5 \cdot T$ seconds and then is zero for the next $0.5 \cdot T$ seconds, causing the LED current to modulate at line frequency.

Similarly, when the two strings of LEDs are connected in parallel with opposite anodes and cathodes in each string, a failure in one string of the LEDs may cause an open circuit to occur in that string. The net effect is the same as before: the current is modulating at line frequency, i.e. 50Hz ~ 60Hz. This low frequency driving current leads to brightness flicker in the LEDs at 50Hz~60Hz, since the current in the LEDs is proportional to their intensity. This is in a range of frequencies that are at risk of causing photosensitive epilepsy.

(2) Residential Dimmer Switches Can Cause Low Frequency Flicker (~3Hz – 70Hz)

Residential dimmers for incandescent bulbs primarily utilize phase modulating dimming through triac switches to control the power sent to the bulb. These dimmers control the RMS voltage applied to the bulb by suppressing part of the AC line voltage using a triac. The effect is a chopped sine wave as shown in Fig.4. Thus, as the dimmer switch is manually adjusted, the value of the off-time, α (often referred to as the phase delay) changes. As α is increased in Fig. 4, less power goes to the incandescent bulb and brightness is reduced

Some LED lamps and their associated drivers may not perform properly with residential phase modulated dimmers. Often on the LED bulb application notes or on the lamp's manufacturer web sites there are warnings to the user that their bulbs may not work properly when used with residential dimmer switches. Rand's work (Rand et al., 2007; Rand, 2005) explains the causes of these failures and shows that low frequency flicker may occur.

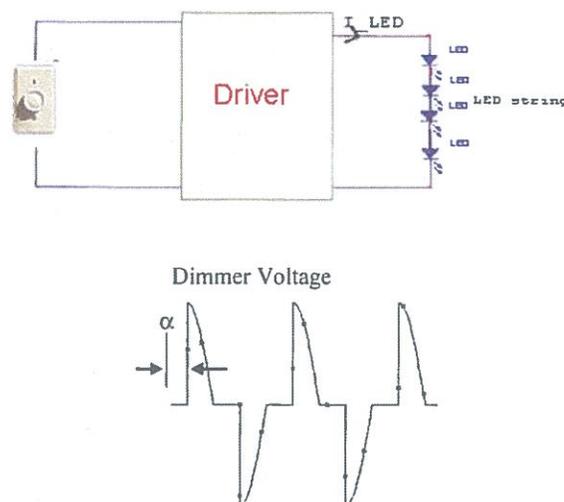


Figure 4. Residential dimmer and its output voltage sent to the driver (Rand et al., 2007).

Fig. 5 illustrates how one type of commercially available LED lamp flickers in the noticeable visual range when connected to a dimmer switch. The particular lamp involved has a common LED driver configuration (further discussed below) of a full bridge rectifier with capacitor filter within their Edison socket, described in more detail by Rand et al., 2007; 2005). The results presented in the figure may be typical of similar driving configurations. The circuit will continuously peak charge the filter capacitor to the peak voltage of the input waveform, i.e. 169Vdc for standard 120Vac line voltage. This high level DC voltage may then be fed into a large string of LEDs in series. For example, some typical lamps may have parallel strings of many Red, Blue, Green LEDs, in series attached through a current limiting resistor to the high level DC voltage. The particular lamp tested utilized a combination of 64 Red, Green and Blue LEDs to produce white light.

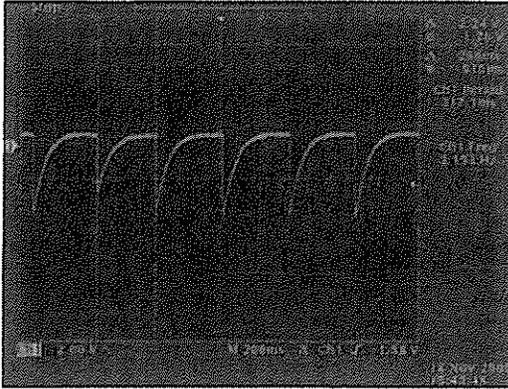


Figure 5. Commercial LED lamp flickers at 3.15Hz when connected to typical residential dimmer switch.

The experimental data in Fig. 5 represents the voltage of a photo-sensor placed directly underneath the LED lamp. Specifically, a photoresistor circuit is used to generate a voltage proportional to the light intensity shining on it. As the experimental voltage shows, the bulb malfunctions when connected to (phase modulated) residential dimmer switch. It produces a noticeable visual flicker. In particular, the flicker varies between around 3.0Hz and 3.3Hz, with average over many cycles of 3.153Hz. This frequency is in the range that has been shown to be a risk for causing photosensitive epileptic seizures.

The flicker illustrated in Fig. 5 is typical of a few LED lamps on the market when connected to a dimmer. However, the precise flicker frequency is hard to predict, as it may either be higher or lower depending on various factors such as number of lamps on the dimmer, position of the dimmer switch (the value of desired off-time α), and/or internal characteristics of the lamp. However, as the experimental oscilloscope plot shows, the flicker frequency may be in the range that induces photosensitive seizures.

The reasons that the dimmer switch may fail when connected to LED lamp bulbs are given in (Rand et al., 2007; 2005).

(3) Uneven Brightness in Different LED Strings When Connected as in Fig. 3(b)- With Strings Having Opposite Anode/Cathode Connections

Consider the circuit in Fig. 3(b). Notice that each LED must have the same dynamic characteristics (forward voltage and dynamic resistance) in order for the current to be perfectly balanced in each alternating illuminated string. If for some reason this does not occur (aging, temperature gradients, poor design), then the current through the strings will not be identical each cycle.

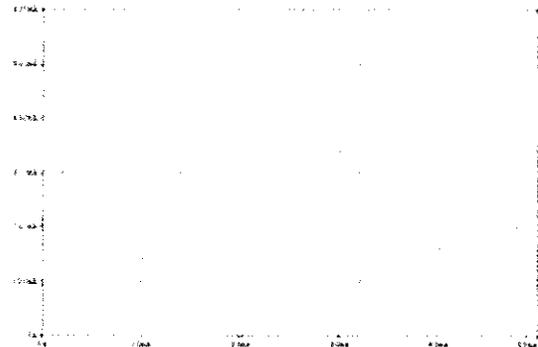


Figure 6. Unbalanced LED Current in Each String of LEDs Using Driving Method in Fig. 3(b). The unbalanced driving will cause uneven luminous output in the lamp and low frequency flicker.

For example, suppose over time, aging causes degradation of one of the two strings in Fig. 3(b) such that its string resistance increases by 50%. This could also be caused by improper design of each string in Fig. 3(b) so that the current in each string is not balanced. This is quite possible since LEDs are binned by different voltages, and further, each string may be composed of different color LEDs that have different nominal voltage drops for the same current. Then, the effective LED current through the bulb will look as in Fig.6.

For example, the effective DC LED current in the numerical simulation of Fig. 6 has average value of around 233mA. However, the Fourier component at 60 Hz (taking FFT) is 80mA and the Fourier component at 120Hz is nearly 240mA. Thus, in this example the low frequency component of 60Hz represents over 33% of the DC component, while the 120 Hz component represents 100% of the DC current. Higher frequency components of the LED current in the above figure are also present in multiples of 60Hz. However, the typical analysis above indicates that LED lamps may demonstrate flicker frequency at line frequency, similar to older fluorescent lamps (previously discussed) that aged unevenly: the flashes/brightness with one direction of line current may not equal those that occur in the other direction.

The above example also illustrates that it is possible for flicker in a lamp to have harmonics with multiple low frequency components, here at both 60Hz and 120Hz.

V. CONCLUSIONS

The purpose of this paper is to make lamp and power electronic designers aware of biological effects of flicker and to introduce the reader to a few LED driving methods that will have flicker. The LED driving approaches described in this paper are not exhaustive and are only meant to introduce the reader to a few common approaches. Other approaches/applications of LED lighting that may also have flicker include, but are not limited to, pulse amplitude modulation driving, triangle wave currents through LEDs,

APPENDIX

TABLE I
FLICKER AND BIOLOGICAL EFFECTS

Source of flicker	Frequency range	Biological effect	Evidence
Sunlight through roadside trees or reflected from waves	Various	Seizures	Clinical histories (Harding and Jeavons, 1994)
Xenon gas discharge photo-stimulator	3-60Hz	Epileptiform EEG in patients with photosensitive epilepsy	Many clinical EEG studies e.g (Harding and Jeavons, 1994)
Malfunctioning fluorescent lighting	Large 50Hz component	Epileptiform EEG in patients with photosensitive epilepsy	(Binnie et al., 1979)
Television	50Hz and 60Hz (discounting 25Hz component)	Epileptiform EEG in patients with photosensitive epilepsy	Many studies eg (Harding and Harding, 2008; Funatsuka et al., 2003)
Flashing televised cartoon	~10Hz	Seizures in children with no previous diagnosis of epilepsy	Major incident (Okumura et al, 2004)
Normally functioning fluorescent lighting (50Hz ballast)	100Hz (small 50Hz component)	Headache and eye strain	Many anecdotes.
Normally functioning fluorescent lighting (50Hz ballast)	100Hz (small 50Hz component)	Headache and eye strain	Double-masked study (Wilkins et al 1989)
Normally functioning fluorescent lighting (50Hz ballast)	32% modulation	Reduced speed of visual search	Two masked studies (Jaen et al., 2005)
Normally functioning fluorescent lighting (60Hz ballast)	120Hz	Reduced visual performance	(Veitch and McColl, 1995)
Normally functioning fluorescent lighting (50Hz ballast)	100Hz (minimal 50Hz component)	Increased heart rate in agoraphobic individuals	(Hazell and Wilkins, 1990)
Normally functioning fluorescent lighting (50Hz ballast)	100Hz	Enlarged saccades over text	(Wilkins, 1986)
Visual display terminals	70-110Hz raster	Changes in saccade size	(Kennedy et al., 1998)
Visual display terminals	~70Hz Raster		Many anecdotal reports of prolonged photophobia
Normally functioning fluorescent lighting	100Hz and 120Hz	Phase-locked firing of LGN neurons in cats	(Eysel and Burandt, 1984)
Various	Up to 162Hz	Human electroretinogram signals at light frequency	(Berman et al., 1991; Burns et al 1992)
Normally functioning fluorescent lighting (50Hz ballast)	100Hz	Inconsistent changes in plasma corticosterone levels in captive starlings	(Maddocks et al., 2001)
Normally functioning fluorescent lighting (50Hz ballast)	100Hz	Mate choice in captive starlings	(Evans et al., 2006)

June 11, 2015

A Much-Needed Recommended Practice for LED Flicker

The emergence of high-frequency electronic ballasts for use with fluorescent lighting did away with most general-illumination flicker concerns back in the 1990s. That is, until the advent of LEDs, which have put flicker back on the table. To help address it, the Institute of Electrical and Electronics Engineers (IEEE) has just published the first recommended practice on the topic, IEEE Std 1789-2015. Entitled "Recommended Practice for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers," it explains what's known about flicker in LED lighting and provides guidance that can help manufacturers design drivers or select them for their products, to minimize possible flicker-associated health and productivity effects.

Flicker is the variation in illuminance or luminance over a period of time. All AC-powered light sources flicker, typically in a periodic manner. However, flicker can be more pronounced in LEDs because, unlike other sources, LEDs have no persistence. This means that LEDs respond to change in forward current with a near-instantaneous change in light output. This is even true for phosphor-coated LEDs, as common LED phosphors respond much faster than some of their fluorescent brethren.

But LEDs pose no inherent flicker hazard, and there are LED lighting products on the market that exhibit less flicker than their conventional counterparts. What primarily determines the degree of flicker in LEDs is the driver. However, it's often more costly to make drivers that minimize flicker — and such drivers often have to be larger in size, to accommodate the components that smooth out the light emission. For that reason, LED flicker is more likely to be a problem in lower-priced products, as well as in those (such as MR16s) that have size constraints.

In addition, the use of dimmers can exacerbate or cause flicker. The key is compatibility between the dimmer and the driver, which is something that should be checked with the manufacturer of the dimmer or luminaire, by asking for the *percent flicker* (a figure obtained by subtracting the minimum from the maximum light output in a cycle, and dividing that by the maximum plus the minimum light output in a cycle) and the *PWM frequency* (for luminaires dimmed using pulse-width

modulation) when the system is dimmed. But if the manufacturer can't supply you with those figures, you may have to test the product yourself.

Why is flicker bad? For one thing, in addition to being annoying and distracting, it can cause eyestrain, blurred vision, and impairment of performance on sight-related tasks. And in those who are flicker-sensitive, it can cause debilitating headaches and migraines — 10% of the population is estimated to suffer from migraines, and that's only one of the groups prone to flicker sensitivity. According to the IEEE recommended practice, flicker has been reported to contribute to autistic behaviors, and can be a trigger for epileptic seizures, although the frequencies seen in architectural products are generally above the critical range for epilepsy. Some of these problems might occur even when the flicker isn't detectable by the eye. Periodic flicker can be characterized by its amplitude modulation, its average value over a periodic cycle, its shape, and its periodic frequency. And all of these characteristics affect the viewer's biological response.

IEEE Std 1789 makes recommendations for managing the biological effects of flicker within two defined risk levels. While operating outside these levels does not mean there will be biological effects, operating within them limits the risk of creating biological effects to defined levels. Determination of which level is appropriate depends on many factors, including characteristics of the user population, exposure time, types of tasks undertaken in the lighted space, and one's risk sensitivity. Tradeoffs with product cost, size, and performance are associated with the various recommendations:

- **To *prevent* seizures** at frequencies below 90Hz, keep the percent flicker below 5% (light doesn't trigger seizures at frequencies above 70Hz).
- **To *limit* the other biological effects of flicker (so that the risk of creating other biological effects is low)**, use the following formulas to determine the maximum percent flicker:
 - At frequencies below 90Hz, maximum percent flicker = frequency x 0.025 [e.g., at 80Hz, the maximum percent flicker is $80 \times 0.025 = 2\%$]
 - At frequencies between 90Hz and 1250Hz, maximum percent flicker = frequency x 0.08 [e.g., at 250Hz, the maximum percent flicker is $250 \times 0.08 = 20\%$]
 - At frequencies above 1250Hz, no restrictions on the percent flicker. (Note: this is the minimum allowed frequency for basic PWM.)
- **To *prevent* the other biological effects of flicker (so that there's no risk of creating other biological effects)**, use the following formulas to determine the maximum percent flicker:
 - At frequencies below 90Hz, maximum percent flicker = frequency x 0.01 [e.g., at 50Hz, the maximum percent flicker is $50 \times 0.01 = 0.5\%$]
 - At frequencies between 90Hz and 3000Hz, maximum percent flicker = frequency x 0.0333 [e.g., at 1200Hz, the maximum percent flicker is

$$1200 \times 0.0333 = 40\%$$

- At frequencies above 3000Hz, no restrictions on the percent flicker.
(Note: this is the minimum allowed frequency for basic PWM.)

This important new recommended practice provides specifiers with flicker performance requirements for managing the risk of biological effects, thereby enabling specifiers to better determine project requirements, and encourages manufacturers to test for flicker and report the results on their cut sheets. That way, the flicker issue can be laid to rest for SSL, just as it was for fluorescent lighting 20 years ago.

As always, if you have questions or comments, you can reach us at postings@akoyaonline.com.

From: Mary Gourley <mgourley@cityofsebastopol.org>
Subject: Fwd: LED Street Lighting
Date: September 13, 2015 4:38:52 PM PDT
To: Richard Emig <remig@cityofsebastopol.org>

FYI

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From: <margyra@comcast.net>
Date: September 13, 2015 at 4:38:37 PM PDT
To: mgourley@cityofsebastopol.org, johneder@comcast.net, unaglass@coastwalk.org, sarahcouncil@yahoo.com, ps sebcc@ps.sebcc@gmail.com, robertjacobcc@sonic.net, lwmclaughln@iuno.com
Subject: LED Street Lighting

Those of the city council and staff,

I am concerned about a potential decision that could be made on 9/15 to allow PG&E to replace already existing street lighting, warm lighting to LED lighting.

I and some others have had first hand experience with newly installed LED overhead lighting along the sidewalk outside of businesses next to whole foods. As soon as they were turned on I, being seated right under them, noticed how blinding they were. And this bright, white lighting which seemed to be of a too high intensity for human exposure gave me a headache which lasted for a couple of hours after leaving the site.

This leaves me wondering about the possible health risks LED lighting of this intensity poses including the EMF and flicker output.

I am not sure LED street lighting is an answer to saving energy, especially when the public might need more information on the benefits of such a decision vs the risks. I support this decision being taken off consent.

Respectfully,

Margy Stewart

Light at Night and Human Health

Recent studies have raised concerns over the possible health implications of light at night (LAN). But given the available research, should any changes be made to currently recommended lighting practices? Shift work has been associated with an increased risk of stress-related coronary heart disease.¹ Research of circadian rhythms suggests that their disruption can compromise the body's defenses against cancer. Studies also suggest that optical radiation is the primary regulating stimulus to the circadian system, and that the circadian system is most sensitive to short-wavelength blue light.² However, the significance of optical radiation exposure relative to other health factors (including abnormal sleep schedule, job stress, and diet) remains unclear. Further, since the current body of available research is inadequate for the purpose of characterizing and restricting exposure to LAN,³ it is not clear at present that typical exposures are likely to pose a threat to human health.

Human rod and cone photoreceptors and their photopigments have been extensively studied, and action spectra and limits of application for photopic and scotopic vision are well established. Much of the current circadian stimulus research is related to the recent discoveries of a class of non-visual photoreceptors, the intrinsically photosensitive retinal ganglion cells (ipRGCs), and the associated photopigment melanopsin. Early circadian research was focused on treatment of cancer and maladies like seasonal affective disorder (SAD), recognizing the importance of synchronizing medications and light exposure with the body's biological rhythms. The utility of these early studies was limited by the methodologies used and the comparability of results in terms of exposure and species tested. Research methods have since been refined, yielding ipRGC action spectra and preliminary models of circadian phototransduction. However, there remains no standard model that incorporates all of the key parameters of exposure:

- **Duration.** Phase shift appears to increase exponentially with duration of exposure to LAN, and the first half of the exposure period appears to be more significant than the second half.
- **Timing.** Daytime exposure to high levels of blue-rich illumination (like daylight) appears to be strictly beneficial in terms of circadian phototransduction and visual performance. In contrast, excessive exposure to LAN appears to hinder synchronization to the natural light-dark cycle.
- **History.** Akin to the mechanism of visual adaptation, the sensitivity of the circadian system to LAN appears to be decreased if exposed to high levels of entraining illumination during the day.
- **Quantity.** Research indicates that circadian sensitivity is not accurately modeled by the photopic or scotopic functions. Also, since the amount of optical radiation reaching the retina depends on pupil size, simple measurements of optical radiation "at the eye" may be inadequate.

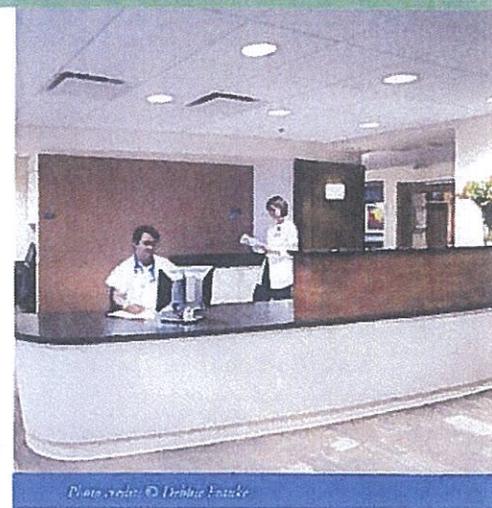


Photo credit: © Debbie Estabke

Terms

Action spectrum – The quantitative actinic response of a chemical or biological substance or living organism as a function of an appropriate spectral parameter such as wavelength or photon energy.

Circadian rhythms – Biological processes, such as the nighttime production of melatonin, that cycle approximately every 24 hours.

Entraining – Synchronizing with the environment.

Mesopic vision – Fully adapted vision at luminance conditions between those of scotopic and photopic vision, i.e., between about 0.034 and 3.4 cd/m².

Optical radiation – Electromagnetic radiation having wavelengths between approximately 100 and 1,000 nm. Includes ultraviolet, visible light, and infrared.

Phase shift – The delay or advancing of biological rhythms relative to the natural light/dark cycle.

Phototransduction – The conversion of optical radiation signals into neural signals for vision and for other body functions.

Spectral opponency – The mechanism by which sensitivity to one wavelength is reduced (a sub-additive response) when the visual system is exposed to additional wavelengths.

¹ World Health Organization. *World Health Report 2002. Reducing Risks, Promoting Healthy Life*. Geneva: World Health Organization, 2002. Chapter 4, p. 75.

² Stevens et al., "Meeting Report: The Role of Environmental Lighting and Circadian Disruption in Cancer and Other Diseases." *Environmental Health Perspectives*, 2007, 115:1357-1362.

³ IES Light and Health Committee. "Light and Human Health: An Overview of the Impact of Optical Radiation on Visual, Circadian, Neuroendocrine, and Neurobehavioral Responses." IES TM-18-08. New York: Illuminating Engineering Society of North America, 2008.

- **Spatial distribution in the visual field.** Melatonin production appears most sensitive to exposure of the lower-inside portion of the retina to optical radiation.
- **Spectral content.** The circadian system is most sensitive to nearly monochromatic blue light. However, if a given blue light source is supplemented by light of non-blue wavelength(s), as in the case of broadband white light, this sensitivity is reduced. This appears to be due to spectral opponency.

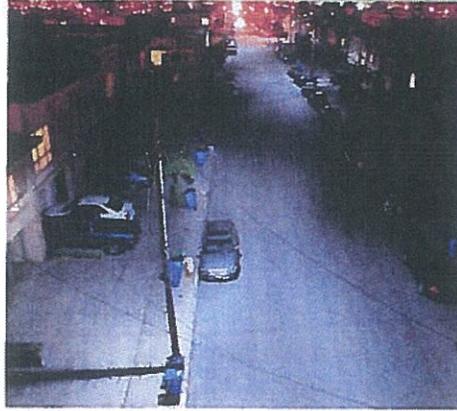


Photo credit: PG&E Emerging Technologies, 2008

While the significance of optical radiation exposure relative to other health factors remains unknown, the potential implications of these preliminary findings are far-reaching. Since sensitivity to LAN appears to be a function of daytime exposure, all lighting systems may require scrutiny, whether interior or exterior, daytime or nighttime. Evening exposures to lighting in common interior environments may be of greater significance than typical exposures encountered outdoors.⁴

Nearly all light sources, including incandescent and fluorescent lamps, produce some blue light and thus may be affected by the outcomes of research on LAN. Because so little is understood now about how humans respond to LAN, even moonlight may require consideration as a source of exposure to LAN.

For most types of light sources, efficacy is not highly dependent on the correlated color temperature (CCT) selected. This is not the case with high-performance LED devices using current phosphor conversion technology, where typical photopic efficacy decreases of approximately 25% can be expected in choosing warmer 3000K over cooler (generally bluer) 6500K. While this may change with improvements in technology, a restriction on spectral content would currently prevent the use of more efficient light sources, with clear implications in terms of pollution from electricity production. Substantial gaps in the spectrum can also reduce visibility through reduced visual contrast and color rendition, thereby potentially compromising safety and security. Research into mesopic vision has shown that exterior light sources with greater scotopic content can improve peripheral detection without compromising on-axis vision,⁵ suggesting an even greater performance gap between LEDs of high and low CCT in these applications. However, as with circadian stimulus research, mesopic vision research is ongoing and currently lacks the validation and consensus required to establish standardized design recommendations.

It would be irresponsible to encourage major changes in lighting practice without first establishing clear cause-and-effect relationships in these budding and very complex fields of science. A rush to judgment could result in tremendous and unnecessary lighting expenditures, while reducing safety at night and increasing the emissions of greenhouse gases, with no improvement in human health. Further research is needed and is already underway. In the meantime, those responsible for the selection of light sources are encouraged to follow local and federal regulations and the current and forthcoming safety guidelines offered by the Illuminating Engineering Society of North America (IES).

⁴ Figueiro M.G., M.S. Rea and J.D. Bullough. "Does architectural lighting contribute to breast cancer?" *Journal of Carcinogenesis*, 2006 5:20.

⁵ IESNA Committee on Effects of Lamp Spectral Distribution, "Spectral Effects of Lighting on Visual Performance at Mesopic Levels." IESNA TM-12-06. New York: Illuminating Engineering Society of North America, 2006.

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Lighting for Health: LEDs in the New Age of Illumination

The proliferation of electric lighting was a hallmark of the 20th century, providing widespread access to light virtually anywhere, at any time of day. In the same way, the 21st century may become the age of lighting for physiological well-being—often referred to with the familiar catchphrase light and health. Recent research has greatly advanced the understanding that light not only enables vision, but is also a critical signal to our biological systems, affecting circadian rhythms, pupillary response, alertness, and more. However, applying early research findings to widespread lighting practices must be done with great caution, if it is ready to be done at all. After all, light as a drug is much different from light as a commodity.

A recent article in the journal *Trends in Neurosciences* argued for a cautious and informed approach when attempting to translate scientific studies to engineering practice and policymaking. In *Measuring and Using Light in the Melanopsin Age*,¹ a diverse group of fourteen leading researchers explored the current state of knowledge on nonvisual photoreception, which is centered on the photopigment melanopsin, and how it can be applied in the field today. This article is an important statement, providing a firm viewpoint from authors at 11 different institutions.

Humans are exposed to a substantial amount of electric lighting, all of which has some effect on our physiology—regardless of the type of source. Now there is a rapidly expanding amount of information on light and health, which is leading to a rapidly expanding number of questions on exactly how we should light architectural spaces. Often, uncertainty surrounds the role of LEDs. This largely stems from the timing of LED technology's quick rise to prominence in the lighting world and the outlook for its future. With LEDs there is greater ability to tailor lighting systems to meet both visual and non-visual needs, which is presenting many new opportunities. At the same time, there is potential for poorly engineered products—including LEDs and other types of light sources—or poorly implemented lighting systems to cause harm.

Current Science and Limitations

The non-image-forming response to light is wide ranging, including circadian, neuroendocrine, pupillary, behavioral, and other physiological effects. Specific outcomes include the daily resetting of circadian clocks (a process called entrainment), as well as acute effects like pupil constriction, increasing

alertness, and melatonin suppression. Light has been shown to be an effective clinical treatment for a variety of conditions, such as Seasonal Affective Disorder (SAD), but also plays an important role in maintaining daily physiological function. Importantly, the non-image-forming photoreceptor system in our eyes is different from our visual system. Although it shares some of the same photoreceptors, it has its own unique spectral and temporal response to light stimuli. This is one of the reasons traditional measures of lighting quantity, such as illuminance, do not accurately quantify the nonvisual effect of a lighting stimulus.

In the past two decades, much has been learned about the sensitivity of the nonvisual photoreceptor system. Most notably, intrinsically photosensitive retinal ganglion cells (ipRGCs) were identified, as was the spectral sensitivity of melanopsin, the photopigment they contain. The ipRGCs have peak sensitivity to blue light—which is thus important for light and health—but the total response of the nonvisual photoreceptive system is a composite of input from the ipRGCs, rod photoreceptors, and cone photoreceptors. This composite response can change based on the spectrum, intensity, and temporal pattern of the light, as well as the light-exposure history and circadian adaptation state of the individual, which is one reason why characterizing nonvisual photoreception with a single spectral weighting function has remained elusive.

LEDs and Nonvisual Photoreception

LEDs are often associated with light and health—either positively or negatively—for several reasons. LEDs came to prominence just as knowledge of nonvisual photoreception was emerging, and the rates of adoption suggest that LEDs will soon be in widespread use in architectural applications. This combination has provided an opportunity to develop and evaluate best practices for nonvisual stimulation. Additionally, LEDs offer superior flexibility in terms of spectrum, intensity, directionality, and controllability, compared to most conventional light sources, and all of these characteristics are important factors in designing a system for nonvisual impact—particularly the ability to tune LED spectrum.

Sometimes the unique relative spectral power distribution of LEDs causes worry, simply because it looks different from other, more familiar, light sources. Although most LED light sources have a blue “pump” that may result in more energy per unit illuminance at a specific wavelength, photoreceptors do not process individual wavelengths. Rather, photoreceptors integrate information over a range of wavelengths—the very principle that the triphosphor fluorescent lamp, for example, was designed to exploit. Thus, an important consideration is that LEDs emit no more short-wavelength (blue) energy than other sources at the same correlated color temperature (CCT).² That is, even though most LEDs have a peak in their

1. Lucas et al. 2014. *Measuring and Using Light in the Melanopsin Age*. *Trends in Neurosciences* 37(1): 1–9.

2. This can be mathematically evaluated, and occurs because CCT calculations

emission around 450 nm, in order to have the same CCT they emit less energy than other comparable-CCT light sources in the regions above and below 450 nm. LEDs are not inherently more hazardous (or beneficial) to human health than any other light source.

Although a 2700 K LED lamp emits about the same amount of blue energy as an incandescent lamp, it is also important to recognize that LED lamps can be engineered to emit light at any desired CCT. Further, while most commercially available LED products have similar spectral output, it would be possible to engineer the relative spectral power distribution to provide maximum benefit if there was a way to effectively and accurately determine the spectrum needed for any given physiological or behavioral benefit. Further, color-tunable products are relatively easily achieved using LED technology, which can offer greater flexibility for changing nonvisual efficacy based on the time of day. At this point, the challenge is identifying exactly what spectral content is the most beneficial—something which is quite possibly application, time-of-day, and user dependent.

Implementing Light and Health Solutions

In many ways, this new age of light and health is a direct reaction to the previous century's transition to illuminated interiors. Now that so much time is spent indoors, there is a need to control the luminous environment to promote health (and avoid harm). However, many architectural spaces serve multiple purposes and have many different users. What may be beneficial for an occupant during the day may be harmful for an occupant at night, and may vary significantly between individuals in a given space. Even more complicated is the need to balance the desire for alertness with preservation of normal circadian rhythms among night-shift medical staff, for example. Therefore, even if a prescription for effective nonvisual stimulation is developed, implementing the solution may not be straightforward, especially if there are users with different histories and needs occupying the space at the same time.

As the authors of *Measuring and Using Light in the Melanopsin Age* state, "Simple prescriptions are as likely to do harm as good, and even experts may have divergent ideas about best practice under some situations." That said, lighting practitioners may choose to follow some basic guidance provided by the authors: if minimizing nonvisual response is a goal, the amount of light reaching the eye—especially short-wavelength (blue) radiation—should be limited; if activating nonvisual

responses is a goal, increasing short-wavelength radiation and total illuminance levels at the eye should be the focus. Understanding when to apply each scenario should be the role and responsibility of the specifier. There are many details to be considered, but few definitive answers to important questions about the effect of light level, spectrum, or otherwise customized solutions on different users or user groups.

Future Development

In the early days of understanding the human visual system, there were dueling theories of color vision: trichromacy and opponent channels. It was not until decades later that scientists were able to decipher that the two theories were complementary, rather than mutually exclusive. It is difficult to say exactly where things are in the maturation of understanding nonvisual photoreception, but it is likely that numerous theories that exist today will continue to be refined, and may even converge. An important question to ask is whether sticking with the status quo is more acceptable than altering design practice based on early research findings, especially when either approach may be determined in the future to be detrimental to health and wellbeing.

While the science may still be building, the lighting industry is already seeing LED products marketed for their health benefits. This is not unique to the technology though, as "full-spectrum" incandescent and fluorescent lamps have been marketed for decades, but there is unprecedented momentum to address light and health thanks to the customizability of LEDs. Specifiers and consumers must understand that no lighting product is a panacea; in fact, any benefit derived is dependent on the proper use of the product. Further, it is possible that no benefit is achieved, or worse, that harm is done. Like many health questions, there is no easy answer. One thing is for certain, however: the lighting industry cannot ignore nonvisual needs indefinitely.

Conclusion

Lighting systems are conventionally designed to meet the task performance needs of users, with comfort, aesthetics, and energy consumption also being important considerations. Thanks to recent scientific advancement, it is clear that nonvisual needs should also be considered, but there remains much to be discovered before widespread implementation of nonvisually-effective solutions is possible. While today's LEDs are generally no more beneficial or dangerous to human health than other, similar light sources, they have the potential to be carefully tuned to meet the diversifying demands placed on lighting systems.

rely on the CIE 1931 Color Matching Functions, one of which covers the blue region of visible light—mainly between 420 nm and 500 nm. This concept is also very important in understanding Blue Light Hazard (i.e., light-induced retinal damage), which is explored in a DOE SSL fact sheet, Optical Safety of LEDs, available at <http://www.ssl.energy.gov/factsheets.html>

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From: Mary Gourley <mgourley@cityofsebastopol.org> 
Subject: FW: Return of incandescent light bulbs as MIT makes them more efficient than LEDs - Telegraph
Date: January 21, 2016 1:46:12 PM PST
To: Richard Emig <remig@cityofsebastopol.org>

1 Attachment 6 KB

FYI

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To: Jeffrey Weaver <JWeaver@sebpd.com>; John Eder <johnEDER@comcast.net>; Kenyon Webster <kwebster@cityofsebastopol.org>; Larry McLaughlin <lwmclaughlin@juno.com>; Mary Gourley <mgourley@cityofsebastopol.org>; Patrick Slayter <ps.sebcc@gmail.com>; Robert Jacob <robertjacobcc@sonic.net>; Sarah Glade Gurney <sarahcouncil@yahoo.com>; Una Glass <unaglass@coastwalk.org>
Subject: Return of incandescent light bulbs as MIT makes them more efficient than LEDs - Telegraph

<http://www.telegraph.co.uk/news/science/science-news/12093545/Return-of-incandescent-light-bulbs-as-MIT-makes-them-more-efficient-than-LEDs.html>

Dear Sebastopol City Council Members,

These incandescent bulbs recently developed at MIT have triple the efficiency of the most efficient new LED light bulbs without the "dangerous chemicals" and nasty health effects of LEDs also mentioned by MIT researchers.

RE New Street Lamps - Sebastopol need not accept another "gift that keeps on giving" (like smart meters) from PG&E at this time. Doesn't it make sense to wait a little longer for something that won't harm the health of our citizens while providing triple the energy savings of currently available bulbs. These bulbs are beyond the theoretical stage.

One health writer has alluded to PG&E customers as "the canaries on the west coast" in relation to the smart meter invasion. Unfortunately, our good health once sold out cannot be repurchased.

Best,
Dave Hubert
[707-823-7302](tel:707-823-7302)



PO Box 1016 Sebastopol CA 95473 707-827-0109

February 2, 2016

Email delivery to: Mary Gourley <mgourley@cityofsebastopol.org>

Rich Emig <remig@cityofsebastopol.org>

cc: Sebastopol city council and city manager

We would like PG&E to address our concerns about LED streetlights by answering the following questions.

1. What are the technical specifications of the LED streetlights in kelvin and lumens?
2. Has PG&E investigated the reports by the DOE and IEEE about the health risks of flicker from inexpensive drivers? 2A. **If yes**, what has PG&E done to mitigate flicker?
3. Do the LED streetlights transmit microwave or radio frequencies? **If yes**: 3A. For what purpose?; 3B. Are there other future uses also possible, for instance: smart meter or cell infrastructure, internet, data, sound, or video capability?; 3C. Please describe the technical specifications of the antennas in terms of watts, antenna gain, frequencies used, mesh network, and pulsed frequencies; 3D. Please disclose the number of transmissions in a 24 hour period and the strength of transmission at the source and at ground level.
4. Have there been studies proving PG&E's LED streetlights reduce energy consumption, reduce greenhouse gas emissions and reduce maintenance costs? 4A. Is there proof of the length of their useful life? 4B. **If yes**, please provide verification.
5. In 2015 on the CPUC ESPI_Uncertain_List, PG&E is asked to update their assumptions on streetlight savings. Has PG&E completed this, if so please provide the results.
6. Does PG&E intend to recoup LED streetlight costs in their general rate case, which means customers pay?
7. Do the LED streetlights emit unintentional radiation onto the power lines? If so, how much?
8. Have there been any complaints about a hum or noise from the LED streetlights?

We ask PG&E to respond with answers to <emfsafe@sonic.net> no later than February 14 by 5pm, or sooner. Please call if you have questions or need clarification.

Thank you,

Sandi Maurer
Director, EMF Safety Network
707-827-0109

From: Mary Gourley <mgourley@cityofsebastopol.org>
Subject: FW: Sebastopol is not Brooklyn - "Its a quality of life issue!"
Date: February 2, 2016 1:05:29 PM PST
To: Richard Emig <remig@cityofsebastopol.org>

1 Attachment, 6 KB

Mary C. Gourley, CMC, City Clerk
City of Sebastopol
7120 Bodega Avenue
Sebastopol, CA 95472
Phone: 707-823-1153
FAX: 707-823-1135
Email: mgourley@cityofsebastopol.org
City Web Site: www.cityofsebastopol.org
OFFICE HOURS: Monday - Thursday - 7:00 am - 5:30 pm (Closed 12:00 - 12:30 pm for Lunch)



From: Dave Hubert [mailto:davehubert@gmail.com]
Sent: Tuesday, February 02, 2016 12:17 PM
To: Jeffrey Weaver <JWeaver@sebpd.com>; John Eder <johnEDER@comcast.net>; Kenyon Webster <kwebster@cityofsebastopol.org>; Larry Mclaughlin <lwmclaughlin@juno.com>; Mary Gourley <mgourley@cityofsebastopol.org>; Patrick Slayter <ps.sebcc@gmail.com>; Robert Jacob <robertjacobcc@sonic.net>; Sarah Glade Gurney <sarahcouncil@yahoo.com>; Una Glass <unaglass@coastwalk.org>
Subject: Sebastopol is not Brooklyn - "Its a quality of life issue!"

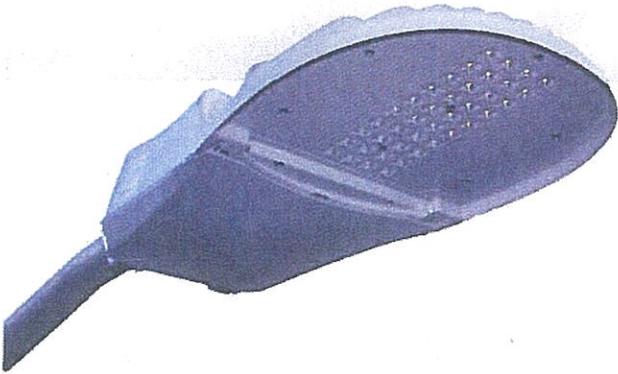
Video of New York news story on LED street lighting and resident reaction.

<http://pix11.com/2015/04/27/new-bright-leds-that-replaced-street-lamps-angering-local-residents/>

Sales of "black-out curtains" have gone through the roof. Personally, I like to allow for air flow at night

Quality of life in New York
has become an afterthought
. I grew up there.

A Municipal Guide for Converting to LED Street Lighting



**A Step-by-Step Approach to Improving Outdoor Lighting,
Saving Energy and Reducing Maintenance Costs.**

Algona, Iowa



Before: 250W HPS (295 System Watts)



After: 104W and 176W LED

Introduction

Driven by the promise of significant energy and maintenance savings provided by Light Emitting Diode (LED) technology, many cities are struggling with effectively implementing LED's in their street lighting. There still remains much confusion and misinformation pertaining to this technology. Furthermore much of the available literature is written in highly scientific jargon targeting an academic audience.

This document is intended as a practical, user friendly, step-by-step guide for individuals responsible for municipal street lighting who may lack a formal lighting background. Thus, the use of lighting jargon in this guide has been minimized.

Note on controls/monitoring systems.

While the potential exists for additional energy savings from the control systems offered by several manufacturers, there is currently no industry standard communication protocol for these systems. Consequently the street lighting control systems on the market today are proprietary and most municipalities have been reluctant to risk standardizing on any of these systems. Also, these systems currently add an additional level of complexity and cost to the street lighting system. Because of these critical issues, we have not yet seen widespread adoption of these systems in the market and therefore controls/monitoring systems are not included in this guide.

It should be noted, however, that many luminaire manufacturers do offer replaceable "power doors" on their street lights which offer the potential for easy replacement in the future with the necessary control equipment. This would allow for a simple luminaire upgrade to include controls when these critical issues are resolved and the systems become more viable. If a city felt they might wish to add a street lighting control system in the future, they may choose to add this "Power Door" feature to the preliminary specification recommended in Step 6.

Step 1 – Decide if LED street lighting makes sense for your community

The first step for any city considering converting their high pressure sodium or mercury vapor street lighting system to LEDs is to evaluate the actual data and draw on the experiences of other communities. Fortunately hundreds of communities throughout North America have already installed some LED street lighting and there is considerable evidence now that at the very least LED street lights will provide the following benefits compared to HID:

- Improved nighttime visibility and safety through better color rendering, more uniform lighting distributions and the elimination of many dark areas between poles.
- Reduced direct and reflected uplight which are the primary causes of urban sky glow.
- 40-80% energy savings (depending on incumbent lighting source and lighting design criteria).
- 50-75% street lighting maintenance savings.

On the downside, there are two major obstacles to an LED street lighting conversion project:

- The first cost of an LED street light conversion will require a significant capital outlay. LED lights are considerably (2-4 times) more expensive than conventional HID “cobra-head” style lights.
- Because of the lack of standardized wattages and the complexities of getting new rates approved, most regulated Investor Owned Utilities (IOU’s) today don’t offer LED street light tariffs for unmetered street lights. Therefore, even if a city converts all of the street lights to LEDs and reduces the power consumption by 50% or greater, most IOUs will only reduce the street lighting bill slightly or not at all. However most IOU’s are aware of the benefits provided by LED technology in street lighting and many are working to develop these tariffs.

It is highly recommended that cities begin networking with other cities who have installed LED street lights as early as possible in the process to help confirm the desired objectives and avoid the pitfalls. A good starting place is the Municipal Solid State Street Lighting Consortium (<http://www1.eere.energy.gov/buildings/ssl/consortium.html>). The MSSLC is funded by the U.S. Department of Energy and is simply a consortium of communities who share experiences and best practices pertaining to LED street lighting. They hold regular workshops throughout the United States and are an excellent resource for technical information.

In addition, at the end of this guide is a partial list of cities, utilities and DOTs that have successfully installed LED street lights.

In spite of the advantages offered by LED street lights, the reality is that many cities may simply lack the personnel to administer these types of projects. Like similar projects, this will usually require development of specifications, preparation of bid documents, and overseeing the implementation of the project.

Finally, the project itself will require some sources of funding which are discussed in Step 3. Some cities may simply be forced to conclude that for financial reasons this project may have to be deferred.

If it is determined that the city lacks the resources to proceed with a street light conversion project, it is recommended that the city consider purchasing just four LED street lights from two or three different manufacturers to test. Many manufacturers offer special pricing programs for these test installations. By putting up (See Step 7 for details on a test) eight or twelve LED street lights you can quickly begin to educate yourself on the technology, the mechanics of the products, the differences in the illumination quality, etc. In addition, you can begin to obtain community feedback (positive and negative) on the lighting quality. In the future when you are able to proceed with this initiative you will have gained valuable experience and not be starting from scratch.

Step 2 - Define the scope of the project

For smaller communities it may be economical to convert all of the street lights at once. Larger cities typically find doing the project in stages is more practical. Defining the scope of the project is best done as follows:

a. Complete an audit of your current street light inventory and light levels.

In many cases cities do not have complete and current knowledge of the extent of their street lighting inventory. Ideally this would include the following:

- Every pole with GPS location.
- The style of luminaire(s) (cobra-head, decorative acorn, decorative teardrop etc.) on each pole.
- The lamp source and wattage of each luminaire.
- Identification of responsibility for ownership and maintenance of each luminaire (city or utility).
- Typical light levels and uniformity provided by each type of luminaire on each type of roadway. A lighting designer with roadway lighting experience or some street lighting manufacturers' representatives may be able to assist you with this if required.

b. If street lights are owned by an IOU, confirm that they offer LED tariffs and/or rebates. This will substantially impact the financial viability of the project.

c. Evaluate the internal resources of the city to determine whether you have the capacity for a complete street lighting retrofit program. Most cities have done their relighting projects in stages such as starting with lower wattage cobra-head products in areas with the greatest need for improved lighting. Also, unlike HID units, lower wattage LED lights are substantially lower cost than higher wattage units.

Because of the high initial cost, replacing decorative lights typically offer financial returns substantially lower than cobra-head units and consequently are often deferred to the later stages.

Step 3 – Determine the funding source

It is wise to carefully consider the funding source early in the process. Today the initial cost of LED street lights is considerably higher than HID lights. In addition, they will typically take several years to pay for themselves in energy and maintenance savings. Here are a few potential sources of funding that have been used or considered by other cities:

- Self Funding
 - If a city has its own municipal utility it may be possible to borrow the funds from the utility and pay it back over several years (typically 5-7) out of the savings in energy and maintenance.
 - With current interest rates, it may also be highly attractive to issue bonds or arrange financing through private capital markets.
- Federal Government
 - Many cities were able to take advantage of block grants in the 2009 American Recovery and Reinvestment Act (ARRA) for these projects. While the ARRA funds are now mostly gone, cities may find other federal grants in the form of matching funds, etc. The MSSLC may be a good resource for identifying these.
- State Programs
 - Many states have grants and low interest loan programs available for energy saving projects.
- Utility Programs
 - Pacific Gas and Electric in Northern California currently has the most comprehensive LED street lighting conversion program in the U.S. This program includes special tariffs, rebates and even a turnkey installation program. Many other IOU's are also developing LED conversion programs for their customer's street lights as well their own.
- ESCO's
 - Large Energy Saving Contractors (ESCO's) are now offering complete turnkey installation programs. They can finance the project as well as purchase and install the lights. The city can pay for this over many years out of energy and maintenance savings as well as any potential energy rebates.
- Manufacturers' Programs
 - Several large street lighting manufacturers are also willing to help finance these projects accepting payments over several years. It is wise to ask the manufacturers about their programs and possibly include these terms in the bid documents.

Certainly two or even three of these options can be combined to achieve the most favorable financing package for the project.

Step 4 – Complete the financial analysis

A preliminary analysis of the financial payback can be done pretty quickly.

The formula for Simple Financial Payback is = $\frac{\text{Initial Cost of the Program}}{\text{Annual Savings in Energy and Maintenance}}$

Example: Replacing (1,000) 100W HPS Cobra-head Style Street Lights with \$.10 kWh energy rate.

Initial Cost:

- Cost of new LED luminaires = $\$230 \times 1,000 = \$230,000$
- Cost of installation = (4 luminaires per hour installed at \$200 per hour for two person crew) $\$50 \times 1,000 = \$50,000$
- Cost of bid, administration, misc. = $\$10,000$
- Less utility rebates = $\$75 \times 1,000 = (\$75,000)$
- Total Initial Cost = $\$215,000$

Annual Savings:

- Annual Energy Savings = 1,000 street lights X 4,000 hours per year X 75W per luminaire savings X .10 kWh rate = $\$30,000$
- Annual Maintenance Savings = 1,000 street lights X \$25 per fixture per year savings (assuming 4 year cycle of HID spot relamping, cleaning, changing igniters, ballasts, photocells, etc. vs. LED 10 year cleaning cycle and occasional photocell and driver replacements) = $\$25,000$.

Total Annual Savings = $\$30,000 + \$25,000 = \$55,000$

Simple Payback = $\$215,000 / \$55,000 = 3.91$ years.

Typically programs with paybacks under 5 years should certainly be done and paybacks over 10 years are usually deferred. However, because of the urgency of global climate change, many communities (especially where the electrical energy source is fossil fuel based) are even proceeding with energy saving programs that have very long financial payback periods. Also if the funding source is a federal or state grant, it will normally make sense for the city to proceed with the project regardless of the payback.

If the payback seems favorable it will probably be desirable to complete a more rigorous financial analysis to determine Return On Investment (ROI) and the Net Present Value (NPV) of the project. The MSSLC offers a more comprehensive on-line tool for helping with these calculations here: <http://www1.eere.energy.gov/buildings/ssl/financial-tool.html>.

Step 5 - Determine if street lights are going to be purchased by the city direct or through the installing contractor

Generally speaking the most cost effective method for these projects is for the city to buy the luminaires directly and have them installed by their own crews or by an outside contractor. Some cities however prefer the simplicity of having a single contractor provide a complete turnkey solution which may also include financing, labor warranties, etc. This approach will normally have a longer financial payback. Also, if the "turnkey solution" is chosen, the contractor may attempt to provide a lower quality street light. It is imperative therefore to list the acceptable products clearly in the bid documents (see Step 9).

Many cities have found it helpful to network with other communities that have completed their LED conversions to help determine how to best purchase the street lights.

Step 6 – Develop a simple, preliminary specification to help narrow down the fixture selection

Below is a sample of a basic, twelve item specification that would normally eliminate most of the very poor quality products and unreliable suppliers. All major U.S. manufacturers that have any significant experience with LED street lighting should have no difficulty in meeting this specification.

LED "Cobra-Head" Style Luminaire Preliminary Specification

- I. Luminaire shall mount to a 1¼" to 2" (1½" to 2¾" O.D.) diameter mast arm.
- II. Luminaires shall have an Effective Projective Area (EPA) not to exceed the EPA rating of the luminaire being replaced.
- III. EMI meets or exceeds FCC 47 CFR Part 15. Transient voltage complies with ANSI C62.41 Cat. C High.
- IV. Luminaires shall pass the 3G vibration test per ANSI C136.31-2001
- IV. Paint finish shall equal or exceed a rating of six per ATSM D1654 after 1000 hours of salt spray testing per ASTM B117. VI.
- V. LEDs shall have a CCT of 4000K ± 300K
- VII. Luminaires shall produce 0 light at or above 90°.
- VIII. Luminaires shall be listed by Lighting Facts.
- IX. Luminaires shall be qualified by the DesignLights Consortium
- X. Luminaires shall be listed by a Nationally Recognized Testing Laboratory as suitable for wet location applications.
- XI. Manufacturer shall provide a minimum five year limited warranty.

XII. Luminaires shall meet the lighting levels and uniformity requirements shown in the scenarios below:

- Scenario A

Replacement of 100W HPS luminaires in local/residential applications with a low pedestrian conflict classification

Road width – 40'

Pole Mounting Height - 25'

Pole Spacings – 150' Single Side of Street

Mounting Arm – 8'

Pole Set Back from Street – 2'

Light Loss Factor in Calculations - .85

Minimum Required Average Illuminance - .4 fc

Average to Minimum Uniformity - 6 to 1

- Scenario B

Replacement of 150W HPS luminaires in collector/commercial applications with a medium pedestrian conflict classification

Road width – 55'

Pole Mounting Height: - 30'

Pole Spacings – 175' Staggered Opposite Sides of Street

Mounting Arm – 8'

Pole Set Back from Street – 2'

Light Loss Factor in Calculations - .85

Minimum Required Average Illuminance - .9 fc

Average to Minimum Uniformity - 4 to 1

Specification Explained:

- I. Luminaire shall mount to a 1¼" to 2" (1½" to 2¾" O.D.) diameter mast arm
This is the standard range of pipe sizes to which both HID or LED "cobra-head" style fixtures mount.
- II. Luminaires shall have an Effective Projective Area (EPA) not to exceed the EPA rating of the luminaire being replaced.
This specification assures that the wind load rating of the luminaire won't be larger than the replacement HID cobra-head and potentially compromise the pole. Typically luminaires with an EPA at or below .9 ft² will comply with this.
- III. EMI meets or exceeds FCC 47 CFR Part 15. Transient voltage complies with ANSI C62.41 Cat. C High.
This is an FCC requirement to make sure that the electronics in the luminaire won't interfere with broadcast or cable systems, etc.
- IV. Luminaires shall pass the 3G vibration test per ANSI C136.31-2001
This is the industry standard test that ensures the luminaire will remain on the mast arm in spite of normal vibrations.

V. Paint finish shall exceed a rating of six per ATSM D1654 after 1000 hours of salt spray testing per ASTM B117.

This is especially important in coastal regions to ensure that the finish won't fail resulting in premature corrosion of the housing.

VI. LEDs shall have a CCT (correlated color temperature) of 4000K ± 300K
4000K is considered a "neutral white" (not too yellow or too blue) color of light similar to both moonlight and metal halide (which is usually used in retail parking lots). Although 6000K is also sometimes used in street lighting, many people find this unnatural and too blue which is why the 4000K enjoys wide market acceptance and is much more common.

VII. Luminaires shall produce 0 light at or above 90°.

With traditional HID cobra-heads there was a tradeoff between drop refractor type lenses and flat glass lenses (previously classified as "full cutoff"). Drop lens units typically produced wider pole spacings and more uniform lighting patterns. Flat glass units usually had less uplight (which contributes to sky glow), better control of light trespass into residential windows, and lower high angle glare. One of the great benefits of LED lights is you can now "have it all". With the precise optical control capability of LEDs it is now possible to achieve the uniformity and spacings of the HID drop glass units as well as the elimination of direct uplight, reduced glare, and light trespass control provided by the flat glass units. Therefore there is really no reason today to accept anything other than a "full cutoff style" street light with zero light above 90°.

VIII. Luminaires shall be listed by Lighting Facts.

Sponsored by the U.S. Department of Energy (DOE), LED Lighting Facts is a voluntary pledge program to assure that LED lighting products are represented accurately in the market. Lighting Facts will publish performance results provided by the manufacturer in five areas—lumens, efficacy, watts, correlated color temperature (CCT), and color rendering index (CRI)—as measured by the industry standard for testing photometric performance, IES LM-79-2008. By adding this to the specification, the municipality is relieved of the burden of having to obtain and evaluate this data.

IX. Luminaires shall be qualified by the DesignLights Consortium.

The DLC is a collaboration of utility companies and regional energy efficiency organizations that evaluate luminaire manufacturers' LED data (LM-80), and their in situ thermal tests. If the manufacturer provides this product data to the DLC and it demonstrates the product meets the DLC criteria for projected LED life, they will add the product to their list of qualified products. By adding this to the specification, the municipality is relieved of the burden of having to obtain and evaluate all of this data. Also, DLC qualification is usually required to qualify for most utility programs or rebates.

Note: Neither Lighting Facts nor the DLC evaluates actual products and their listing provides no assurance of product quality in the areas of meeting the desired lighting levels, mechanical features, etc.

X. Luminaires shall be listed by a Nationally Recognized Testing Laboratory as suitable for wet location applications.

Requiring a label from UL, ETL, or CSA, etc. assures that the product has passed industry standard tests for product safety. The thermal and environmental tests performed for the wet location rating assure the product was suitably designed for outdoor applications. Also, the National Electric Code requires electric lights to have this label.

XI. Manufacturer shall provide a minimum five year limited warranty.

The warranty should cover the entire luminaire - especially failures of the LEDs (usually 10% or more LED failures constitute a luminaire failure), power supply, and paint finish. The industry standard today for LED street light warranties is 5 years. Many manufacturers may be willing to offer longer warranties, but they will usually charge a premium for this. As with most "extended warranties" these are not generally a good value because a) failure rates are likely to be relatively low during the precise period of the extension, and b) after five years the product pricing is likely to be lower than current prices (as is the case for most electronic products). Therefore it will likely be more cost effective to simply buy the lower cost replacement product at that time.

XII. Luminaires shall meet the lighting levels and uniformity requirements shown in the scenarios below:

It is a good idea to specify some application-based lighting criteria.

*The scenarios listed are typical but are by no means standard. It may be useful to simply list these scenarios in the initial specification, but it would normally be preferable to replace the values in **bold underline** with the actual mounting heights, pole spacings, etc. that exist in your community. To create the design to verify the lighting criteria is achieved by each manufacturer, the same LM-79 IES file should be used that was submitted to gain listing by Lighting Facts.*

Notes:

1) The footcandle and uniformity values shown in the specification are derived from the Illuminating Engineering Societies (IES) RP-8 Recommended Practice for Roadway Lighting. This is the industry standard for lighting roadways. However, many communities today do not light to this standard. Also, if these values are not being achieved currently with HID lights, it may not be realistic to achieve these lighting levels when converting to LEDs. Those communities instead typically try to achieve light levels that are as good as or better than what had existed with the incumbent technology.

2) There is considerable research suggesting that, especially at low light levels, humans have better visibility under the white light produced by LEDs than the yellow light produced by high pressure sodium. Many people believe therefore the overall "photopic light levels" (what a standard light meter reads) can be lowered when converting to LEDs without reducing visibility to achieve further energy savings. While not disputing the validity of the research, the IES does not yet specifically endorse this design approach in street lighting.

Step 7 - Invite manufacturers to present their products for testing and preliminary evaluation

Contacting manufacturers and inviting them in to present their luminaires and data is very important. Wherever possible, it is also advisable to include the maintenance department in these meetings.

Generally the most successful LED street lighting conversion projects have been in cities that began dialogues with several manufacturers early in the process. They invited them to present their products and photometric analysis to determine:

- a. Compliance with the spec
- b. Visual product quality
- c. Apparent ease of installation and maintenance
- d. Experience, integrity, and solvency of manufacturer

The vast majority of LED cobra-head street lights installed in the U.S. are from these manufacturers:

- American Electric Lighting
- Beta/Cree
- Cooper Lighting
- General Electric
- Hadco Philips
- Holophane
- LED Roadway
- Leotek Electronics USA
- Lighting Sciences Group
- LSI
- Philips Roadway

In addition, it is recommended that local lighting representatives be encouraged to bring in any additional luminaires which comply with the preliminary specification. As with most solid state technologies, there are many new products constantly being introduced that offer new features. It is wise however to consider the stability and experience of the manufacturer when evaluating quality, service capability, and value of the warranty.

Step 8 – Test the preferred luminaires in a residential street application

Based on the results of the preliminary evaluation in Step 7, it is a good idea to identify between three and seven potential manufacturers who presented products that met the specification and offered mechanical or performance features that the city found desirable. These might include things like tool-less access to the electrical compartment, replaceable power door for future control system, appealing daytime form, or new higher efficiency LEDs.

A good location for a street light test is a low traffic residential location with existing 70W or 100W HPS cobra heads, consistent single-sided pole spacings and minimal trees.

After this area is identified invite the selected manufacturers to run the lighting calculations with their product's IES files for your test installation (1.0 light loss factor to facilitate verification) using the precise street width, pole locations and mounting height. The proposed products should meet your lighting design criteria such as RP-8 or your existing HID light levels for this application.

Many manufacturers have discount programs to sell a few street lights for these types of test installations. It is recommended that four luminaires from each manufacturer be purchased. These samples should be visually evaluated prior to installation. Particular attention should be given to packaging. If there is insufficient cartoning, luminaires may be damaged in shipments. However, excessive packaging will greatly slow down the installation as extra trips will be required to pick up additional luminaires and return carton material for recycling.

After inspecting the sample products replace four adjacent HID luminaires with the four purchased products and repeat for all of the manufacturers in the selected test location. If possible test for the actual power consumption (system watts) of each of the units prior to or during installation.

To test lighting performance use a light meter designed to read measurements to .01 fc to take measurements at grade below the luminaires, across the street from the luminaires, at the point between the luminaires, and the opposite side of the street from the midpoint of the luminaires. Compare these values with the manufacturer's calculations. This will allow you to confirm the manufacturers' calculations and evaluate the energy use and efficiency of each light. The most important metric of efficiency is the wattage required to provide the desired light levels. In other words, "footcandles on your street/per watt" is more important than "lumens per watt".

There is also a strong subjective element to street lighting and it is very wise to obtain input from everyone involved in the project. After the test units are installed invite feedback from city council, public works department, maintenance department or installing contractors, local citizens etc. on ease of installation, quality of illumination, light trespass, glare, and other issues that are deemed important.

Step 9 – Issue and award bid

Based on the results from the test installation select the products that are acceptable. Now writing the specification becomes very simple. You can use the original preliminary specification and simply add the selected manufacturers' names and part numbers. Generally speaking, the more products you allow the more favorable the pricing will be. Therefore you should certainly list at least two products and federal contracts may require at least three. It should be added in the bid documents that no other products will be considered since you have completed your evaluation.

If the decision in Step 5 was to purchase the luminaires directly using the city's own crews for installation the Request for Quote (RFQ) will be for luminaires only. If an outside contractor is being used there will need to be a separate RFQ for "installation labor only". Finally, if a contractor is being selected for a complete turnkey installation then a single RFQ can be issued for furnishing and installing the luminaires.

Notes:

- If there is a significant preference for one or more of the "acceptable" luminaires, it may be desirable to develop a "weighting point system" where price is only one of the factors in selecting the luminaire. Additional weight can be given to specific product features, application efficiency ("footcandles per watt on the test area"), manufacturer's experience, etc. This would allow the flexibility to purchase the luminaire with the preferred features if it is only slightly higher priced than the unit with the lowest bid.
- If your utility offers a "turnkey option", it is usually wise to get a competitive bid as their programs can be quite expensive.
- It is usually a good idea to include a reasonable delivery requirement in the RFQ as well (eg. "Luminaires shall be delivered to the City Maintenance Yard within 60 business days of project award"). During the preliminary product evaluation phase, you can simply ask the suppliers what their typical delivery would be on the quantity on the RFQ. Similarly you can informally survey local contractors to determine what kind of a schedule they would normally require for this type of project.

Based on how you structured your awards (material only point system, furnish and install, etc.), you should issue the award after you have completed the evaluation of the bids per your normal award process.

Step 10 – Implement project

If the city's own crews are doing the installation this will obviously require more oversight than if an outside contractor is used. Some cities have used a combination of their own personnel and an outside contractor to install the luminaires. Based on cost and project schedule this can add significant flexibility to the project.

Networking with other cities who have had similar projects can provide a good basis for evaluating the number of installs per day that should be achieved. In addition, they can be an excellent source for suggestions on creating the most efficient crews, staging material, etc.

Post award communication with the luminaire manufacturer is also a key element for success. It is highly recommended to have a meeting with the manufacturer (or their representative) and the contractor (if applicable) immediately after the award. An additional luminaire sample should be provided at that meeting representing the exact model that will be furnished on the job. This should include any special wiring configurations, paint finish, labeling, accessories, carton, etc. This will avoid any misunderstanding of exactly what is being ordered and delivered.

Delivery should also be discussed. A realistic schedule should be developed that will allow the manufacturer to deliver the products consistent with the city's ability to have them installed. Often on large projects, storage is a critical issue. If the project becomes delayed due to weather or other unforeseen circumstances and the city does not have the facilities to store the luminaires, contingency arrangements should be made.

Step 11 – Develop long term maintenance program

Unlike traditional HID lamps, LEDs don't typically fail by "burning out" after some period of time. Rather, over long periods of time LEDs will gradually simply become dimmer. However, the better LEDs used in street lights on the market today may still be producing over 80% of their initial light after 100,000 hours (25 years in typical applications) in the field.

Although it is impossible to predict the lighting technology in 15-20 years, certainly the LEDs on the market today will no longer be available. We can further reasonably assume if the lights need to be replaced, the light source products on the market in 15+ years will be considerably more efficient, physically different, and not mechanically compatible with current luminaires. Consequently it really doesn't make any sense to plan for "changing light bulbs" as you would for HID lamps. Therefore, there is really no practical advantage to specifying "replaceable LEDs" or "modular light engines", etc. At some point it will simply make economic sense to replace the luminaires with the latest technology product available.

Given the very long life of LEDs, there is a paradigm shift on how we consider designing a long term maintenance program. There are two major issues worth considering – 1) Spot replacement of components and 2) Luminaire cleaning.

Spot Replacement of Components

Unlike HID systems where there are failures of lamps, igniters, ballasts, and photocontrols; with LED systems only power supplies (drivers) and photocontrols are normally subject to replacement. Today's power supplies are typically rated for 100,000 hour life and the expectation is that replacements will be very rare – probably less than 1% over the 100,000 hour life of the system.

Because of the projected long life of these systems it may not be practical to stock replacement "power supplies" or "power doors". Because the entire luminaire is typically covered by the manufacturer's warranty for the first 5 years, it will probably just make sense to replace the complete unit in the event of an occasional failure. Also, this will allow the greatest flexibility when different manufacturers or different product generations are used in the city.

There are also now "long life photocells" on the market designed to last up to twenty years. While these have a considerable price premium over conventional photocontrols, it may be a worthwhile investment if they don't have to be replaced as frequently.

Luminaire Cleaning

Like all luminaires LED street lights are subject to dirt depreciation that will reduce light output over time. Unfortunately, because LED street lighting is still relatively new there is no extensive field data that would prescribe a precise cleaning program for various environments. Much less heat is generated on the lenses by LEDs than HID lamps so less dust will normally adhere and fuse to the lens than has been historically experienced in outdoor luminaires. For this reason we would expect to see considerably lower Luminaire Dirt Deprecation (LDD) on LED luminaires.

Given the lack of data regarding the necessity for cleaning luminaires a reasonable program such as the following would seem to make sense:

- A. As soon as luminaires are installed check the light levels directly below the luminaires at grade at several pole locations. For accuracy, it is advisable to use a light meter designed to read measurements to .01 fc. Log this data.
- B. On an annual basis recheck the light levels at the exact locations and compare the data.
 - Try to test at the same time of year to avoid any temperature caused discrepancy.
 - LEDs will often initially increase their light output before they begin their depreciation so it is not uncommon to have readings after one year be higher than when first installed.
- C. After a few years when the light levels have dropped by more than 10% try a high pressure wash on the lens from the ground and then recheck the light levels. If there is no significant improvement it may be necessary to visit the luminaires and wash the lenses with a wet cloth.
- D. Continue to check the light levels periodically and ultimately design a luminaire cleaning program based on the frequency required to maintain the desired illumination levels.

Resources

- Municipal Solid State Street Lighting Consortium -
<http://www1.eere.energy.gov/buildings/ssl/consortium.html>
- Illuminating Engineering Society
RP-8 – Guide to Roadway Lighting is available for ordering
<http://www.ies.org/>
- DesignLights Consortium
<http://www.designlights.org/>
- LED Lighting Facts – A Program of the United States Department of Energy
<http://www.lightingfacts.com/>
- Leotek Electronics USA –
This LED Street Lighting Guide is available on line without charge.
<http://leotek.com/>

Partial List of LED Street Lighting Installations

Municipalities

- Algona, IA
- Bakersfield, CA
- Bell, CA
- Boston, MA
- Brooklyn Park, MN
- Chula Vista, CA
- Colton, CA
- Davis, CA
- Fremont, CA
- Galt, CA
- Gering, NE
- Greenville, NC
- Hayward, CA
- Hollister, CA
- Holyoke, MA
- Hoover, AL
- Huntington Beach, CA
- Iowa City, IA
- Kinston, NC
- Lima, OH
- Lompoc, CA
- Longview, WA
- Los Angeles, CA
- Madison, WI
- Marysville, WA
- Middleboro, KY
- Milpitas, CA
- Modesto, CA
- Monaca, PA
- Nether Providence Township, PA
- New Haven, CT
- New Orleans, LA
- Novato, CA
- Oakley, CA
- Olympia, WA
- Ontario, CA
- Oroville, CA
- Palo Alto, CA
- Phoenixville, PA
- Pittsburgh, PA
- Pocahontas, IA
- Reading, PA
- Redding, CA
- Redmond, WA
- Redondo Beach, CA
- Rocklin, CA
- San Jose, CA
- Santa Ana, CA
- San Ramon, CA
- Sausalito, CA
- Seattle, WA
- Spencer, IA
- Springfield, OR
- Tulare, CA
- Tuscaloosa, AL
- Upper Marion Township, PA
- Vallejo, CA
- Ventura, CA
- Watsonville, CA
- Wauwatosa, WI
- Weimer, TX
- West Fargo, ND
- West Lake Village, CA
- West Palm Beach, FL
- Wrangell, AK

Utilities

- Clark County PUD, WA
- Iowa Association of Municipal Utilities (IAMU), IA
- Lincoln Electric, NE
- Los Angeles – Dept. of Water and Power, CA
- Pacific Gas and Electric, CA
- Progress Energy, NC
- Puget Sound Energy, WA
- Snohomish County PUD, WA

Transportation Departments

- California Department of Transportation (Cal Trans)
- Seattle Department of Transportation, WA
- Tuscaloosa Department of Transportation, AL
- Washington Department of Transportation



An American Success Story

Focusing 100% on LED technology, Leotek Electronics was founded in 1992 in the heart of Silicon Valley, California. Leotek was instrumental in revolutionizing the traffic signal business and saving cities millions of dollars in energy and maintenance costs while reducing the green house gases required for powering incandescent traffic signals. Today Leotek is a leading supplier of traffic signals in North America having shipped over 4 million units in the last decade.

Recognizing the benefits of LEDs over HID sources, in 2006 Leotek introduced their first LED street light. Through product innovation and superior service, today Leotek is now also a leading supplier of LED street lights in the United States.

In 2007, Leotek was acquired by the Lite-On Corporation. This \$6 billion electronics company provides financial stability and the customer assurance that Leotek will be around for generations to honor any warranty claims and continue innovating exceptional LED products.



Leotek Electronics USA Corp. | San Jose, CA

GREEN Cobra™



- Clean Daytime Form with Proven Market Acceptance
- "Full Cutoff" Optics with the Performance of a Drop Lens
- Tool-less Access to Electrical Compartment
- Over 100,000 Units Now Installed Throughout the USA

ECobra-head™



- Leotek's Newest LED Roadway Luminaire
- Utilizing State-of-the-Art LED Technology
- Replaces up to 1000W HID
- Reduces Energy Consumption by Over 50%
- Surprisingly Affordable



**EXERPT FROM APPROVED MINUTES OF SEPTEMBER 15, 2015 CITY COUNCIL
MEETING**

(Attachment #4)

Attachment 4

1. Approval of Change out of PG&E Owned Street Lights to LED by PG&E
(Superintendent of Public Works)

Superintendent of Public Works Emig presented the staff report recommending the City Council Approve the Change out of PG&E Owned Street Lights to LED by PG&E.

Councilmember Glass questioned if staff found out if there is only one kind of replacement bulb that is available or are there different bulbs with different levels of intensity. She stated she does not want bright bulbs.

Superintendent Emig commented that he can obtain information on the brightness and will look into this with PG&E.

Councilmember Eder questioned if there is a time or date sensitive application or process.

Superintendent Emig stated that PG&E would like to know by the end of this calendar year. He stated if not, this will probably not happen until a couple years from now.

Councilmember Eder stated it is his impression that there are still a lot of things that we do not know about this and he his thinking that a technical presentation in a language that can be understood by lay people be done by PG&E. He stated that this would go a long way for everyone's benefit. He stated that this is a very complex issue and cannot be easily decision and that the PG&E governmental representative should arrange a presentation.

Superintendent Emig stated PG&E has indicated they could do that and staff could return this to the City Council.

Councilmember Eder stated he does not want to delay this issue, but that it is a complex issue. He stated he does not want to move forward without knowing what the City Council is moving forward on.

Mayor Slayter commented as follows:

- Stated the LEDs come in different temperatures and read the readings
- Discussed the quality or color of the light emitted
- Discussed the lower number 2700K LED is a warmer light and closing replicates incandescent
- Stated HPS lights that are currently all over town have a very poor color rendering
- Stated on a scale of 1-80, the HPS is in the range of 20-30 and the LEDs are on the 70 scale
- Discussed the savings and stated the numbers of savings of 68 percent are optimistic
- Stated he is not familiar with HPS light costs but stated the range of savings for LEDs is within the range of reality

Mayor Slayter opened for public comments.

Jack Fisher commented as follows:

- Discussed being a graphic designer
- Discussed how light can change images
- Stated there are issues that need consideration before the decision to change the whole night scape of town can be made
- Stated the issue is worthy of real consideration
- Stated he is living one block from lights and is a victim of light pollution
- Discussed cherishing a place where people can experience the night sky
- Stated these are important valuable moments
- Stated night is night and day is day
- Stated to turn night into day to save some money for PG&E is something that needs to be considered
- Discussed aesthetic changes
- Stated the decision should not be taken lightly or made solely on how many pennies this could save PG&E
- Everyone in town will be living with these lights
- Stated part of the process is to see where another town has already done this and see what that actually looks like

Sandi Maurer commented as follows:

- Thanked the Council for removing this item from the consent calendar
- Thanked staff for their research and looking at emails and attachments
- Stated she stands for preserving for warm light ambiance
- Street lights are a form of light pollution from night sky
- Heard LEDs are awful
- Concern of ruining the City's evening ambiance
- Took photo of street light and took photo of LED Street light and stated the LED is very white
- Eliminate any health risk from flicker
- Serious issue
- June 2015 - Department of Energy Report backs up the concern of eye flickering
- Read excerpts from the report
- Lights are very likely to be increasing use of radio frequencies
- Do not know all details of how work
- Adding to dirty electricity on grid
- Do not trust PG&E to give honest believable answers
- Cautious of trusting PG&E

Donna Fisher stated she suffered from childhood epilepsy brought on by light flickering and stated it is real and scary.

A member of the audience commented as follows:

- Thanked staff for their research
- Read excerpts from reports on LEDs
- Discussed spending \$350,000 to replace LED lights amid neighborhood complaints

- Stated these lights are not pleasant
- Discussed melatonin
- Stated this is a big issue
- Appreciate the Council taking this off the consent calendar to be discussed

Mayor Slayter stated there has been a suggestion to table this item until the Council can receive a presentation.

Councilmember Eder commented as follows:

- Easier to decide if categorize okay and not okay or good or bad
- LED Street light – lack of real knowledge of
- Stated he is a big proponent of energy efficiency and LEDs
- Support their installation if there are ways we can mitigate some of the known or perceived health risks posed by them
- Issue with flicker - are there ways to potentially mitigate with drivers
- Suggested asking PG&E the quality of drivers to stop or reduce the flicker
- Discussed the blue rich and yellow rich LED bulbs
- Stated the yellow bulb tends to be warmer and less likely to create health affects
- Stated San Francisco, Berkeley and Oakland are installing yellow LED bulbs currently
- Stated that 40 cities are converting street lights to LEDs
- Stated this is not doing something radical or weird
- Stated he recognizes there could be health affects
- Read staggering statistic that if a small percent of households would adapt to LED bulbs, hundreds of coal powered plants would be shuttered
- Discussed offsetting health to reduction of plants
- Stated the Country has to reduce their appetite and consumption of energy
- Fist hand knowledge in emergency vehicles of LEDs
- Driving force here is not to save a few pennies but to reduce energy consumption
- Bigger picture item
- Question whether dimmers are used on street lights
- Unclear if part of the circuitry

Councilmember Eder stated the street lights to not use dimmers.

Councilmember Eder questioned if all City owned street lights will remain in the current configuration.

Superintendent Emig stated that the City will need to convert our own at some point.

City Manager McLaughlin stated that PG&E has spearheaded a program to assist cities with replacing its own street lights to LED and stated this is a loan situation but that staff has not looked into that at this time.

Councilmember Eder commented as follows:

- Stated this is a technically acceptable solution and the City could have uniform lighting system in town

- Discussed the bright lights in front of Whole Foods and stated there is a dramatic difference between the lights in the Plaza and Whole Foods
- Discussed shielded and unshielded LED lights
- Discussed staring at the bulb to see if he can see it flicker
- Stated that LED lights can be focused in pattern

Superintendent Emig commented as follows:

- Cobra head shine down where decorative are more globe shape and the light does in all directing
- Other places where the City has LEDs are the crosswalks that are enhanced with safety lights
- Street light on each side uses shields based on resident's requests

Councilmember Eder commented as follows:

- Discussed benefits and controversy
- Stated he looks forward to getting more information to make a more informed decision

Councilmember Glass commented as follows:

- Voiced concern with health effects of lighting
- Concerned of health effects of climate change
- Stated sometimes the solution finds some unintended consequences
- Stated she is also looking forward to receiving more information
- Stated she is not entirely convinced that just having a presentation from an organization that has a vested interest in putting through that technology in place is necessarily the best place to get information
- Suggested trying to find additional information from someone who can focus on the health effects of lighting
- Stated we need to look at both things
- Stated this is not about money but is about energy
- Stated we are seeking energy independent
- Stated she is looking forward to hearing more information

Councilmember Jacob discussed the comments of PG&E's interest if change to LED and stated the City will use less power and PG&E will lose money.

Mayor Slayter stated that the electricity for the lights runs through Sonoma Clean Power.

Councilmember Jacob commented that he does not understand PG&Es interests.

Councilmember Glass stated they are mandated by CPUC.

Councilmember Jacob commented as follows:

- Discussed the average energy bill of \$79822
- Stated if the City implements LEDs, it will save the City 68% which is \$54,278 a year
- Stated that would fund the Community Benefit Grant program
- Stated he is a Wi-Fi and LED person and has two Wi-Fi routers and a LED desk lamp that has four different colors with 5 different intensities

Agenda Item Number: _____

- Stated he understands the concern of health affects in a way that he is not affected
- Logical choice is to put out to two to three period
- Take time to understand how LEDs are good
- Discussed the Brooklyn neighborhood who rose up against LED lights and pushed back
- Stated that is an inner City urban lifestyle not liking the brightness
- Worry of light leaking to the Laguna
- Need to reduce GHG
- Waiting for this topic to come forward but now looking at it in a different perspective
- PG&E will finance the \$100,000 it will take to replace the LEDs
- Stated more citizens are affected by the blue green lights as you enter the City than will be affected by the health effects
- Stated this is a small town and high tech blue light that does not go together
- Push decision off
- Need to look at cooler light colors
- Need to be appropriately educated by PG&E and an outside vendor
- Deflect lights
- Dimmers on all or add when appropriate
- Stated PG&E probably used the cheapest and most generic LED fixture
- Need to see specifications and options
- No surprise Sebastopol going to question street lights and LED lights
- Wait until time to schedule a presentation to the City Council
- Postpone decision until time find right LED unit that fits town and needs

Mayor Slayter commented as follows:

- See need for greater education on this item
- Need to invite PG&E to come and make a presentation
- Suggest industry folks from lighting world to also make a presentation
- Discuss at agenda setting meeting
- Opportunities to change to LED have been clearly listed
- Less energy use is better
- Can more highly focus these type soft lights and reduce light pollution
- Use low output LEDs – different wattages
- Dial in color
- Not comfortable telling PG&E okay and approved if the City does not know what getting
- More information is needed

City Council Action: Postponed this item until such time that a presentation can be made to the City Council by PG&E and other approved organization.

Minute Order Number: 2015-131

City Council

Mayor Patrick Slayter
Vice Mayor Sarah Glade Gurney
John Eder
Una Glass
Robert Jacob



City Manager

Larry McLaughlin
lwmcLaughlin@juno.com

City Clerk

Mary Gourley
mgourley@cityofsebastopol.org

City of Sebastopol

APPROVED

CITY OF SEBASTOPOL CITY COUNCIL REGULAR MEETING MINUTES

Meeting of September 15, 2015

As Approved by the City Council at their meeting of October 6, 2015

6:00 pm - Convene Regular City Council Meeting, Sebastopol Youth Annex/Teen Center, 425 Morris Street, Sebastopol, CA

The public is advised that pursuant to Government Code Section 54957.5 all writings submitted to the City Council are public records and will be made available for review.

Please note that minutes are not verbatim minutes and are meant to be the City's record of a summary of actions that took place at the meeting.

Notice: All Resolutions and Ordinances introduced and/or adopted under this agenda are waived of all reading of entire resolution(s) and ordinance(s).

The Sebastopol City Council welcomes you to its meetings that are generally scheduled for the 1st and 3rd Tuesday of every month. Your interest and participation are encouraged and appreciated.

A notice of the meeting was posted by the City Clerk on September 10, 2015.

6:00 pm CONVENE REGULAR CITY COUNCIL MEETING, Sebastopol Youth Annex, 425 Morris Street, Sebastopol, CA

CALL TO ORDER: Mayor Slayter called the meeting to order at 6:02 p.m.

Mayor Slayter announced the next City Council meeting will be at Analy High School Library as part of the City Council's continuing effort of outreach and engagement to the community.

ROLL CALL

Present: Mayor Slayter
Councilmember Eder
Councilmember Glass
Councilmember Jacob

Absent: Vice Mayor Gurney

Staff: City Manager-City Attorney Larry McLaughlin

City Clerk Mary Gourley
Planning Director Kenyon Webster
Superintendent of Public Works Richard Emig
Engineering Manager Henry Mikus
Captain James Conner

SALUTE TO THE FLAG: Mayor Slayter led the salute to the flag.

Mayor Slayter read a prepared statement.

“I was in a conversation recently with a friend and was asked the standard question of, “how are things going?” It’s easy to reply with an equally standard answer of “everything’s fine”, but that wasn’t how I felt and decided to answer honestly. I said that I was feeling uneasy and unsettled. The horrible news from Lake County and the number of people displaced from their homes and jobs, dislodged from the everyday activities of life with families, friends and pets causes me to consider how equal we all are in the face of such tragedy. Thousands of people are suddenly homeless, some perhaps permanently, all will face tremendous hardship in restarting their lives and reestablishing a sense of normalcy. Many residents will return home to the joy of seeing their homes still standing but many will suffer the abject sorrow at what has been lost. Our regional community has been permanently altered by this summer’s fires in Lake County and as members of that community we must do whatever we can to help put people’s lives back together; consider opening your home to a friend of a friend for a week or two; volunteer at a temporary shelter, spend a day shuttling animals to regional facilities who have opened their doors and overflowing kennels to the many lost and bewildered pets; but the easiest way to help is to simply donate money to the relief efforts and the most reliable way to ensure donations will go directly to those in need is to visit Redwood Credit Union, who in conjunction with state senator Mike McGuire, has established a relief fund. 100% of all donations will go directly to aid victims.

Locally, there will be a Wildfire Relief Benefit hosted by the Farmer’s Build and the Sebastopol Grange this Thursday from 6 – 9 at the Sebastopol Grange located on Highway 12. There will be a benefit dinner, auction and food drive to support victims of the Valley Fire in Lake County, CA. Donations will be accepted at the door on a sliding scale and folks are encouraged to give whatever they can. In the spirit of community, this is a potluck dinner and contributions of food for the evening’s meal are also being sought.

Another local organization has also stepped up to offer assistance; Levi’s GranFondo has moved to support fire victims. Starting immediately they’re expanding charitable giving to include disaster relief efforts for victims of the Valley Fire. Between today and the morning of the GranFondo, 80% of the money raised is going towards housing, food, clothing, and other immediate needs of the people and animals whose homes were taken from them in a literal flash, the balance will continue to support their usual nonprofit organizations. This will continue through the auspices of the Lake County Rotary Clubs, who are coordinating area relief at the grassroots level and passing 100% of donation to those who need it. Also, if any registered riders have lost any of their already-shipped riding gear for the 2015 GranFondo in the fire, it will be replaced at no cost, all one has to do is ask.”

PROCLAMATIONS/PRESENTATIONS: There were none.

APPROVAL OF MINUTES OF: September 1, 2015

Councilmember Glass moved and Councilmember Jacob seconded the motion to approve the City Council Meeting Minutes of September 1, 2015 as submitted:

VOTE:

Ayes: Councilmembers Glass, Jacob, and Mayor Slayter
 Noes: None
 Absent: Vice Mayor Gurney
 Abstain: Councilmember Eder

PUBLIC COMMENTS: (This is an opportunity for the public to address the City Council on items that are not listed on the agenda. This time is set aside to receive comments from the public regarding matters of general interest not on the agenda, but related to City Council business. Pursuant to the Brown Act, however, the City Council cannot consider any issues or take action on any requests during this comment period. Speakers are allowed to speak for a maximum of three minutes so that all speakers have an opportunity to address the City Council. The Mayor has the authority to limit the time allowed for speakers dependent on the amount of speakers in attendance. It is the goal of the Council to conclude the public comments portion of the agenda within 30 minutes. If the public comment period exceeds twenty minutes, the presiding officer, typically the Mayor, reserves the right to reduce the time per speaker or carry over public comments to after all business items are completed. *There were none.*

STATEMENTS OF CONFLICTS OF INTEREST BY MAYOR/CITY COUNCILMEMBERS FOR ITEMS ON THE AGENDA (This is the time for the Mayor or City Councilmembers to indicate any statements of conflicts of interests for any item listed on this agenda) *There were none.*

Consent calendar items are routine matters or matters which have been reviewed by the City Council previously. These items may be approved by one motion without discussion unless a member of the City Council requests that the item be taken off the consent calendar. Items removed from the consent calendar will be taken up upon completion of action on the remainder of the items on the consent calendar.

CONSENT CALENDAR:

Councilmember Jacob requested Item Number(s) 1 and 4 be pulled from the consent calendar.

Councilmember Jacob moved and Councilmember Glass seconded the motion to approve Consent Calendar Item(s) 2, 3, and 5 as listed below.

VOTE:

Ayes: Councilmembers Eder, Glass, Jacob, and Mayor Slayter
 Noes: None
 Absent: Vice Mayor Gurney
 Abstain: None

1. ~~Approval of Change out of PG&E Owned Street Lights to LED by PG&E (Superintendent of Public Works)~~
2. Approval of Second Reading and Adoption of Ordinance 1078 Amending Sebastopol Municipal Code Chapter 13.08, Regulations for Sewer Service (Superintendent of Public Works)

City Council Action: Approved for Second Reading and Adoption of Ordinance 1078 Amending Sebastopol Municipal Code Chapter 13.08, Regulations for Sewer Service

Minute Order Number: 2015-132

3. Approval of Resolution authorizing River Parkways grant application for Laguna Preserve Restoration and Improvement Project (Planning Director)

City Council Action: Approved Resolution authorizing River Parkways grant application for Laguna Preserve Restoration and Improvement Project

Resolution Number: 6058

4. ~~Approval of Second Reading and Adoption of Ordinance 1079 regulating the establishment of 'formula' business uses in Sebastopol. The ordinance would create restrictions and~~

~~procedural requirements regarding specified "formula" businesses—generally retail stores or restaurants, sometimes franchises, which have standardized décor, services, uniforms, etc., which make them substantially identical to other businesses elsewhere in the United States. The purpose of this ordinance is to protect the unique character of Sebastopol, maintain diversity in its businesses, and ensure that the city's businesses serve the needs of the community. The proposed ordinance would prohibit some types of new formula businesses in the downtown area, and require Use Permits in certain circumstances for new formula businesses in the downtown and other areas of the City. (Planning Director)~~

5. Approval of General Plan Joint Planning Commission and City Council Meeting Dates and Times (Planning Director)

City Council Action: Approved General Plan Joint Planning Commission and City Council Meeting Dates and Times

Minute Order Number: 2015-134

INFORMATIONAL ITEMS/PRESENTATION:

6. Complete Streets Advisory Committee Informational Update to the City Council of Activities Conducted to Date since November 2014 (Planning Director/Complete Streets Chair David Ore)

Chair David Ore commented as follows:

- Discussed the committee wanting more interaction with the City Council
- Discussed receiving no information on the request for funding for a feasibility study or outcome of the grant request
- Stated the committee wanted to know why \$200,000 was approved for the striping of Highway 116 and not \$100,000 as was asked for
- Stated the Council at that time did not know what was approved (\$200,000) and stated the Council also thought it was \$100,000
- Stated the committee had a hard time to get \$10,000 for a feasibility study
- Stated the bike and pedestrian plan falls into the Complete Streets Committee purview
- Stated the Council knows how the committee was formed and what their duties are
- Would like support of City Council
- Stated the committee may need to step up more
- Stated they would like direction as to what they are supposed to be doing
- Stated they would like to get feedback from the City Council

Councilmember Jacob commented as follows:

- Apologized for any confusion
- Stated there is a confusion on the Council as the Council believed that Lynn Deedler was in charge of communicating for the Complete Streets Advisory Committee
- Stated the Council believed Mr. Deedler was the appointed person to provide that education and information between the committee and Council
- Stated he would like feedback on how to solve the confusion of the roles
- Stated it is important to include the committee throughout the process
- Discussed stop gaps
- Stated many of the questions and concerns raised tonight could be answered
- Discussed the grant funding

- Discussed the comments of “we” and questioned Mr. Ore if he was talking for the committee or as an individual
- Questioned if the committee was provided talking points or a summary of these issues and if they have the same feeling
- Stated he is not sure that this information that is being conveyed to the Council is being conveyed for the entire advisory committee and that these are the things the advisory committee wanted to tell the Council

Mr. Ore commented as follows:

- Stated that the committee reviewed the report last week and stated there were a couple of issues and talking points of the committee that they wanted presented to the City Council
- Stated he fully understands the confusion of the Council believing Lynn Deedler was somehow representative of a group that was involved in the external trails
- Stated Lynn did a lot of the preliminary work and most or all of the contact with the various citizens
- Stated Lynn was instrumental to getting people on board and stated he was the driver behind that
- Stated a big problem is that people had the misconception that the trails that Lynn had come up with were somehow carved in stone
- Stated that is why the committee asked for a feasibility study and the \$10,000 last year
- Stated that \$10,000 was put into the budget but now is going to be used for community forums and outreach to see if there is interest in these trails
- Stated it seems clear that the work Lynn did and his trails group did were overshadowed by the huge group of people from a small section of a public street who made the inference the City could not put a bike lane on that street
- Stated he was not sure what their problem was or how they felt that they had that kind of control
- Stated that once it came to the Council, the committee felt that it was unfairly represented
- Voiced concern with one small interest group being able to put the whole thing off the table
- Discussed the \$100,000 funding for the grant and stated only \$100,000 was requested
- Stated that when that piece of legislation or act was signed, it was said by the Council that the funding was to be \$100,000 yet the document stated \$200,000
- Stated this item went through without any information or questions of staff
- Questioned how this extra money got co-opted by something that we do not need the money for
- Stated there are other projects that would directly affect senior citizens, school children and other local citizens that would be more beneficial
- Stated there are more beneficial projects than the Highway 116 striping project

Mayor Slayter commented as follows:

- Discussed the Highway 116 striping project
- Stated this project pre-dates the Complete Streets Advisory Committee
- Stated this has been a long term project of the City that is coming to fruition
- Stated that this pre-dates the committee and is an indication that this is something that the Council voted for many years ago

- Stated this is not the forum for this back and forth conversation and suggested staff figure out how the Council can work with the committee and vice versa
- Stated this is one of the newest City Council advisory committees formed and that they are still finding their way and the Council is finding their way with them
- Asked Captain Conner about the pedestrian crossing comments and the informal study of the number of cars not stopping for pedestrians or bikes and questioned law enforcement of this area

Captain Conner commented as follows:

- Discussed general traffic enforcement and direct enforcement in and around the downtown area during commute hours
- Stated this is law enforcement's primary responsibility during those times
- Stated presence is primary enforcement
- Surprised to hear the report that more than half of vehicles did not stop for pedestrians
- Discussed if this included people waiting on the sidewalks versus when they actually step off the sidewalk or corner
- Stated they can look at specific data if requested

Councilmember Glass commented as follows:

- Discussed the public outreach funding designated in the budget
- Discussed Eleanor Avenue comments
- Stated the meeting also had Burbank Housing residents who were also upset about the trails
- Purpose was because we are a small town where a lot of issues get blown into big problems
- If starting out that way not a good way to move public process forward
- Ideas of multi-use trails may move forward but part of the problem is that there were people on the committee and involved in moving these trails forward that were well intentioned but met resistance
- Stated the community forum is a more prudent thing to do
- Go to neighbors and educate about options and ideas and get feedback and build more consensus
- Be proactive
- Get feasibility of project
- Get what looking for into the plan
- To do when upset is when we end up in these situations
- Better idea if try to engage public in having a calm discussion about what the possibilities are and what options really mean and then move forward

Mr. Ore commented as follows:

- Stated he concurred with the comments
- Stated there is some confusion because of Mr. Deedler's extreme enthusiasm about the trails and was part of the outrage of the Eleanor Avenue and Burbank residents
- Stated the problem was a lot of mis-information
- Important to get community feedback
- Important if there is a consensus by the people of Sebastopol who live in Sebastopol for additional Class 1 trails, that there needs to be money for a feasibility study
- Stated this is going backwards to find out what we can do

- Discussed the same problem of group with the trails idea
- Misinformation out there
- What was real and what was someone's dream
- Discussed the \$100,000 confusion of funding

Councilmember Eder questioned if it is accurate to say the creation of multi-use trails study areas and their inclusion and adoption into the bike and pedestrian master plan is the consensus of the Complete Streets Advisory Committee.

Mr. Ore stated that is correct.

Councilmember Eder questioned if it was accurate to say that the use of the \$10,000 that was allocated by the City Council to be used for community forums to determine priority bike and pedestrian desires and ideas in town, in general, usurps the original intent of that funding as proposed by the Complete Streets Advisory Committee.

Mr. Ore stated that is correct.

Councilmember Eder questioned when the City Council determined that they would enact a process to engage the community on prioritization of pedestrian and bike facilities or projects in Sebastopol, did the committee feel that they were by-passed and left out of that process.

Mr. Ore stated it is hard to say but that was the general consensus of the committee meeting last week. He stated that the committee is in favor of the Highway 116 striping and the committee is committed to help the people who live in and go to school in Sebastopol to get around without a car and feel safe about it. He stated it is a very eclectic group and that it is important that it stay that way. He stated the committee wishes to be asked to do more.

Councilmember Eder thanked Mr. Ore and the group for their efforts.

Mayor Slayter opened for public comment. There was none.

Mayor Slayter thanked Mr. Ore for the report.

City Council Action: None Required. Informational only.

Reference Order Number: 2015-135

PUBLIC HEARING: NONE

REGULAR CALENDAR AGENDA ITEMS (DISCUSSION AND/OR ACTION):

7. Discussion and Action of Request from Russian River Watershed Association Chairman, Mark Landman, and Andy Rodgers, Executive Director, for a Presentation for Stewardship Ordinance for Unused Medication and Request for Letter of Support (Mayor Slayter)

Andy Rodgers and Chair Mark Landman presented information on the Stewardship Ordinance for Unused Medication and requested a letter of support for the concept.

Councilmember Eder commented as follows:

- Thanked the presenters for this information

- Questioned if in their opinion, if this moves forward, would the County be using a model like Alameda that has already been vetted through the legal process

Mr. Landman commented as follows:

- Stated the intent would be not to reinvent the wheel
- Stated that Alameda has a good ordinance
- Stated there are differences to assess and consider
- Stated there is a good sense of the general outline of how this would work
- Stated Alameda's would probably be similar to what might be seen here

Mayor Slayter commented as follows:

- Discussed the numbers presented from Councilmember Eder on RRWA when he reports back from attendance at these meetings
- Stated it is a staggering amount of medication
- Questioned if it is known or can it be known how many foreign compounds are finding their way into our water ways
- Questioned if millions of things are getting in there that do not belong

Mr. Landman commented as follows:

- Discussed infrastructure and contaminants
- Discussed municipal systems
- Stated it would be hard to guess the number of compounds
- Discussed concern with those levels of compounds working together that creates other compounds
- Stated the answer could be years in the making
- Stated it will take a strong heart and firm wallet
- Discussed tonight's agenda item as low hanging fruit
- Stated this will get a small portion of the compounds off the table
- Discussed re-use of treated wastewater – be beneficial to actually ensure it meets standards
- Small start but a good start

Mayor Slayter discussed the ten tons of medication collected, and questioned once collected, where do the compounds go and how are they disposed of.

Mr. Landman stated that they are disposed of by incineration which is the safest, most effective and environmentally least damaging method.

Mayor Slayter questioned if any of the existing regulations have any kind of protection for the public as far as the drug companies to not increase costs to the public.

Mr. Landman stated he shares those concerns and stated there are protections build it. He discussed point of sale (cannot add in an additional price for this) and when the item is brought back, cannot be charged for it either. He stated this will leverage the power of multi-billion dollars to have a more effective tool to get these compounds out of the environment.

Mayor Slayter questioned if the proposal would be for the existing disposal methods to stay in place and that this is not asking for companies to take over and clean up on back end and that they will not be running the clean-up.

- Mr. Landman commented as follows
Stated that they will be running the clean up
- Stated there will need to be a list of goals, targets and requirements as well as oversight
- Discussed the flexibility to pay for implementation, secure collection, and proper disposal by incineration
- Discussed incentives to pharmacies
- Discussed requiring prepaid envelopes with prescriptions
- Try to give leash but require good end results

Mayor Slayter opened for public comments. There were none.

Councilmember Eder commented as follows:

- Stated before he become a Councilmember and now a representative on the Russian River Watershed Association, he did not think of where all the drugs in the world go
- Stated it has been an eye-opening education
- Wanted to reiterate that all the drugs that wind up in our waste water system generally speaking, it is his understanding that the plant does not have the technology to remove them from the water at the treatment plant on Llano Road
- Stated those compounds in combination create new compounds
- Big supporter of this idea
- Anything we can do to maximize removal and disposal of these compounds out of this environment is for everyone's benefit
- Discussed pharmaceutical industry being responsible only makes logical sense to take out of hands and finance of local government

Councilmember Jacob commented as follows:

- Grateful that the City is a member of the Russian River Watershed Association
- Thanked the RRWSA for dealing with the issues they deal with
- Stated the City does not have the staff to deal with these issues
- Stated joining the cooperative and regional effort and the work that is being done in investing the in the County has a whole is admirable
- Thanked Mr. Rodgers and Mr. Landman for the report

Councilmember Jacob moved and Councilmember Glass seconded the motion to approve the letter of support as requested.

VOTE:

Ayes: Councilmembers Eder, Glass, Jacob, and Mayor Slayter

Noes: None

Absent: Vice Mayor Gurney

Abstain: None

City Council Action: Approved Request from Russian River Watershed Association Chairman, Mark Landman, and Andy Rodgers, Executive Director, for a Presentation for Stewardship Ordinance for Unused Medication and Request for Letter of Support
Reference Order Number: 2015-136

8. Discussion and Action of Request from Discussion of City Council Position on Resolution(s) for the League of California Cities Conference to be held September 30 – October 2, 2015 for Voting by Designated Representative(s) (City Manager/City Clerk)

City Manager McLaughlin presented the report recommending the City Council discuss and act on the City Council Position on Resolution(s) for the League of California Cities Conference to be held September 30 – October 2, 2015 for Voting by Designated Representative(s).
Mayor Slayter opened for public comments.

The Council discussed the resolutions as follows:

#1. League By Law Amendment
Council in support of Resolution

#2. Overconcentration of Alcohol and Drug Treatment Facilities
Councilmember Jacob commented as follows:

- Stated he does not support this resolution
- Discussed oppression in disenfranchise communities
- Discussed concern for people for people recovering from alcohol or drug abuse not being afforded the opportunity to settle into a community there they choose
- Discussed this as classist, break down in our society and is no different than our prison system
- Does not believe in separatism
- We should not be making the decision that certain people are not good enough to live in a certain concentration in the community

Councilmember Glass commented as follows:

- Stated she is not sure if this is classist
- Questioned if there are concentrations generally occurring in low income communities
- Discussed if communities are putting these kinds of facilities in low income communities where there is not much NIMBY response
- Questioned if this is problem lower income communities are having

Mayor Slayter stated he is not sure the legislation discusses the distribution of these types of facilities.

Councilmember Glass questioned where does the problem exist and stated it may be the opposite of classist.

Councilmember Jacob thought the idea is that you cannot have too many drug addicts living too close together and voiced concern with idea of let's not put disenfranchised people in poor communities.

Councilmember Eder commented as follows:

- Stated this is confusing
- Concurs with Councilmember Jacob about the idea of putting all in one physical location who require treatment
- Discussed on the other hand theories of affordable housing, mental health facilities, and disbursement of those throughout your community
- Stated he can see the argument on both sides of equation
- Stated 300 feet not excessive
- Stated he is not sure vote on this
- Not support increased distance; letting local authorities decide what is appropriate

Mayor Slayter stated this item was brought by the City of Malibu with a list of concurring cities and communities that he is not familiar with. He stated he can see both sides of the issue, but stated he does not look like it takes away local control; however, if it takes local control away, he would be disinclined to support.

Councilmember Glass stated she concurs with the Mayor.
The Council was in consensus to not support this resolution.

#4. Residential Rentals, Support for SB 593 (McGuire)

Councilmember Glass commented as follows:

- Discussed the proliferation of a short term transient occupant rental is in some ways detracting from our provision of affordable housing
- People are choosing to rent out rooms to transient rather than on a long term basis to lower income
- Interested in encouraging rentals to longer term occupants
- Stated these rentals transient occupant rentals are competing with our regular kinds of transient occupant facilities and should be paying same fees as everyone else

Councilmember Jacob commented as follows:

- Concurs with Councilmember Glass
- Stated no matter what we approve here, the League does what it wants
- Voiced concern with trust with the League of CA Cities
- Stated they push the agenda of Southern California
- Concerned with this body initiating these items
- Discussed balance and that taking a position on this item may be poor
- Stated we do not have the data to vote on this item and he would abstain

Councilmember Eder commented as follows:

- Stated this is a complex issue
- Stated as long as there are air B&Bs existing, we are going to be left to deal with it
- Supports the registration of those places and collection of TOT by the City
- Sees this in a desirable place like Sebastopol becoming a big issue
- More attractive than renting a studio apartment
- Stated the City should receive financial benefits of it

Mayor Slayter commented as follows:

- Stated he concurs
- Stated this is a stop gap measure that is attempting to address the issue that lots of communities that have on signed on are in support of
- Stated the City will struggle with this in the foreseeable future
- Stated he does not see anything in bill that removes local control; inclined to support if it has local safeguards
- Councilmembers Eder, Glass and Mayor Slayter Support
- Councilmember Jacob does not support

#2. Compensation for Prolonged Electrical Power Outages

Mayor Slayter stated this seems reasonable

The Council was in consensus to support this resolution.

City Council Action: Provided direction as discussed.

Reference Order Number: 2015-137

Mayor Slayter called for a break at 7:25 pm and reconvened the meeting at 7:40 pm.

The Council then addressed the items removed from the consent calendar

1. Approval of Change out of PG&E Owned Street Lights to LED by PG&E (Superintendent of Public Works)

Superintendent of Public Works Emig presented the staff report recommending the City Council Approve the Change out of PG&E Owned Street Lights to LED by PG&E.

Councilmember Glass questioned if staff found out if there is only one kind of replacement bulb that is available or are there different bulbs with different levels of intensity. She stated she does not want bright bulbs.

Superintendent Emig commented that he can obtain information on the brightness and will look into this with PG&E.

Councilmember Eder questioned if there is a time or date sensitive application or process.

Superintendent Emig stated that PG&E would like to know by the end of this calendar year. He stated if not, this will probably not happen until a couple years from now.

Councilmember Eder stated it is his impression that there are still a lot of things that we do not know about this and he his thinking that a technical presentation in a language that can be understood by lay people be done by PG&E. He stated that this would go a long way for everyone's benefit. He stated that this is a very complex issue and cannot be easily decision and that the PG&E governmental representative should arrange a presentation.

Superintendent Emig stated PG&E has indicated they could do that and staff could return this to the City Council.

Councilmember Eder stated he does not want to delay this issue, but that it is a complex issue. He stated he does not want to move forward without knowing what the City Council is moving forward on.

Mayor Slayter commented as follows:

- Stated the LEDs come in different temperatures and read the readings
- Discussed the quality or color of the light emitted
- Discussed the lower number 2700K LED is a warmer light and closing replicates incandescent
- Stated HPS lights that are currently all over town have a very poor color rendering
- Stated on a scale of 1-80, the HPS is in the range of 20-30 and the LEDs are on the 70 scale
- Discussed the savings and stated the numbers of savings of 68 percent are optimistic
- Stated he is not familiar with HPS light costs but stated the range of savings for LEDs is within the range of reality

Mayor Slayter opened for public comments.

Jack Fisher commented as follows:

- Discussed being a graphic designer
- Discussed how light can change images
- Stated there are issues that need consideration before the decision to change the whole night scape of town can be made
- Stated the issue is worthy of real consideration
- Stated he is living one block from lights and is a victim of light pollution
- Discussed cherishing a place where people can experience the night sky
- Stated these are important valuable moments
- Stated night is night and day is day
- Stated to turn night into day to save some money for PG&E is something that needs to be considered
- Discussed aesthetic changes
- Stated the decision should not be taken lightly or made solely on how many pennies this could save PG&E
- Everyone in town will be living with these lights
- Stated part of the process is to see where another town has already done this and see what that actually looks like

Sandi Maurer commented as follows:

- Thanked the Council for removing this item from the consent calendar
- Thanked staff for their research and looking at emails and attachments
- Stated she stands for preserving for warm light ambiance
- Street lights are a form of light pollution from night sky
- Heard LEDs are awful
- Concern of ruining the City's evening ambiance
- Took photo of street light and took photo of LED Street light and stated the LED is very white
- Eliminate any health risk from flicker

- Serious issue
- June 2015 - Department of Energy Report backs up the concern of eye flickering
- Read excerpts from the report
- Lights are very likely to be increasing use of radio frequencies
- Do not know all details of how work
- Adding to dirty electricity on grid
- Do not trust PG&E to give honest believable answers
- Cautious of trusting PG&E

Donna Fisher stated she suffered from childhood epilepsy brought on by light flickering and stated it is real and scary.

A member of the audience commented as follows:

- Thanked staff for their research
- Read excerpts from reports on LEDs
- Discussed spending \$350,000 to replace LED lights amid neighborhood complaints
- Stated these lights are not pleasant
- Discussed melatonin
- Stated this is a big issue
- Appreciate the Council taking this off the consent calendar to be discussed

Mayor Slayter stated there has been a suggestion to table this item until the Council can receive a presentation.

Councilmember Eder commented as follows:

- Easier to decide if categorize okay and not okay or good or bad
- LED Street light – lack of real knowledge of
- Stated he is a big proponent of energy efficiency and LEDs
- Support their installation if there are ways we can mitigate some of the known or perceived health risks posed by them
- Issue with flicker - are there ways to potentially mitigate with drivers
- Suggested asking PG&E the quality of drivers to stop or reduce the flicker
- Discussed the blue rich and yellow rich LED bulbs
- Stated the yellow bulb tends to be warmer and less likely to create health affects
- Stated San Francisco, Berkeley and Oakland are installing yellow LED bulbs currently
- Stated that 40 cities are converting street lights to LEDs
- Stated this is not doing something radical or weird
- Stated he recognizes there could be health affects
- Read staggering statistic that if a small percent of households would adapt to LED bulbs, hundreds of coal powered plants would be shuttered
- Discussed offsetting health to reduction of plants
- Stated the Country has to reduce their appetite and consumption of energy
- First hand knowledge in emergency vehicles of LEDs
- Driving force here is not to save a few pennies but to reduce energy consumption
- Bigger picture item

- Question whether dimmers are used on street lights
- Unclear if part of the circuitry

Councilmember Eder stated the street lights to not use dimmers.

Councilmember Eder questioned if all City owned street lights will remain in the current configuration.

Superintendent Emig stated that the City will need to convert our own at some point.

City Manager McLaughlin stated that PG&E has spearheaded a program to assist cities with replacing its own street lights to LED and stated this is a loan situation but that staff has not looked into that at this time.

Councilmember Eder commented as follows:

- Stated this is a technically acceptable solution and the City could have uniform lighting system in town
- Discussed the bright lights in front of Whole Foods and stated there is a dramatic difference between the lights in the Plaza and Whole Foods
- Discussed shielded and unshielded LED lights
- Discussed staring at the bulb to see if he can see it flicker
- Stated that LED lights can be focused in pattern

Superintendent Emig commented as follows:

- Cobra head shine down where decorative are more globe shape and the light does in all directing
- Other places where the City has LEDs are the crosswalks that are enhanced with safety lights
- Street light on each side uses shields based on resident's requests

Councilmember Eder commented as follows:

- Discussed benefits and controversy
- Stated he looks forward to getting more information to make a more informed decision

Councilmember Glass commented as follows:

- Voiced concern with health effects of lighting
- Concerned of health effects of climate change
- Stated sometimes the solution finds some unintended consequences
- Stated she is also looking forward to receiving more information
- Stated she is not entirely convinced that just having a presentation from an organization that has a vested interest in putting through that technology in place is necessarily the best place to get information
- Suggested trying to find additional information from someone who can focus on the health effects of lighting
- Stated we need to look at both things
- Stated this is not about money but is about energy

- Stated we are seeking energy independent
- Stated she is looking forward to hearing more information

Councilmember Jacob discussed the comments of PG&E's interest if change to LED and stated the City will use less power and PG&E will lose money.

Mayor Slayter stated that the electricity for the lights runs through Sonoma Clean Power.

Councilmember Jacob commented that he does not understand PG&E's interests.

Councilmember Glass stated they are mandated by CPUC.

Councilmember Jacob commented as follows:

- Discussed the average energy bill of \$79822
- Stated if the City implements LEDs, it will save the City 68% which is \$54,278 a year
- Stated that would fund the Community Benefit Grant program
- Stated he is a Wi-Fi and LED person and has two Wi-Fi routers and a LED desk lamp that has four different colors with 5 different intensities
- Stated he understands the concern of health affects in a way that he is not affected
- Logical choice is to put out to two to three period
- Take time to understand how LEDs are good
- Discussed the Brooklyn neighborhood who rose up against LED lights and pushed back
- Stated that is an inner City urban lifestyle not liking the brightness
- Worry of light leaking to the Laguna
- Need to reduce GHG
- Waiting for this topic to come forward but now looking at it in a different perspective
- PG&E will finance the \$100,000 it will take to replace the LEDs
- Stated more citizens are affected by the blue green lights as you enter the City than will be affected by the health effects
- Stated this is a small town and high tech blue light that does not go together
- Push decision off
- Need to look at cooler light colors
- Need to be appropriately educated by PG&E and an outside vendor
- Deflect lights
- Dimmers on all or add when appropriate
- Stated PG&E probably used the cheapest and most generic LED fixture
- Need to see specifications and options
- No surprise Sebastopol going to question street lights and LED lights
- Wait until time to schedule a presentation to the City Council
- Postpone decision until time find right LED unit that fits town and needs

Mayor Slayter commented as follows:

- See need for greater education on this item
- Need to invite PG&E to come and make a presentation
- Suggest industry folks from lighting world to also make a presentation
- Discuss at agenda setting meeting

- Opportunities to change to LED have been clearly listed
- Less energy use is better
- Can more highly focus these type soft lights and reduce light pollution
- Use low output LEDs – different wattages
- Dial in color
- Not comfortable telling PG&E okay and approved if the City does not know what getting
- More information is needed

City Council Action: Postponed this item until such time that a presentation can be made to the City Council by PG&E and other approved organization.

Minute Order Number: 2015-131

4. Approval of Second Reading and Adoption of Ordinance 1079 regulating the establishment of ‘formula’ business uses in Sebastopol. The ordinance would create restrictions and procedural requirements regarding specified “formula” businesses – generally retail stores or restaurants, sometimes franchises, which have standardized décor, services, uniforms, etc., which make them substantially identical to other businesses elsewhere in the United States. The purpose of this ordinance is to protect the unique character of Sebastopol, maintain diversity in its businesses, and ensure that the city’s businesses serve the needs of the community. The proposed ordinance would prohibit some types of new formula businesses in the downtown area, and require Use Permits in certain circumstances for new formula businesses in the downtown and other areas of the City. (Planning Director)

Planning Director Webster presented the staff report recommending the City Council Approve the Second Reading and Adoption of Ordinance 1079 regulating the establishment of ‘formula’ business uses in Sebastopol. The ordinance would create restrictions and procedural requirements regarding specified “formula” businesses – generally retail stores or restaurants, sometimes franchises, which have standardized décor, services, uniforms, etc., which make them substantially identical to other businesses elsewhere in the United States. The purpose of this ordinance is to protect the unique character of Sebastopol, maintain diversity in its businesses, and ensure that the city’s businesses serve the needs of the community. The proposed ordinance would prohibit some types of new formula businesses in the downtown area, and require Use Permits in certain circumstances for new formula businesses in the downtown and other areas of the City.

Councilmember Jacob commented as follows:

- Discussed the email received from the owner of the Pleasant Hill shopping center that contains 7-11
- Stated he does not recall why that center was not on the shopping center list of special provisions

Planning Director Webster commented as follows:

- Stated it was not one of the shopping centers identified in the moratorium
- Councilmember subcommittee had created the draft ordinance and did not include this
- Stated neither was the Safeway shopping enter
- Other locations were identified as possible shopping centers that could be on the list
- Did not think there was specific discussion of the 7 11 center as to whether it should or should not be and stated it was not listed

Councilmember Jacob commented as follows:

- Stated he was on the subcommittee
- Stated the intent was to push larger amounts of traffic to the outer edge of town
- Stated the Council can look at specific requests
- Stated the Pleasant Avenue shopping center is on the rural side of the City

Director Webster stated he was not present at the original subcommittee discussions and did not know why it was not included.

Councilmember Jacob commented that based on staff's comments, he is comfortable moving forward.

Mayor Slayter opened for public comments. There were none.

Mayor Slayter commented as follows:

- Stated the Council did receive the letter from the owner of the 7-11 shopping center
- Stated the Council did have a brief discussion of this in the most recent round of talks
- Stated he is not sure if the property owner was aware of this

Director Webster commented that he was aware of the ordinance prior, but may not have been aware of how the ordinance has evolved since that time.

Mayor Slayter stated a formula business is clearly defined as such in the ordinance and if it wants to locate the shopping center, questioned what the procedure to do so is.

Director Webster stated formula business use permit would be required.

Councilmember Glass questioned since there is a formula business in that shopping center that already exists, if that store (7-11) were to move or leave, does that mean that another like formula business could move in.

Director Webster stated that is correct. He stated if another like mini market chain that is substantially similar could move in without a use permit.

Councilmember Jacob questioned if that new business could not expand without a Use Permit.

Director Webster stated that is correct.

Councilmember Eder commented as follows:

- Apologized for his absence at the last meeting
- Questioned why we are exempting electronic stores, gyms and tax preparation services in the downtown area
- Questioned specifically electronic stores
- Questioned why we are making an exemption for one category of business
- Stated the argument can be made for a gun store but we are not exempting gun stores
- Stated hypothetically what if CVS remained at the Redwood Market Place and the old Pellini building was sold to a Best Buy or similar store, could Best Buy not build on that site

Director Webster stated that could occur.

Councilmember Eder questioned how has the ordinance furthered the goal of keeping Sebastopol's small town and unique downtown character.

City Manager McLaughlin questioned if Best Buy is an electronic store.

Councilmember Eder questioned what it would be if it was not an electronic store.

City Manager McLaughlin stated they sell more than electronics.

Councilmember Eder commented as follows:

- Discussed a store that could qualify as an electronic store
- Unclear why making electronic store does not have to jump through hoops as horse apparel store
- Why are they exempt
- Tax preparation service falls under the heading of office
- Questioned if it is okay to see an H&R block taking over the area vacated by the Toy store under the Charter School or seeing a Golds Gym in the downtown area
- Stated it seems the use permit findings section is vague and to think that a corporation with deep pockets is willing to sue the City, could probably find a means to invoke in this section as inadequate to exclude the downtown

City Manager McLaughlin commented that the findings that have been developed are those that have withstood legal challenges. He stated the approval would be at the discretion of the decision maker by a weighing of the evidence.

Councilmember Eder commented as follows:

- Item F
- CVS Store as proposed 15,000 SF but a formula business could be greater than 15,000 SF if it provides needed goods, etc.
- Questioned if CVS rolls into town under 15,000, how will that affect the City's ability to utilize determining factors

City Manager McLaughlin commented that it has to meet the characteristics and that if it is under 15,000 the rest of the provisions apply.

Councilmember Eder commented as follows:

- Belief the goal of a wide section of this community is not see formula or chain businesses in the downtown under any circumstances
- Not sure legally prohibit them
- Advocate idea that offices, banks, credits unions, and gas stations are the only permitted uses in downtown without use permit and anything else deemed to be formula business would have to comply with the use permit process

City Manager stated the City could ban outright formula business as defined in the geographical area of the downtown with proper findings such as the downtown's historical nature.

Councilmember Eder commented as follows:

- Questioned what is our goal
- Do we want to maintain a downtown area zone for locally owned small businesses free of threat from chain or formula business
- Provide for those chains for formula business opportunity locations in numerous shopping centers as laid out
- Not excluding them from the entire town
- Or questioned if we want to have to fight one battle after another with formula businesses wanting to locate in the downtown to include gyms or electronics

Councilmember Jacob commented as follows:

- Idea around banks is similar to tax preparation
- Want people to pay taxes
- Give opportunity to have H&R as an economical place for people to go
- Effort to ensure we maintain that service everywhere
- Have H&R block where Mockingbird Books is located
- Gyms – not stop formula business at any costs or circumstance
- Happy healthy financially responsible community
- Not care what kind of gym
- Glad in our town and available to citizens
- Expect a small owned gym survival is hard
- Want access to healthy opportunities
- Electronic stores – the City does not have one and a use permit process allows for that to open if meeting an unmet need
- Tax revenue
- Same for gas stations
- Banning is one position
- Believe ordinance struck appropriate balance
- Tweaks can still be done
- Likes the ordinance

Councilmember Glass commented as follows:

- On second thought agrees with Councilmember Eder about gyms
- Have had two locally owned fitness centers that have survived here for a long time
- Would like to see them continue to thrive
- Not interested in seeing having gyms move into downtown
- Why do we exempt electronic stores
- People who dream of having an Apple store in downtown Sebastopol – not happening
- Exclude tax preparation - have had H&R block downtown without terrible consequences
- Not think we can get anything other than formula gas stations anymore
- Office, banks, and gas stations make sense
- Not know of excluding gyms and electronics

Mayor Slayter commented as follows:

- Raised same questions
- Wondered why exempted
- Understand why they were exempted
- Leaning towards not a problem why should not they also have to go through same use permit process
- Strong wording in Section 17.150.040 prohibited formula business uses
- Exempting office banks and credit unions and gas stations
- Discussed the use permit process
- Discussed that businesses in the Southpoint Shopping Center are now located in the Redwood Market Place
- Stated the exercise business in the Southpoint Shopping center was a franchise and the owner gave up the franchise and opened her own business and the business is thriving
- Discussed use of the permit process

Councilmember Jacob suggested waiting to discuss this until a full Council was present.

Councilmember Jacob moved and Councilmember Glass seconded the motion to postpone this item until a full Council is present.

VOTE:

Ayes: Councilmembers Glass, Jacob, and Mayor Slayter

Noes: Councilmember Eder

Absent: Vice Mayor Gurney

Abstain: None

City Council Action: Postponed the item until such time that a full City Council was in attendance to discuss.

Minute Order Number: 2015-133

CITY COUNCIL REPORTS:

9. City Manager-Attorney/City Clerk Reports:

Valley Fire Update

Reminder next City Council meeting to be held at Analy High School Library.

10. City Council Reports/Committee/Sub-Committee Meeting Reports: (Reports by Mayor/City Councilmembers Regarding Various Agency Meetings/Committee Meetings/Sub-Committee Meeting /Conferences Attended and Possible Direction to its Representatives (If Needed) on pending issues before such Boards)

None

11. Council Communications Received: None

12. Future City Meeting Dates/Events (Informational Only): (See Attached)

ADJOURNMENT: Mayor Slayter adjourned the regular City Council Meeting of September 1, 2015, at 8:45 p.m. to the next Regular City Council Meeting to be held on Tuesday, October 6, 2015, at 6:00 pm at the **ANALY HIGH SCHOOL LIBRARY, 6950 ANALY AVENUE,** Sebastopol, CA. **PLEASE NOTE CHANGE IN LOCATION OF MEETING.**

Respectfully Submitted,



Mary C. Gourley

Mary Gourley, CMC, City Clerk

Attachment 5

From: "McArthur, John" <JMcArthur@rpcity.org>
Subject: RE: LED Street Lights
Date: February 2, 2016 6:10:28 PM PST
To: 'Richard Emig' <remig@cityofsebastopol.org>
Cc: "Zwillinger, Terrie" <tzwillinger@rpcity.org>

Hi Rich - We recently completed a successful street light conversion project through the PG&E OBF Program. I am copying the City's Project Coordinator Terrie Zwillinger - Terrie can provide you with the project details. Good luck with your project - all in all, it worked out very well for us.
John

-----Original Message-----

From: Richard Emig [mailto:remig@cityofsebastopol.org]
Sent: Tuesday, February 02, 2016 4:50 PM
To: McArthur, John
Subject: LED Street Lights

Hi John,

My name is Rich Emig and I'm the Public Works Superintendent for the City of Sebastopol.

Our City is considering converting street lights from HPSV to LED, as part of a PG&E street light conversion program. I understand that your City has converted street lights to LEDs and I'm interested in hearing about your experience with them. Some considerations of our City Council, besides the energy savings, are brightness and any adverse health effects or complaints from the citizens.

If you are not the right person for me to contact regarding this, could you please redirect me? I appreciate your time.

Thank you,

Rich Emig
Public Works Department
City of Sebastopol
(707) 823-5331 x 205

From: Dan Takasugi <dtakasugi@sonomacity.org>
Subject: RE: LED Streetlights
Date: February 3, 2016 12:00:51 PM PST
To: Richard Emig <remig@cityofsebastopol.org>

No, we haven't heard complaints of any of those health effects.

I think there are published studies that show no added health effects from LED lights.

In doing my initial research, I found that many other cities went through an extensive analysis and outreach to convince their communities on the benefits of LED streetlights. We didn't do that much outreach. Some cities even did a pilot project on a small section of town. We just told people to go visit Napa or all our Caltrans intersections already had LED streetlights.

As we have an environmentally-sensitive community almost as much as yours, we relied on telling them that we are saving 312,000 kWh energy reduction and translated that into saving 164,000 pounds of CO2 emissions annually.

Thanks, Dan T.

From: Richard Emig [mailto:remig@cityofsebastopol.org]
Sent: Wednesday, February 03, 2016 11:52 AM
To: Dan Takasugi
Subject: Re: LED Streetlights

Dan,

Thank you very much for your quick response. Have you heard if anyone in your community have health concerns associated with the lights? Like flicker effect, or headaches? Those concerns were voiced in our town.

Rich

On Feb 2, 2016, at 5:17 PM, Dan Takasugi wrote:

Hi Rich:

Yes, I'd be glad to fill you in on our process. We are just finishing our LED streetlight conversion this week.

We expect to save about \$70,000 annually in PG&E energy costs. We expect to receive about \$40,000 in PG&E rebates. Further, we expect to lower our annual maintenance costs by about \$20,000. We also got PG&E On-Bill financing of \$250,000 at 0%.

We went with a turnkey operation through Tanko lighting. There are dozens of contractors out there who do this, but we found that Tanko had a good track record. We piggybacked on a RFP that San Bruno did, so that saved some work.

We have had very few complaints. But some residents thought that the LED streetlights were brighter than the HPS lights. They are not necessarily brighter in lumens on the ground, but they may have a brighter point source if one were to stare up at the light. We went with a color temperature of 4000K, which is the color of moonlight. As you know this leads to better color rendering.

I'd be glad to share other details if you desire.

Thanks,

Dan Takasugi, P.E.
Public Works Director / City Engineer
City of Sonoma
No. 1 the Plaza
Sonoma, CA 95476-6618

Office: (707) 933-2230

From: noreply@sonomacity.org [<mailto:noreply@sonomacity.org>]

Sent: Tuesday, February 02, 2016 4:59 PM

To: Dan Takasugi

Subject: Email from website

Below is the copy of the email from website to Dan Takasugi at :2/2/2016 4:58:37 PM

Name: Rich Emig

Email: remig@cityofsebastopol.org

Subject LED Street Lights

Attach

File

Hi Dan, I'm Rich Emig, City of Sebastopol Public Works Superintendent. We met at the GSA meetings last summer. Our City is considering converting street lights from HPSV to LED, as part of a PG&E street light conversion program. I understand that your City has converted street lights to LEDs and I'm interested in hearing Message about your experience with them. Some considerations of our City Council, besides the energy savings, are brightness and any adverse health effects or complaints from the citizens. If you are not the right person for me to contact regarding this, could you please redirect me? I appreciate your time. Thank you, Rich Emig Public Works Department City of Sebastopol (707) 823-5331 x 205

From: Jill Mercurio <Jill.Mercurio@cityofvallejo.net>
Subject: RE: LED Street Lights
Date: February 4, 2016 9:27:15 AM PST
To: Richard Emig <remig@cityofsebastopol.org>
Cc: Mike Schreiner <Mike.Schreiner@cityofvallejo.net>

Good morning, Rich,

Yes, the City of Vallejo converted 7,206 HPSV streetlights to LED in under four months last year. I know that we received a rebate check from PG&E for a little over \$500,000, and we anticipate \$300,000/year in electrical cost savings due to the conversion.

Mike Schreiner, Assistant Maintenance Supervisor - Streets & Traffic, oversaw the project and would be able to provide details of the work itself, as well as any feedback we have received from the public post-installation. I know we have had some complaints, but not the extent or the specific issues raised. I am cc'ing him on this response so you may contact him with your specific questions.

I know that Moraga, a town closer to the size of Sebastopol, is in the process of converting to LED right now, so you might want to see what types of concerns their residents had and how they were addressed prior to implementation. I'm sure you've seen this, but just in case, I am attaching the link to the pre- and post-conversion photos from the Walnut Creek conversion several years ago. Theirs have been in place for 6-7 years, so they may be able to also provide some long-term issues or concerns that they faced. One thing that I know has come up is the "light pollution" issue, but residents do not understand that because of the directional abilities of the LEDS, they are much more dark sky compliant than the existing lights. When the LEDS were placed in Walnut Creek, Ygnacio Valley Road (6 lanes wide) absolutely disappeared from sight from sight when viewed from the surrounding hillsides - it was remarkable!

https://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/rebatesincentives/ref/lighting/beforeafter_walnutcreek.pdf

Good luck!!

Thank you,

Jill A. Mercurio, P.E.
Assistant Public Works Director/City Engineer
City of Vallejo | Public Works - Engineering
555 Santa Clara Street, Vallejo, CA 94590
(707) 648-4085 jill.mercurio@cityofvallejo.net

Note - this is my NEW email address. Please update your address book. Thank you!

-----Original Message-----

From: Richard Emig [mailto:remig@cityofsebastopol.org]
Sent: Wednesday, February 03, 2016 9:26 AM
To: Jill Mercurio <Jill.Mercurio@cityofvallejo.net>
Subject: LED Street Lights

Hello Jill,

My name is Rich Emig and I'm the Public Works Superintendent for the City of Sebastopol.

Our City is considering converting street lights from HPSV to LED, as part of a PG&E street light conversion program. I understand that your City has converted street lights to LEDs and I'm interested about your experience with the new lights. Some considerations of our City Council, besides the energy savings, are brightness and any adverse health effects or complaints from the citizens associated with the LED lights.

If you are not the right person for me to contact regarding this, could you please redirect me? I appreciate your time.

Thank you,

Rich Emig
Public Works Department
City of Sebastopol
(707) 823-5331 x 205

From: Jonathon Goldman <JGoldman@ci.sausalito.ca.us>
Subject: RE: LED Street Lights
Date: February 3, 2016 2:18:03 PM PST
To: 'Richard Emig' <remig@cityofsebastopol.org>

No worries. I have received no complaints regarding flicker. Might be worth trying to confirm the fixture manufacturer and the specifications for the fixture that someone complained about. We also specified dimmable fixtures in order that they might be retrofitted with occupancy sensing in the future. I note that the drive current is field adjustable -- it may be that the drive current or other power waveforms could result in visible flicker. Maybe buy some units and install them on test...?

Here's the basic cut sheet for the Leoteks. <ftp://ftp.dot.wi.gov/dtsd/bto/qpl/electrical/6591115-luminairesutilityled-leda-leotek.pdf>

Jonathon Goldman, PE QSD CFM
Director of Public Works, City Engineer and ADA Coordinator
City of Sausalito
420 Litho Street
Sausalito, California 94965-1933
direct: 415-289-4176
fax: 415-339-2256
www.ci.sausalito.ca.us

-----Original Message-----

From: Richard Emig [mailto:remig@cityofsebastopol.org]
Sent: Wednesday, February 03, 2016 11:55 AM
To: Jonathon Goldman
Subject: Re: LED Street Lights

Thank you for your quick response Jonathon. I received an email from Tim at DCE with more information, and it all helps me. Have you heard of any citizen concerns regarding the lights relating to flicker effect or headaches? Those concerns were voiced in our town.

Thanks again,

Rich

On Feb 3, 2016, at 8:47 AM, Jonathon Goldman wrote:

> Good morning Mr. Emig. We started by replacing a few cobra heads that had been knocked down with Beta and then Leotek LED fixtures. We then advised our City Council and community that we were evaluating replacing the HPSV cobra-heads with the LED fixtures. We got no comments. We then piggy-backed on a contract the City of Novato competitively let several years ago to replace cobra-head HPSV fixtures on more than 540 of our streetlights. We replaced the cobra-heads in two phases, the first pay-as-you-go and the second with assistance from a California Energy Commission grant. We did have one resident request a warmer color temperature on a joint-pole mounted fixture. Leotek offers several color temperatures. My recollection is that all of ours except that one are 4,000 K color temperature. My experience is that the white light is not an issue and works well with our pavement markings even in foggy conditions. Our electricity and maintenance costs are also significantly less than they were, and we took credit for carbon footprint reduction too.

>

> Later, we also had retrofit kits manufactured to replace the light sources in 21 of our decorative pendant-style fixtures on Marbelite poles from the 1940's. We intend to eventually retrofit all of those too.

>

> I recommend DC Electric out of Cotati for advice and as a furnish, install and maintain contractor. Please let me know if you have any questions.

>

> Jonathon Goldman, PE QSD CFM
> Director of Public Works, City Engineer and ADA Coordinator City of
> Sausalito
> 420 Litho Street
> Sausalito, California 94965-1933
> direct: 415-289-4176
> fax: 415-339-2256
> www.ci.sausalito.ca.us

>
>
> -----Original Message-----
> From: Richard Emig [<mailto:remig@cityofsebastopol.org>]
> Sent: Tuesday, February 02, 2016 5:34 PM
> To: Jonathon Goldman
> Subject: LED Street Lights

> Hello Jonathon,

> My name is Rich Emig and I'm the Public Works Superintendent for the City of Sebastopol.

> Our City is considering converting street lights from HPSV to LED, as part of a PG&E street light conversion program. I understand that your City has converted street lights to LEDs and I'm interested in hearing about your experience with them. Some considerations of our City Council, besides the energy savings, are brightness and any adverse health effects or complaints from the citizens.

> If you are not the right person for me to contact regarding this, could you please redirect me? I appreciate your time.

> Thank you,

> Rich Emig
> Public Works Department
> City of Sebastopol
> (707) 823-5331 x 205

From: Tim Carter <tim@dcelectricgroup.com>
Subject: RE: LED Street Lights
Date: February 3, 2016 9:44:38 AM PST
To: <remig@cityofsebastopol.org>
Cc: 'Jonathon Goldman' <JGoldman@ci.sausalito.ca.us>

Jonathon, thanks for the recommendation.

Rich, hope you're doing well!

Back at Republic, I worked with Jonathon on the Sausalito LED Streetlight Retrofit projects (phases 1 and 2), and here at DCE we have retrofitted a good chunk of their remaining fixtures to LED as well (including retrofitting non-cobra fixtures with LED retrofit kits). Over the past few years here at DCE we've completed retrofits in San Anselmo, Mill Valley, Rohnert Park, Contra Costa County, Pleasant Hill, Martinez, and Tracy... approximately 8,000 lights. Additionally, our current Staff (both field and office) managed many of the LED streetlight retrofit projects in the bay area while at our former employer.

From our experience in working with the various agencies over the years and hearing from residents, the far majority have been pleased with the new lighting except for when it shines into their windows at night. This is almost always remedied with a snap-in shield from the manufacturer (or a custom fabricated shield using metal flashing around the front of the fixture if the home is directly across the street from the light). I'd say about 5% or less of all the lights installed in residential neighborhoods have had shield requests. Our recommendation would be to automatically install a shield (during installation of the new fixture) for any location which previously had a shield. That'll save you from having to pay for the extra trip back to the fixture at a later date.

NOTE: I've been informed by PG&E (we've been working with them a lot latterly) that the City of Sebastopol was looking at retrofitting their lights and they mentioned the City's concerns (as described in your email to Jonathon below). As Jonathon mentioned, and I'm sure PG&E has thoroughly discussed with you over the past few months, the major manufacturers (Leotek, Cree, etc.) now produce cobra fixtures that come in 3,000K or 4,000K color temperature, as the demand for 3,000K has grown enough for them to make it available at no additional cost; that wasn't the case until this past 6-months or so. Going with 3,000K (softer/warmer light) in residential neighborhoods might help reduce the number of complaints/shield requests.

Don't hesitate to call me anytime, otherwise have a great day!

Tim Carter
Project Manager
8023 Gravenstein Hwy S.
Cotati, CA 94931
(707) 992-0141 (Office)
(707) 781-8562 (Direct)
(707) 484-6128 (Cell)
(888) 525-8419 (Fax)
tim@dcelectricgroup.com
www.DCElectricgroup.com
Lic. #949934
DIR #1000003395

-----Original Message-----

From: Jonathon Goldman [mailto:JGoldman@ci.sausalito.ca.us]
Sent: Wednesday, February 03, 2016 8:47 AM
To: 'Richard Emig' <remig@cityofsebastopol.org>
Cc: Tim DCElectric <tim@dcelectricgroup.com>
Subject: RE: LED Street Lights

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our City Council and community that we were evaluating replacing the HPSV cobra-heads with the LED fixtures. We got no comments. We then piggy-backed on a contract the City of Novato competitively let several years ago to replace cobra-head HPSV fixtures on more than 540 of our streetlights. We replaced the cobra-heads in two phases, the first pay-as-you-go and the second with assistance from a California Energy Commission grant. We did have one resident request a warmer color temperature on a joint-pole mounted fixture. Leotek offers several color temperatures. My recollection is that all of ours except that one are 4,000 K color temperature. My experience is that the white light is not an issue and works well with our pavement markings even in foggy conditions. Our electricity and maintenance costs are also significantly less than they were, and we took credit for carbon footprint reduction too.

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Jonathon Goldman, PE QSD CFM
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-----Original Message-----

From: Richard Emig [mailto:remig@cityofsebastopol.org]
Sent: Tuesday, February 02, 2016 5:34 PM
To: Jonathon Goldman
Subject: LED Street Lights

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Thank you,

Rich Emig
Public Works Department
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