Attachments

SB 307-FN - AS AMENDED BY THE SENATE

03/14/2019 0869s

19-1063
06/05

STATE OF NEW HAMPSHIRE

In the Year of Our Lord Two Thousand Nineteen

AN ACT relative to outdoor lighting.

Be it Enacted by the Senate and House of Representatives in General Court convened:

1 State Purchase of Permanent Outdoor Lighting Design. Amend RSA 9-E:2, I(c) to read as follows:

(c) The director of the agency responsible for the funding of such luminaire or having authority over the illuminated infrastructure ensures***:***

(1) That consideration is given to minimizing glare and light trespass.

(2) That such luminaires have a color correlated temperature of 3,000 degrees Kelvin or less when initially installed or replaced in municipalities that have a policy calling for outdoor lighting to have a color correlated temperature of 3,000 degrees Kelvin or less if the community so requests, provided it does not increase the cost to the state in any pre-existing contracts or procurements.

2 New Hampshire Dark Sky Policy. Amend RSA 9-E:3 to read as follows:

9-E:3 New Hampshire Dark Sky Policy.

I. It shall be the policy of the state of New Hampshire to encourage municipalities to enact such local ordinances and regulations as they deem appropriate to conserve energy consumed by outdoor lighting; to minimize light pollution and glare; and to preserve dark skies as a feature of rural character wherever practicable.

II. To better enable communities to conserve energy consumed by outdoor lighting and carry out dark sky policies, the public utilities commission shall institute proceedings and may approve pilots or adopt rules or waivers as it deems necessary to reasonably enable the state, its agencies, subdivisions, and instrumentalities to own and operate outdoor street lights on utility poles under its jurisdiction under RSA 374:34-a or otherwise, including the use of smart adaptive street lighting with networked lighting controls. To the extent technically and economically feasible and consistent with the public good, the commission shall enable the use of revenue grade metering built into networked street lighting controls and may enable the collaborative or shared use of networked street lighting controls and supporting communication systems by utilities and the state, its agencies, subdivisions, and instrumentalities for providing additional utility and public services, such as advanced electric and water meter reading, public electric vehicle charging stations, and environmental sensors used for traffic and parking management and public safety.

3 New Section; Exemption. Amend RSA 72 by inserting after section 12-e the following new

SB 307-FN - AS AMENDED BY THE SENATE

section:

72:12-f Exemption. Street lights, including networked street lighting controls, built in revenue grade metering, supporting communication system hardware, and other connected or networked equipment used to provide public governmental functions or services, such as environmental sensors and public electric vehicle charging stations, and that are paid for by the state, its agencies, subdivisions, and instrumentalities shall be exempt from taxation as real estate.

4 Effective Date. This act shall take effect 60 days after its passage.

July 10, 2019

Governor's Veto Message Regarding Senate Bill 307

By the authority vested in me, pursuant to part II, Article 44 of the New Hampshire Constitution, on July 10, 2019, I have vetoed Senate Bill 307, relative to outdoor lighting.

This bill is an overly prescriptive attempt to regulate streetlight purchases by state agencies. The Department of Transportation has already adjusted its standard to match that which is specified in the bill. Under this bill, minor adjustments to streetlights would require an act of the general court. The State of New Hampshire needs to be more nimble than that to address future technology changes. Furthermore, the PUC is already able to address these issues through ongoing dockets.

For the reasons stated above, I have vetoed Senate Bill 307.

Respectfully submitted,

Christopher T. Sununu
Governor

Source: http://gencourt.state.nh.us/Senate/calendars_journals/calendars/2019/sc%2034.pdf, p. 13.

CITY OF LEBANON

51 North Park Street

Lebanon, NH 03766

(603) 448-4220

April 2, 2019

Hon. Robert Backus
Chair, Science, Technology & Energy Committee
New Hampshire House of Representative4s
107 North Main St.
Concord, NH 03301

RE: SB 307-FN Outdoor Lighting

Dear Chairman Backus and Members of the Science, Technology and Energy Committee,

I appear on behalf of the City of Lebanon to support the passage of SB 307 that Sen. Hennessey filed on behalf of the City and other municipalities interested in acting in accordance with New Hampshire's Dark Sky Policy as expressed at RSA 9-E:3, by conserving energy consumed by outdoor lighting with LED conversions and dimming control and by specifying the use of dark sky friendly LED lighting that is warm in color temperature (3000°K or less). For your convenient reference I have attached a copy of the 10 year old RSA Chapter 9-E, Outdoor Lighting Efficiency, in its entirety showing how it would be amended by passage of SB 307 as amended by the Senate.

SB 307 does 3 main things corresponding to the amended analysis:

1) Section 1 of the bill directs state agencies installing or replacing permanent outdoor lighting to use luminaires that have a color temperature of 3000°K or less (warmer white) in municipalities that have a policy calling for such if so requested and if it can be done at no additional cost to the state. The International Dark Sky Society and the American Medical Association both strongly call for only 3000°K or warmer (i.e. lower color temperature) for outdoor lighting for a variety of very good reasons, including that fact that cooler colored LED street lights can have enough blue light content that they suppress melatonin production to the point that they can cause sleep disruption and public health problems. Cooler/whiter LED also usually creates more of a glare problem and is ecologically harmful. I have attached an article about the AMA policy and the AMA report recommending the policy.

NHDOT has a contract with Affinity LED Lighting of Dover to convert all street lights that DOT pays for in the Eversource and Unitil service areas to LED. This is project is still in its early stages. Affinity offers both 3000°K and 4000°K lamp color temperatures for the same cost (and efficacy), and as stated in the original Fiscal Note (FN) DOT had adopted a policy of using 4000°K even in communities that otherwise have 3000°K. An impetus for this provision of the bill was the fact that Affinity had indicated that they have had just such a request that had been turned down. Lebanon and some other communities have adopted policies calling for 3000°K or warmer street lights to minimize blue spectrum, so we would like the DOT fixtures in our community (including at four I-89 interchanges in Lebanon) to do so too, at no additional cost to the state. Since SB 307 was heard in the Senate, my understanding is that NHDOT has executed a change order with Affinity and will be installing all 3000°K LED roadway lights instead of the originally planned 4000°K LEDs, which I think was a very good choice for the State as a whole. Existing RSA 9-E:2, II provides for additional exceptions to this requirement, such as a compelling safety interest.

2a) Section 2 of the bill, at lines 17-23 gives direction to the PUC to enable publicly owned street lighting throughout the state, as is common in many places in the United States and the rest of the world. While Eversource allows communities to select and purchase their own LED street lights and even install them with qualified contract crews, they typically assume ownership once they are installed on utility poles, although I understand there may be exceptions where some communities, such as Manchester, have been allowed to retain ownership and maintenance responsibility for their street lights. Neither Unitil's nor Liberty's tariffs provide for such presently. Liberty Utilities is working with the City of Lebanon and on new tariff to enable the City to select and pay for new street lights, including the use of adaptive or networked lighting controls, but they have not yet adopted a general policy or tariff enabling municipal ownership of the street lights.

This bill does not set any timelines for PUC action but does set forth a policy to recognize that there is not an inherent electric utility monopoly on ownership of street lighting for public ways. The State of New Hampshire and its subdivisions, primarily municipalities, provide and maintain the public rights-of-way that host the utility poles that in turn host the public street lighting, so it makes sense that the state and its municipalities should be able to own and control the street lights that they pay for, subject to PUC oversight as they interact with the regulated utilities. One reason for this is to allow the State and its subdivisions to decide to discontinue the use of a particular street light that they have purchased and paid installation costs with public funds, to be able to take back that fixture for use in a different location, rather than forfeiting the fixture to the utility because the utility has assumed ownership and control of the fixture.

2b) Section 2 at lines 23-30 gives direction to the PUC to enable the use of revenue grade metering that can be integrated into networked street lighting control nodes for billing purposes, subject to technical and economic feasibility and consistency with the public good. This provision also empowers the PUC to enable the collaborative or shared use of networked street lights and supporting communication systems by utilities and municipalities and state agencies for providing additional utility and public services such as supporting public electric vehicle charging stations and parking systems like the City of Concord operates. Dover and Nashua are the only communities in NH that have invested in this kind of networked dimmable street lighting, often called "smart LED street lighting," but they get no rate credit if they trim or dim their lighting below full output. Trimming means setting the initial output at less than 100%, say 75%, extending the life of luminaires by 5-10 years or more, and allowing a reduction in trim towards the end of life as the output fades, for lumen maintenance. Competition has driven innovation in this realm and smart street lighting offers communities opportunities for additional energy savings and carbon reductions through trimming and adaptive dimming of street lights that is more dark sky friendly because they can be dimmed for fireworks, meteor showers, a full moon, inactivity, or routinely late at night.

The City of Portland Maine for example is already using its smart street lighting network, equipped with traffic sensors in some locations, to improve traffic flow through two congested corridors, saving commuter time and idling energy (by >20% at certain high-volume traffic lights). However, the business case for such adaptive networked controls largely depends on getting credit for the reduced kWh consumption for smart trimming and dimming, while allowing communities to brighten and adjust street lighting levels on the fly for first responders, public safety, and special events. In Lebanon we estimate that LED conversion alone should save about 54% of our street lighting energy, while adding network controls and selective dimming, mainly late at night in residential areas, could increase that to about a 70% reduction in kWh, which is what some cities in Europe have achieved with adaptive controls.

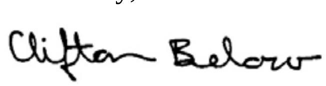
I've attached some literature on one vendor's product, Acuity Brand's Dark-to-Light DTL DSN networked photocontrols that works with the Itron network. These are products that the City and Liberty are considering proposing to the PUC to pilot, but there are many other vendors in this space, including several that are now offering their built-in revenue grade metering with IR pulse output that is key to affordably being able to test and verify metering accuracy (seconds per node with pulse output versus hours per node without).

SB 307 as introduced would have required the PUC to allow the state and its subdivisions to own the street light control nodes with revenue grade metering built-in. The bill was amended in the Senate after the major stakeholders (PUC, utilities, Clean Energy NH, & City of Lebanon) all sat down together to discuss concerns about the original language. In particular, the electric utilities felt that if they were going to be required to use metering data from lighting control nodes for billing, that they should own the control nodes since they would function as revenue-grade meters, so they can test them and replace as necessary, like they do with other electric meters. The amended language leaves such questions and details about possible standards and implementation to the PUC while simply expressing policy intent and appropriate enabling language. Again, no timeline is set for PUC action, so they can move at their own deliberative pace with the ability to oversee this and set conditions and requirements as are determined necessary or desirable by their processes, such as evidentiary hearings.

3) The 3rd section of the bill starting at the bottom of p. 1, line 31 to the end, provides that street lights and networked street lighting controls, supporting communication system hardware, and connected equipment providing public governmental functions or services, such as public roadway lighting and public electric vehicle charging stations, that are paid for the state or its subdivisions, shall be exempt from taxation as real estate. This was added by the Senate amendment in recognition that the PUC may conclude that equipment that may be paid for by the state or a municipality, such as networked street light control nodes, and used for a public purpose, shouldn't be taxed like private property, even if the PUC determines that ownership and some control has to be turned over to a regulated electric utility. It doesn't make sense that Manchester, Littleton, Wolfeboro and other towns own their own street lights don't pay taxes on them as public property, even as other towns that likewise have paid for such, but then had to turn over ownership to the investor-owned utility, do pay state and local property taxes on the exact same type and use of property. It doesn't make sense that NHDOT should be paying local property taxes on interstate lighting that it paid for, anymore than it would make sense for the City of Lebanon to pay the state utility property tax on equipment that the City pays for that is used for a public purpose.

I'm happy to respond to any questions and work with the committee on any concerns you may have about the specific policies and language in this bill. Thank you for your attention to this matter.

Yours truly,



Clifton Below
City Councilor & Asst. Mayor
Clifton.Below@LebanonNH.gov

THE CONVERSATION
Academic rigor, journalistic flair

American Medical Association warns of health and safety problems from ‘white’ LED streetlights

June 17, 2016 3.48pm EDT

New LED-based streetlights are whiter than traditional ones and contain more blue light, which can disrupt people’s circadian rhythms. meltedplastic/flickr, CC BY-NC-ND

Author

Richard G. "Bugs" Stevens
Professor, School of Medicine, University of Connecticut

The American Medical Association (AMA) has just adopted an official policy statement about street lighting: cool it and dim it.

The statement, adopted unanimously at the AMA’s annual meeting in Chicago on June 14, comes in response to the rise of new LED street lighting sweeping the country. An AMA committee issued guidelines on how communities can choose LED streetlights to “minimize potential harmful human health and environmental effects.”

Municipalities are replacing existing streetlights with efficient and long-lasting LEDs to save money on energy and maintenance. Although the streetlights are delivering these benefits, the AMA’s stance reflects how important proper design of new technologies is and the close connection between light and human health.

The AMA’s statement recommends that outdoor lighting at night, particularly street lighting, should have a color temperature of no greater than 3000 Kelvin (K). Color temperature (CT) is a measure of the spectral content of light from a source; how much blue, green, yellow and red there is in it. A higher CT rating generally means greater blue content, and the whiter the light appears.

A white LED at CT 4000K or 5000K contains a high level of short-wavelength blue light; this has been the choice for a number of cities that have recently retrofitted their street lighting such as Seattle and New York.

But in the wake of these installations have been complaints about the harshness of these lights. An extreme example is the city of Davis, California, where the residents demanded a complete replacement of these high color temperature LED street lights.

Can communities have more efficient lighting without causing health and safety problems?

Light is composed of light of different colors (red, blue and green) and some LED streetlights have a relatively high portion of blue light, which can disrupt people's circadian rhythms. flakepardigm/flickr, CC BY-SA

Two problems with LED street lighting

An incandescent bulb has a color temperature of 2400K, which means it contains far less blue and far more yellow and red wavelengths. Before electric light, we burned wood and candles at night; this artificial light has a CT of about 1800K, quite yellow/red and almost no blue. What we have now is very different.

The new "white" LED street lighting which is rapidly being retrofitted in cities throughout the country has two problems, according to the AMA. The first is discomfort and glare. Because LED light is so concentrated and has high blue content, it can cause severe glare, resulting in pupillary constriction in the eyes. Blue light scatters more in the human eye than the longer wavelengths of yellow and red, and sufficient levels can damage the retina. This can cause problems seeing clearly for safe driving or walking at night.

You can sense this easily if you look directly into one of the control lights on your new washing machine or other appliance: it is very difficult to do because it hurts. Street lighting can have this same effect, especially if its blue content is high and there is not appropriate shielding.

The other issue addressed by the AMA statement is the impact on human circadian rhythmicity.

Color temperature reliably predicts spectral content of light – that is, how much of each wavelength is present. It's designed specifically for light that comes off the tungsten filament of an incandescent bulb.

However, the CT rating does not reliably measure color from fluorescent and LED lights.

Another system for measuring light color for these sources is called correlated color temperature (CCT). It adjusts the spectral content of the light source to the color sensitivity of human vision. Using this rating, two different 3000K light sources could have fairly large differences in blue light content.

Therefore, the AMA's recommendation for CCT below 3000K is not quite enough to be sure that blue light is minimized. The actual spectral irradiance of the LED – the relative amounts of each of the colors produced – should be considered, as well.

The reason lighting matters

The AMA policy statement is particularly timely because the new World Atlas of Artificial Night Sky Brightness just appeared last week, and street lighting is an important component of light pollution. According to the AMA statement, one of the considerations of lighting the night is its impact on human health.

In previous articles for The Conversation, I have described how lighting affects our normal circadian physiology, how this could lead to some serious health consequences and most recently how lighting the night affects sleep.

In the case of white LED light, it is estimated to be five times more effective at suppressing melatonin at night than the high pressure sodium lamps (given the same light output) which have been the mainstay of street lighting for decades. Melatonin suppression is a marker of circadian disruption, which includes disrupted sleep.

Bright electric lighting can also adversely affect wildlife by, for example, disturbing migratory patterns of birds and some aquatic animals which nest on shore.

Street lighting and human health

The AMA has made three recommendations in its new policy statement:

First, the AMA supports a "proper conversion to community based Light Emitting Diode (LED) lighting, which reduces energy consumption and decreases the use of fossil fuels."Second, the AMA "encourage[s] minimizing and controlling blue-rich environmental lighting by using the lowest emission of blue light possible to reduce glare."

Third, the AMA "encourage[s] the use of 3000K or lower lighting for outdoor installations such as roadways. All LED lighting should be properly shielded to minimize glare and detrimental human and environmental effects, and consideration should be given to utilize the ability of LED lighting to be dimmed for off-peak time periods."

There is almost never a completely satisfactory solution to a complex problem. We must have lighting at night, not only in our homes and businesses, but also outdoors on our streets. The need for energy efficiency is serious, but so too is minimizing human risk from bad lighting, both due to glare and to circadian disruption. LED technology can optimize both when properly designed.

REPORT OF THE COUNCIL ON SCIENCE AND PUBLIC HEALTH

CSAPH Report 2-A-16

Subject: Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting

Presented by: Louis J. Kraus, MD, Chair

Referred to: Reference Committee E
(Theodore Zanker, MD, Chair)

INTRODUCTION

With the advent of highly efficient and bright light emitting diode (LED) lighting, strong economic arguments exist to overhaul the street lighting of U.S. roadways.[1-3] Valid and compelling reasons driving the conversion from conventional lighting include the inherent energy efficiency and longer lamp life of LED lighting, leading to savings in energy use and reduced operating costs, including taxes and maintenance, as well as lower air pollution burden from reduced reliance on fossil-based carbon fuels.

Not all LED light is optimal, however, when used as street lighting. Improper design of the lighting fixture can result in glare, creating a road hazard condition.[4,5] LED lighting also is available in various color correlated temperatures. Many early designs of white LED lighting generated a color spectrum with excessive blue wavelength. This feature further contributes to disability glare, i.e., visual impairment due to stray light, as blue wavelengths are associated with more scattering in the human eye, and sufficiently intense blue spectrum damages retinas.[6,7] The excessive blue spectrum also is environmentally disruptive for many nocturnal species. Accordingly, significant human and environmental concerns are associated with short wavelength (blue) LED emission. Currently, approximately 10% of existing U.S. street lighting has been converted to solid state LED technology, with efforts underway to accelerate this conversion. The Council is undertaking this report to assist in advising communities on selecting among LED lighting options in order to minimize potentially harmful human health and environmental effects.

METHODS

English language reports published between 2005 and 2016 were selected from a search of the PubMed and Google Scholar databases using the MeSH terms "light," "lighting methods," "color," "photic stimulation," and "adverse effects," in combination with "circadian rhythm/physiology/radiation effects," "radiation dosage/effects," "sleep/physiology," "ecosystem," "environment," and "environmental monitoring." Additional searches using the text terms "LED" and "community," "street," and "roadway lighting" were conducted. Additional information and perspective were supplied by recognized experts in the field.

ADVANTAGES AND DISADVANTAGES OF LED STREET LIGHTS

The main reason for converting to LED street lighting is energy efficiency; LED lighting can reduce energy consumption by up to 50% compared with conventional high pressure sodium (HPS) lighting. LED lighting has no warm up requirement with a rapid "turn on and off" at full intensity. In the event of a power outage, LED lights can turn on instantly when power is restored, as opposed to sodium-based lighting requiring prolonged warm up periods. LED lighting also has the inherent capability to be dimmed or tuned, so that during off peak usage times (e.g., 1 to 5 AM), further energy savings can be achieved by reducing illumination levels. LED lighting also has a much longer lifetime (15 to 20 years, or 50,000 hours), reducing maintenance costs by decreasing the frequency of fixture or bulb replacement. That lifespan exceeds that of conventional HPS lighting by 2-4 times. Also, LED lighting has no mercury or lead, and does not release any toxic substances if damaged, unlike mercury or HPS lighting. The light output is very consistent across cold or warm temperature gradients. LED lights also do not require any internal reflectors or glass covers, allowing higher efficiency as well, if designed properly.[8,9]

Despite the benefits of LED lighting, some potential disadvantages are apparent. The initial cost is higher than conventional lighting; several years of energy savings may be required to recoup that initial expense.[10] The spectral characteristics of LED lighting also can be problematic. LED lighting is inherently narrow bandwidth, with "white" being obtained by adding phosphor coating layers to a high energy (such as blue) LED. These phosphor layers can wear with time leading to a higher spectral response than was designed or intended. Manufacturers address this problem with more resistant coatings, blocking filters, or use of lower color temperature LEDs. With proper design, higher spectral responses can be minimized. LED lighting does not tend to abruptly "burn out," rather it dims slowly over many years. An LED fixture generally needs to be replaced after it has dimmed by 30% from initial specifications, usually after about 15 to 20 years.[1,11]

Depending on the design, a large amount blue light is emitted from some LEDs that appear white to the naked eye. The excess blue and green emissions from some LEDs lead to increased light pollution, as these wavelengths scatter more within the eye and have detrimental environmental and glare effects. LED's light emissions are characterized by their correlated color temperature (CCT) index.[12,13] The first generation of LED outdoor lighting and units that are still widely being installed are "4000K" LED units. This nomenclature (Kelvin scale) reflects the equivalent color of a heated metal object to that temperature. The LEDs are cool to the touch and the nomenclature has nothing to do with the operating temperature of the LED itself. By comparison, the CCT associated with daylight light levels is equivalent to 6500K, and high pressure sodium lighting (the current standard) has a CCT of 2100K. Twenty-nine percent of the spectrum of 4000K LED lighting is emitted as blue light, which the human eye perceives as a harsh white color. Due to the point-source nature of LED lighting, studies have shown that this intense blue point source leads to discomfort and disability glare.[14]

More recently engineered LED lighting is now available at 3000K or lower. At 3000K, the human eye still perceives the light as "white," but it is slightly warmer in tone, and has about 21% of its emission in the blue-appearing part of the spectrum. This emission is still very blue for the nighttime environment, but is a significant improvement over the 4000K lighting because it reduces discomfort and disability glare. Because of different coatings, the energy efficiency of 3000K lighting is only 3% less than 4000K, but the light is more pleasing to humans and has less of an impact on wildlife.

Glare

Disability glare is defined by the Department of Transportation (DOT) as the following:

> "Disability glare occurs when the introduction of stray light into the eye reduces the ability to resolve spatial detail. It is an objective impairment in visual performance."

Classic models of this type of glare attribute the deleterious effects to intraocular light scatter in the eye. Scattering produces a veiling luminance over the retina, which effectively reduces the contrast of stimulus images formed on the retina. The disabling effect of the veiling luminance has serious implications for nighttime driving visibility.[15]

Although LED lighting is cost efficient and inherently directional, it paradoxically can lead to worse glare than conventional lighting. This glare can be greatly minimized by proper lighting design and engineering. Glare can be magnified by improper color temperature of the LED, such as blue-rich LED lighting. LEDs are very intense point sources that cause vision discomfort when viewed by the human eye, especially by older drivers. This effect is magnified by higher color temperature LEDs, because blue light scatters more within the human eye, leading to increased disability glare.[16]

In addition to disability glare and its impact on drivers, many residents are unhappy with bright LED lights. In many localities where 4000K and higher lighting has been installed, community complaints of glare and a "prison atmosphere" by the high intensity blue-rich lighting are common. Residents in Seattle, WA have demanded shielding, complaining they need heavy drapes to be comfortable in their own homes at night.[17] Residents in Davis, CA demanded and succeeded in getting a complete replacement of the originally installed 4000K LED lights with the 3000K version throughout the town at great expense.[18] In Cambridge, MA, 4000K lighting with dimming controls was installed to mitigate the harsh blue-rich lighting late at night. Even in places with a high level of ambient nighttime lighting, such as Queens in New York City, many complaints were made about the harshness and glare from 4000K lighting.[19] In contrast, 3000K lighting has been much better received by citizens in general.

Unshielded LED Lighting

Unshielded LED lighting causes significant discomfort from glare. A French government report published in 2013 stated that due to the point source nature of LED lighting, the luminance level of unshielded LED lighting is sufficiently high to cause visual discomfort regardless of the position, as long as it is in the field of vision. As the emission surfaces of LEDs are highly concentrated point sources, the luminance of each individual source easily exceeds the level of visual discomfort, in some cases by a factor of 1000.[17]

Discomfort and disability glare can decrease visual acuity, decreasing safety and creating a road hazard. Various testing measures have been devised to determine and quantify the level of glare and vision impairment by poorly designed LED lighting.[20] Lighting installations are typically tested by measuring foot-candles per square meter on the ground. This is useful for determining the efficiency and evenness of lighting installations. This method, however, does not take into account the human biological response to the point source. It is well known that unshielded light sources cause pupillary constriction, leading to worse nighttime vision between lighting fixtures and causing a "veil of illuminance" beyond the lighting fixture. This leads to worse vision than if the light never existed at all, defeating the purpose of the lighting fixture. Ideally LED lighting installations should be tested in real life scenarios with effects on visual acuity evaluated in order to ascertain the best designs for public safety.

Proper Shielding

With any LED lighting, proper attention should be paid to the design and engineering features. LED lighting is inherently a bright point source and can cause eye fatigue and disability glare if it is allowed to directly shine into human eyes from roadway lighting. This is mitigated by proper design, shielding and installation ensuring that no light shines above 80 degrees from the horizontal. Proper shielding also should be used to prevent light trespass into homes alongside the road, a common cause of citizen complaints. Unlike current HPS street lighting, LEDs have the ability to be controlled electronically and dimmed from a central location. Providing this additional control increases the installation cost, but may be worthwhile because it increases long term energy savings and minimizes detrimental human and environmental lighting effects. In environmentally sensitive or rural areas where wildlife can be especially affected (e.g., near national parks or bio-rich zones where nocturnal animals need such protection), strong consideration should be made for lower emission LEDs (e.g., 3000K or lower lighting with effective shielding). Strong consideration also should be given to the use of filters to block blue wavelengths (as used in Hawaii), or to the use of inherent amber LEDs, such as those deployed in Quebec. Blue light scatters more widely (the reason the daytime sky is "blue"), and unshielded blue-rich lighting that travels along the horizontal plane increases glare and dramatically increases the nighttime sky glow caused by excessive light pollution.

POTENTIAL HEALTH EFFECTS OF "WHITE" LED STREET LIGHTING

Much has been learned over the past decade about the potential adverse health effects of electric light exposure, particularly at night.[21-25] The core concern is disruption of circadian rhythmicity. With waning ambient light, and in the absence of electric lighting, humans begin the transition to nighttime physiology at about dusk; melatonin blood concentrations rise, body temperature drops, sleepiness grows, and hunger abates, along with several other responses.

A number of controlled laboratory studies have shown delays in the normal transition to nighttime physiology from evening exposure to tablet computer screens, backlit e-readers, and room light typical of residential settings.[26-28] These effects are wavelength and intensity dependent, implicating bright, short wavelength (blue) electric light sources as disrupting transition. These effects are not seen with dimmer, longer wavelength light (as from wood fires or low wattage incandescent bulbs). In human studies, a short-term detriment in sleep quality has been observed after exposure to short wavelength light before bedtime. Although data are still emerging, some evidence supports a long-term increase in the risk for cancer, diabetes, cardiovascular disease and obesity from chronic sleep disruption or shiftwork and associated with exposure to brighter light sources in the evening or night.[25,29]

Electric lights differ in terms of their circadian impact.[30] Understanding the neuroscience of circadian light perception can help optimize the design of electric lighting to minimize circadian disruption and improve visual effectiveness. White LED streetlights are currently being marketed to cities and towns throughout the country in the name of energy efficiency and long term cost savings, but such lights have a spectrum containing a strong spike at the wavelength that most effectively suppresses melatonin during the night. It is estimated that a "white" LED lamp is at least 5 times more powerful in influencing circadian physiology than a high pressure sodium light based on melatonin suppression.[31] Recent large surveys found that brighter residential nighttime lighting is associated with reduced sleep time, dissatisfaction with sleep quality, nighttime awakenings, excessive sleepiness, impaired daytime functioning, and obesity.[29,32] Thus, white LED street lighting patterns also could contribute to the risk of chronic disease in the populations of cities in which they have been installed. Measurements at street level from white LED street lamps are needed to more accurately assess the potential circadian impact of evening/nighttime exposure to these lights.

ENVIRONMENTAL EFFECTS OF LED LIGHTING

The detrimental effects of inefficient lighting are not limited to humans; 60% of animals are nocturnal and are potentially adversely affected by exposure to nighttime electrical lighting. Many birds navigate by the moon and star reflections at night; excessive nighttime lighting can lead to reflections on glass high rise towers and other objects, leading to confusion, collisions and death.[33] Many insects need a dark environment to procreate, the most obvious example being lightning bugs that cannot "see" each other when light pollution is pronounced. Other environmentally beneficial insects are attracted to blue-rich lighting, circling under them until they are exhausted and die.[34,35] Unshielded lighting on beach areas has led to a massive drop in turtle populations as hatchlings are disoriented by electrical light and sky glow, preventing them from reaching the water safely.[35-37] Excessive outdoor lighting diverts the hatchlings inland to their demise. Even bridge lighting that is "too blue" has been shown to inhibit upstream migration of certain fish species such as salmon returning to spawn. One such overly lit bridge in Washington State now is shut off during salmon spawning season.

Recognizing the detrimental effects of light pollution on nocturnal species, U.S. national parks have adopted best lighting practices and now require minimal and shielded lighting. Light pollution along the borders of national parks leads to detrimental effects on the local bio-environment. For example, the glow of Miami, FL extends throughout the Everglades National Park. Proper shielding and proper color temperature of the lighting installations can greatly minimize these types of harmful effects on our environment.

CONCLUSION

Current AMA Policy supports efforts to reduce light pollution. Specific to street lighting, Policy H-135.932 supports the implementation of technologies to reduce glare from roadway lighting. Thus, the Council recommends that communities considering conversion to energy efficient LED street lighting use lower CCT lights that will minimize potential health and environmental effects. The Council previously reviewed the adverse health effects of nighttime lighting, and concluded that pervasive use of nighttime lighting disrupts various biological processes, creating potentially harmful health effects related to disability glare and sleep disturbance.[25]

RECOMMENDATIONS

The Council on Science and Public Health recommends that the following statements be adopted, and the remainder of the report filed.

1. That our American Medical Association (AMA) support the proper conversion to community-based Light Emitting Diode (LED) lighting, which reduces energy consumption and decreases the use of fossil fuels. (New HOD Policy)

2. That our AMA encourage minimizing and controlling blue-rich environmental lighting by using the lowest emission of blue light possible to reduce glare. (New HOD Policy)

3. That our AMA encourage the use of 3000K or lower lighting for outdoor installations such as roadways. All LED lighting should be properly shielded to minimize glare and detrimental human and environmental effects, and consideration should be given to utilize the ability of LED lighting to be dimmed for off-peak time periods. (New HOD Policy)

Fiscal Note: Less than $500

REFERENCES

1. Municipal Solid State Street Lighting Consortium. http://www1.eere.energy.gov/buildings/ssl/consortium.html. Accessed April 4, 2016.

2. Illuminating Engineering Society RP-8 – Guide to Roadway Lighting. http://www.ies.org/? 2014. Accessed April 4, 2016.

3. LED Lighting Facts–A Program of the United States Department of Energy. http://www.lightingfacts.com. Accessed April 5, 2016.

4. Lin Y, Liu Y, Sun Y, Zhu X, Lai J, Heynderickz I. Model predicting discomfort glare caused by LED road lights. *Opt Express*. 2014;22(15):18056-71.

5. Gibbons RB, Edwards CJ. A review of disability and discomfort glare research and future direction. 18th Biennial TRB Visibility Symposium, College Station TX, United States, April 17-19, 2007.

6. Shang YM, Wang GS, Sliney D, Yang CH, Lee LL. White light–emitting diodes (LEDs) at domestic lighting levels and retinal injury in a rat model. *Environ Health Perspect.* 2014:122(3):269-76.

7. Lougheed T. Hidden blue hazard? LED lighting and retinal damage in rats, *Environ Health Perspect*. 2014;122(3):A81.

8. A Municipal Guide for Converting to LED Street Lighting, (http://www1.eere.energy.gov/buildings/ssl/consortium.html) 10/13/2013.

9. In depth: Advantages of LED Lighting. http://energy.ltgovernors.com/in-depth-advantages-of-led-lighting.html. Accessed April 5, 2016.

10. Silverman H. How LED Streetlights Work. HowStuffWorks.com. June 22, 2009. http://science.howstuffworks.com/environmental/green-tech/sustainable/led-streetlight.htm. Accessed April 7, 2016.

11. Jin H, Jin S, Chen L, Cen S, Yuan K. Research on the lighting performance of LED street lights with different color temperatures. *IEEE Photonics Journal*. 2015;24(6):975-78. http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7328247. Accessed April 7, 2016.

12. Morris N. LED there be light. Nick Morris predicts a bright future for LEDs. *Electrooptics.com*. http://www.electrooptics.com/features/junjul06/junjul06leds.html. Accessed April 7, 2016.

13. Mills MP. The LED illumination revolution. *Forbes Magazine*. February 27, 2008. http://www.forbes.com/2008/02/27/incandescent-led-cfl-pf-guru_in_mm_0227energy_inl.html. Accessed April 5, 2016.

14. Opinion of the French Agency for Food, Environmental and Occupational Health & Safety, October 19, 2010. https://web.archive.org/web/20140429161553/http:/www.anses.fr/Documents/AP2008sa0408EN.pdf

15. U.S. Department of Transportation, Federal Highway Administration, 2005.

16. Sweater-Hickcox K, Narendran N, Bullough JD, Freyssinier JP. Effect of different coloured luminous surrounds on LED discomfort glare perception. *Lighting Research Technology*. 2013;45(4):464-75. http://lrt.sagepub.com/content/45/4/464. Accessed April 5, 2016.

17. Scigliano E. Seattle's new LED-lit streets Blinded by the lights. *Crosscut*. March 18, 2013. http://crosscut.com/2013/03/streetlights-seattle-led/. Accessed April 6, 2016.

18. Davis will spend $350,000 to replace LED lights after neighbor complaints. CBS Local, Sacramento;October 21, 2014. http://sacramento.suntimes.com/sac-news/7/138/6000/davis-will-spend-350000-to-replace-led-lights-after-neighbor-complaints.

19. Chaban M. LED streetlights in Brooklyn are saving energy but exhausting residents. *NY Times*; March 23, 2015. http://www.nytimes.com/2015/03/24/nyregion/new-led-streetlights-shine-too-brightly-for-some-in-brooklyn.html?_r=0. Accessed April 5, 2016.

20. Vos JJ. On the cause of disability glare and its dependence on glare angle, age and ocular pigmentation. *Clin Exp Optom*. 2003;86(6):363-70.

21. Stevens RG, Brainard GC, Blask DE, Lockley, SW, Motta, ME. Breast cancer and circadian disruption from electric lighting in the modern world. *CA Cancer J Clin*. 2014;64:207-18.

22. Evans JA, Davidson AJ. Health consequences of circadian disruption in humans and animal models. *Prog Mol Biol Transl Sci*. 2013;119:283-323.

23. Wright KP Jr, McHill AW, Birks BR, Griffin BR, Rusterholz T, Chinoy ED. Entrainment of the human circadian clock to the natural light-dark cycle. *Curr Biol*. 2013;23:1554-8.

24. Energy Savings Estimates of Light Emitting Diodes in Niche Lighting Applications. Building Technologies Program, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy. January 2011. http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/nichefinalreport_january2011.pdf.Accessed April 7, 2016.

25. Council on Science and Public Health Report 4. Light pollution. Adverse effects of nighttime lighting. American Medical Association, Annual Meeting, Chicago, IL. 2012.

26. Cajochen C, Frey S, Anders D, et al. Evening exposure to a light-emitting diodes (LED)-backlit computer screen affects circadian physiology and cognitive performance. *J Appl Physiol*. 2011;110:1432-8.

27. Chang AM, Aeschbach D, Duffy JF, Czeisler CA. Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness. *Proc Natl Acad Sci USA.* 2015;112:1232-7.

28. Gooley JJ, Chamberlain K, Smith KA, et al. Exposure to room light before bedtime suppresses melatonin onset and shortens melatonin duration in humans. *J Clin Endocrinol Metab*. 2011;96:E463-72.

29. Koo YS, Song JY, Joo EY, et al. Outdoor artificial light at night, obesity, and sleep health: Cross-sectional analysis in the KoGES study. *Chronobiol Int*. 2016;33(3):301-14.

30. Lucas RJ, Peirson SN, Berson DM, et al. Measuring and using light in the melanopsin age. *Trends Neurosci*. 2014;37:1-9.

31. Falchi F, Cinzano P, Elvidge CD, Keith DM, Haim A. Limiting the impact of light pollution on human health, environment and stellar visibility. *J Environ Manage*. 2011;92:2714-22.

32. Ohayon M, Milesi C. Sleep deprivation/insomnia and exposure to street lights in the American general population. American Academy of Neurology Annual Meeting. April 15-21, 2016. Vancouver, BC.

33. Pawson SM, Bader MK. Led lighting increases the ecological impact of light pollution irrespective of color temperature. *Ecological Applications*. 2014;24:1561-68.

34. Gaston K, Davies T, Bennie J, Hopkins J. Reducing the ecological consequences of night-time light pollution: Options and developments. *J Appl Ecol*. 2012;49(6):1256–66.

35. Salmon M. Protecting sea turtles from artificial night lighting at Florida's oceanic beaches. In-Rich C, Longcore T (eds.). *Ecological Consequences of Artificial Night Lighting*. 2006:141-68. Island Press, Washington, DC.

36. Rusenko KW, Mann JL, Albury R, Moriarty JE, Carter HL. Is the wavelength of city glow getting shorter? Parks with no beachfront lights record adult aversion and hatchling disorientations in 2004. Kalb H, Rohde A, Gayheart K, Shanker, K, compilers. 2008. *Proceedings of the Twenty-fifth Annual Symposium on Sea Turtle Biology and Conservation*, NOAA Technical Memorandum NMFS-SEFSC-582, 204pp. http://www.nmfs.noaa.gov/pr/pdfs/species/turtlesymposium2005.pdf

37. Rusenko KW, Newman R, Mott C, et al. Using GIS to determine the effect of sky glow on nesting sea turtles over a ten year period. Jones TT, Wallace BP, compilers. 2012. *Proceedings of the Thirty-first Annual Symposium on Sea Turtle Biology and Conservation*. NOAA Technical Memorandum NOAA NMFS-SEFSC-631:32p.

Acknowledgement: The Council thanks George Brainard, PhD (Thomas Jefferson University); Richard Stevens, PhD (University Connecticut Health Center); and Mario Motta, MD (CSAPH, Tufts Medical School) for their contributions in preparing the initial draft of this report, and the commentary by Travis Longcore, PhD, on the ecological impact of nighttime electrical lighting.

App	Units	Base Cost	Burden Co	Total Cost	Bid Price
7	38.5	7.41	45.91	45.92	0.02%
IN	35	256.85	79.62	336.47	336.48
PY	0.7	36.04	53.51	89.55	89.55
Total:		**331.39**	**140.55**	**471.93**	**471.95**

30W LED ROADWAY STREET LIGHT W/BRACKET INSTALLED COST								
App	Unit Code	Units	Description	Base Cost	Burden Co	Total Cost	Bid Price	
IN	8830-0811030	1	BRACKET, LTG, UPSWEEP, 6FT X 2IN DIA, ALUM	74	22.94	96.94	96.95	
IN	8830-4005640	5	WIRE, GROUNDING, SOLID CU COVERED, SOFT DRAWN,	5.25	1.63	6.88	6.88	
IN	8830-7001501	1	BOLT, MACH, 5/8IN X 12IN, SQ HD, GALVS	1.24	0.38	1.62	1.62	Apparent
IN	8830-7006014	1	WASHER, SQ FLAT, GALV, 11/16IN HOLE, 2-1/4IN X 2-1/4	0.27	0.08	0.35	0.35	bracket &
IN	8830-7011833	2	SCREW, LAG, SQ HEAD, PLT PT, 1/2IN. X 4IN., TWIST DR,	1.32	0.41	1.73	1.73	line tap
IN	8830-9201786	1	CONNECTOR, INSULATING PIERCING, TAP, CU/AL 2/0 - 1/	6.03	1.87	7.9	7.9	costs
IN	8830-9201925	5	CONDUIT, FLEX, 1/2IN LIQUID-TIGHT, NON-METALLIC, GI	2.65	0.82	3.47	3.47	
IN	8830-9202617	17	WIRE, 2/C, #10 AWG, 7-STRD, SD-CU, RHH/RHW/USE-2,	18.02	5.59	23.61	23.61	
IN	8830-9387130	1	LUMINAIRE, LED 30W 4000K TYPE III ROADWAY DLC COC	125	38.75	163.75	163.75	142.51
IN	8830-9387138	1	CONTROL, PHOTOELEC, 120-277VAC, 1000W(10A), LONG	23.07	7.15	30.22	30.22	
								Apparent
								bracket &
								line tap
								costs as %
								of total:
PY	Crew Leader	0.7	Crew Leader	36.04	55.31	89.55	89.55	
EQ	EQ012	0.7	Line Truck	38.5	7.41	45.91	45.92	
							471.95	30.2%

Identifier	Cost	Burden	Profit	Total
EQ	$38.50	$7.41	$0.01	$45.92
IN	$256.85	$79.62	$0.01	$336.48
PY	$36.04	$53.51	$0.00	$89.55
SUB-TOTAL	**$331.39**	**$140.55**	**$0.02**	**$471.95**

Selected Events:

7933 30W LED ROADWAY Installation Cost

From Liberty's Attachment to CoL TS 1-4.xlsx, with yellow highlighting and red text added by Clifton Below

App	Units	Base Cost	Burden Co	Total Cost	Bid Price
EQ	0.7	38.5	7.41	45.91	45.92
IN	35	268.85	83.34	352.19	352.22
PY	0.7	36.04	53.51	89.55	89.55
Total:		**343.39**	**144.27**	**487.65**	**487.69**

50W LED ROADWAY STREET LIGHT W/BRACKET INSTALLED COST

App	Unit Code	Units	Description	Base Cost	Burden Co	Total Cost	Bid Price	
	8830-0811030	1	BRACKET, LTG, UPSWEEP, 6FT X 2IN DIA, ALUM	74.00	22.94	96.94	96.95	
IN	8830-4005640	5	WIRE, GROUNDING, SOLID CU COVERED, SOFT DRAWN,	5.25	1.63	6.88	6.88	
IN	8830-7001501	1	BOLT, MACH, 5/8IN X 12IN, SQ HD, GALVS	1.24	0.38	1.62	1.62	Apparent bracket & line tap costs
IN	8830-7006014	1	WASHER, SQ FLAT, GALV, 11/16IN HOLE, 2-1/4IN X 2-1/4	0.27	0.08	0.35	0.35	
IN	8830-7011833	2	SCREW, LAG, SQ HEAD, PLT PT, 1/2IN. X 4IN., TWIST DR,	1.32	0.41	1.73	1.73	
IN	8830-9201786	1	CONNECTOR, INSULATING PIERCING, TAP, CU/AL 2/0 - 1/	6.03	1.87	7.9	7.9	
IN	8830-9201925	5	CONDUIT, FLEX, 1/2IN LIQUID-TIGHT, NON-METALLIC, GI	2.65	0.82	3.47	3.47	
IN	8830-9202617	17	WIRE, 2/C, #10 AWG, 7-STRD, SD-CU, RHH/RHW/USE-2,	18.02	5.59	23.61	23.61	
IN	8830-9387131	1	LUMINAIRE, LED 50W 4000K TYPE III ROADWAY DLC COC	137.00	42.47	179.47	179.49	142.51
IN	8830-9387138	1	CONTROL, PHOTOELEC, 120-277VAC, 1000W(10A), LONG	23.07	7.15	30.22	30.22	
								Apparent bracket & line tap costs as % of total:
PY	Crew Leader	0.7	Crew Leader	36.04	53.51	89.55	89.55	
EQ	EQ012	0.7	Line Truck	38.5	7.41	45.91	45.92	
							487.69	29.2%

Identifier	Cost	Burden	Profit	Total
EQ	$38.50	$7.41	$0.01	$45.92
IN	$268.85	$83.34	$0.03	$352.22
PY	$36.04	$53.51	$0.00	$89.55
SUB-TOTAL	**$343.39**	**$144.27**	**$0.04**	**$487.69**

Selected Events:

7934 50W LED ROADWAY Installation Cost

From Liberty's Attachment to CoL TS 1-4.xlsx, with yellow highlighting and red text added by Clifton Below

App	Units	Base Cost	Burden Co	Total Cost	Bid Price
EQ	0.7	38.5	7.41	45.91	45.92
IN	35	429.85	133.25	563.1	563.11
PY	0.7	36.04	53.51	89.55	89.55
Total:		**504.39**	**194.18**	**698.56**	**698.58**

130W LED ROADWAY STREET LIGHT W/BRACKET INSTALLED COST

App	Unit Code	Units	Description	Base Cost	Burden Co	Total Cost	Bid Price	
IN	8830-0811030	1	BRACKET, LTG, UPSWEEP, 6FT X 2IN DIA, ALUM	74.00	22.94	96.94	96.95	
IN	8830-4005640	5	WIRE, GROUNDING, SOLID CU COVERED, SOFT DRAWN,	5.25	1.63	6.88	6.88	
IN	8830-7001501	1	BOLT, MACH, 5/8IN X 12IN, SQ HD, GALVS	1.24	0.38	1.62	1.62	Apparent
IN	8830-7006014	1	WASHER, SQ FLAT, GALV, 11/16IN HOLE, 2-1/4IN X 2-1/4	0.27	0.08	0.35	0.35	bracket &
IN	8830-7011833	2	SCREW, LAG, SQ HEAD, PLT PT, 1/2IN. X 4IN., TWIST DR,	1.32	0.41	1.73	1.73	line tap
IN	8830-9201786	1	CONNECTOR, INSULATING PIERCING, TAP, CU/AL 2/0 - 1/	6.03	1.87	7.9	7.9	costs
IN	8830-9201925	5	CONDUIT, FLEX, 1/2IN LIQUID-TIGHT, NON-METALLIC, GI	2.65	0.82	3.47	3.47	
IN	8830-9202617	17	WIRE, 2/C, #10 AWG, 7-STRD, SD-CU, RHH/RHW/USE-2,	18.02	5.59	23.61	23.61	
IN	8830-9387132	1	LUMINAIRE, LED 130W 4000K TYPE II RDWY DLC EATON	298.00	92.38	390.38	390.38	142.51
IN	8830-9387138	1	CONTROL, PHOTOELEC, 120-277VAC, 1000W(10A), LONG	23.07	7.15	30.22	30.22	
								Apparent
								bracket &
								line tap
								costs as %
PY	Crew Leader	0.7	Crew Leader	36.04	53.51	89.55	89.55	of total:
EQ	EQ012	0.7	Line Truck	From Libe	7.41	45.91	45.91	
							698.57	20.4%

Identifier	Cost	Burden	Profit	Total
EQ	$38.50	$7.41	$0.01	$45.92
IN	$429.85	$133.25	$0.01	$563.11
PY	$36.04	$53.51	$0.00	$89.55
SUB-TOTAL	**$504.39**	**$194.18**	**$0.02**	**$698.58**

Selected Events:

7935 130W LED ROADWAY Installation Cost

From Liberty's Attachement CoL Ts 1-4.xlsx, with yellow highlighting and red text added by Clifton Below

Like It or Not, Chicago's About to Get a Lot Less Orange

When Chicago's high-pressure sodium lights are replaced with LEDs, the city will lose its distinctive orange glow. Maybe it's for the best.

BY WHET MOSER

Streetlights, people. PHOTO: TIM KOPRA/NASA

PUBLISHED APRIL 21, 2017

ke
'e

On Wednesday, City Council signed off on its $160 million plan to change the color of Chicago, replacing its 270,000 high-pressure sodium lights, which give the city its, um, distinctive orange glow, to LED. Right now Chicago is one of the most orange cities in the world; when the project is done, it'll look completely different, on the street and from space.

Chicago's been orange for about 40 years. It started with an experiment on the Dan Ryan in 1969, about the time high-pressure sodium-vapor lights were perfected enough to go into widespread use, and a handful of the blueish mercury-vapor lights were replaced. Three years later the Lawndale People's Planning and Action Conference proposed their light installation on Roosevelt Avenue as a crime-fighting tactic. But it was unclear if the investment would pay off. In 1973, UCLA astronomer Kurt Riegel, concerned about light pollution, correlated rising crime to increased outdoor luminosity in a piece for *Science*, concluding that "the selling has also been very succesful–most people now believe that outdoor lighting buys them security." (He found that the evidence was mixed.)

Riegel also observed that "high pressure sodium lamps do not account for a very high percentage of outdoor lights in operation presently," but that "municipalities and commercial light users are beginning to install them at a high rate, and the possibility that much of the skylight near urban areas will someday be from this type of lamp should be considered."

He was right. The OPEC oil embargo hit in October 1973, a few months after Riegel's piece was published, and the promise of more light for much less energy was attractive. Riegel plotted out how new technology enabled us to have brighter cities with only a modest increase in energy use.

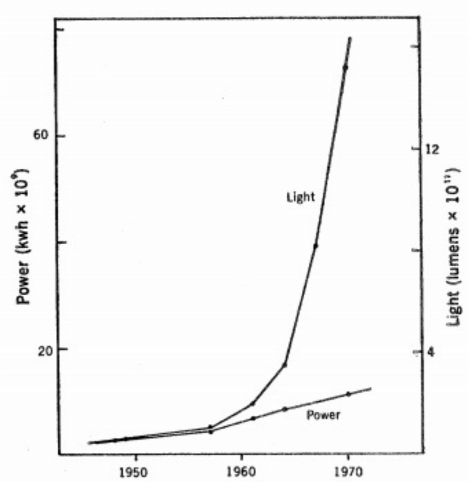


Fig. 5. The growth of power consumption devoted to outdoor public lighting (bottom curve), and the light (top curve) produced by that power, for the past 22 years.

Chicago went fully onboard with high-pressure sodium lights immediately after the OPEC embargo. In November 1973, Mayor Daley requested money for the change. In December the *Tribune* reported that his plan would make Chicago "the first large U.S. city to have sodium vapor lamps on all residential streets"–plausible, given how new the technology was–replacing the "85,000 harsh metallic-blue mercury vapor streetlights on all residential streets with more cheerful, brighter, gold-colored sodium vapor lamps." In 1976 the city started installing them on its arterial streets.

But as you may have noticed, "cheerful" and "gold-colored" were perhaps an exaggeration. And the city was warned: *Trib* columnist Jack Mabley spoke with an artist from Vancouver, Ralf Kelman, who had watched his city switch from incandescent lighting to the mercury-vapor lights then common in Chicago. "These [mercury vapor] lights are intense, but they are metallic and harsh. They distort colors and intensity shadows," Kelman said. "They destroy a good mood. A woman goes out in a red dress. She feels great. This light washes her out, turns her dress to mud red. It's ghostly. It produces gloom."

Kelman was barely more enthusiastic about high-pressure sodium lighting. "Well, that will make an orange city," he said. "And when I say orange, I mean orange. It washes everything with orange. It's the lesser evil… better than blue. It's warmer."

It fell on deaf ears in Chicago. Toronto listened, and stuck with incandescent lamps (even as its suburbs went to HPS) until cooler metal halide lamps were rolled out. You can see how metal halide light changes the city in this picture from astronaut Chris Hadfield.

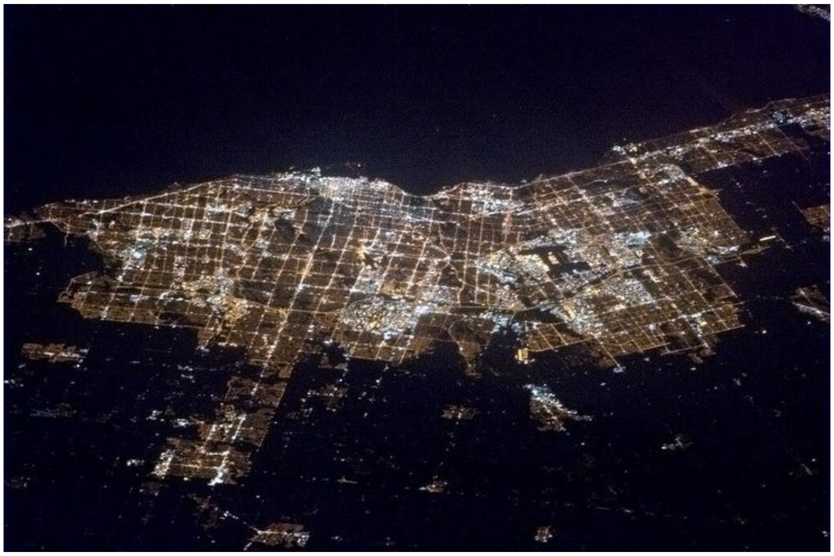


PHOTO: CHRIS HADFIELD/NASA

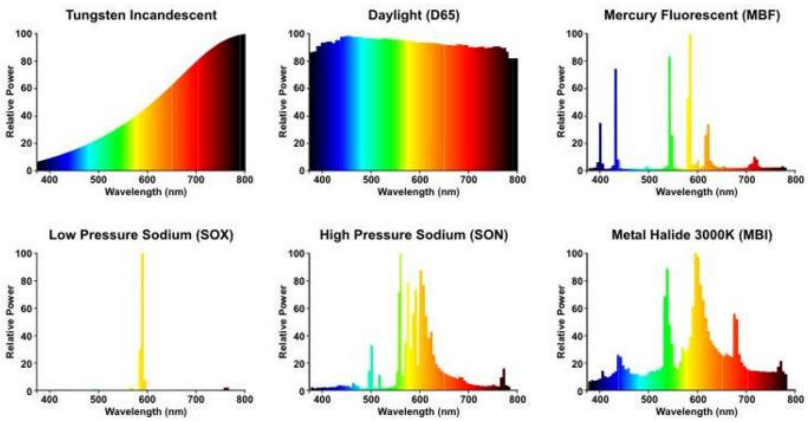
Another skeptic was the *Tribune*'s legendary architecture critic Paul Gapp. "[Sodium vapor lamps] are more than twice as bright as the blue mercury vapor lights which they would replace and produce an artificial daylight effect whose peculiar offensiveness must be visually experienced to be understood. How can it be said?" Gapp wrote in 1974. "One looks at the eerie, ominous quality of sodium vapor illumination and thinks of the bizarre paintings of Hieronymous Bosch, the frightening futurism of Stanley Kubrick's *A Clockwork Orange*, and other nightmares."

Gapp called up Toronto officials to figure out how and why they banned sodium-vapor lights. It was indeed Kelman, who simply reached out to the city when he found out they were planning on switching to high-pressure sodium, and his arguments caught on, dovetailing with Riegel's observations about crime. "The general, popular reaction in our city was that these orange lights smacked of a police state or a big security system," an assistant to the mayor told Gapp. "The people liked the old [incandescent] lights because they had a pleasant, warm, human quality and did not give the city the look of an armed camp."

"This was an example of the whole citizen access thing we have here," the assistant continued, "which, I guess, is different from what you have in American cities."

Gapp continued railing against the lights, writing that they "have given Chicago the eerie, ominous, after-dark look of a concentration camp" (1976), "grotesque and unnecessary" (in a later 1976 column about how Evanston had shot down the sodium vapor lamps), "quickly took on a symbolism synonymous with danger," "brand the city as one big combat zone," "as a maker of judgments on how our streetscape should look after dark, Daley is strictly a vulgarian" (1976), "the prison yard look" (1978), "sickening" (1980), "absurdly bright and ugly" (1983).

The observations of Kelman, the artist, and Gapp, the architecture critic, have backing in science. Three years ago, Dave Kendricken of No Film School looked at the future of movies in the context of Los Angeles switching from high-pressure sodium to LED, reproducing this spectral power distribution chart from Lamptech:



Daylight obviously has the widest spectrum, and it's given a Color Rendering Index of 100–a perfect score. How all other lights render colors are compared to the CRI of daylight.

Mercury vapor (not shown above), the lights that Kelman hated in Vancouver, have a CRI in the 20s. His example of the woman in the red dress may have been a bit dramatic, but he's right about the colors: "While the light source itself appears to be bluish-white, there is a deficiency of long wavelength radiation and most objects appear to have distorted colors. Blue, green, and yellow are emphasized; orange and red appear brownish."

Incandescent lights, which Kelman prevailed on Toronto to keep, reproduce colors very well, and have a CRI near 100, with a wide, warm spectrum, hence the mayoral assistant's description of their "pleasant, warm, human quality." But they're inefficient, so Toronto switched to metal halide when the technology became available. It doesn't offer as wide a spectrum as incandescent, but its CRI is in the 60s to 80s, "suitable for commercial areas," which is why car dealerships use metal halide–color rendering is critical to selling cars.

Typical high-pressure sodium lights have a CRI in the 20s; there are improved versions (CRI of 65 or 70) that you can see in these photos from Stockholm that cover a breadth of streetlights, but they're less efficient. They reproduce colors badly, so a lot of people hate them, but they generate a lot of light very efficiently.

(Low-pressure sodium lights are monochromatic and *don't* render colors, as you can see in this picture, so their use is uncommon. Hilo, Hawaii, and Flagstaff, Arizona, both near major observatories, make heavy use of low-pressure sodium lights because the fact that they're monochromatic allows astronomers to filter the light, and because it creates less sky glow. As a result, Flagstaff is well regarded among dark-sky proponents, with 60 percent of their streetlights being low-pressure sodium.)

Now LEDs are almost certainly the future of street lights. Looks better, right?

PHOTO: CITY OF CHARLOTTE, FLORIDA

It's a bit more complicated than that. High-pressure sodium lamps produce very little blue light. LEDs–or at least some of the ones that cities started to install as street lights–produce a lot. And even though it arguably looks a lot better, once they started going in, people started to think that maybe a wider spectrum wasn't what we wanted. Think about how people use light at different times of day:

> An incandescent bulb has a color temperature of 2400K, which means it contains far less blue and far more yellow and red wavelengths. Before electric light, we burned wood and candles at night; this artificial light has a [color temperature] of about 1800K, quite yellow/red and almost no blue. What we have now is very different.

High-pressure sodium is around 2200K, in between fire and incandescent light. The first round of LED streetlights had color temperatures between 4000K and 5000K–cool and blue, like the fluorescent lights lots of us work under, and closer to daylight–because lower temperatures are less energy efficient.

LEDs started becoming popular as researchers were looking into the effects of artificial lighting on the body. There's a reason the lights we use during the daytime are cool, but they may not be suited for nighttime:

> Blue wavelengths—which are beneficial during daylight hours because they boost attention, reaction times, and mood—seem to be the most disruptive at night. And the proliferation of electronics with screens, as well as energy-efficient lighting, is increasing our exposure to blue wavelengths, especially after sundown.
>
> [snip]
>
> While light of any kind can suppress the secretion of melatonin, blue light at night does so more powerfully. Harvard researchers and their colleagues conducted an experiment comparing the effects of 6.5 hours of exposure to blue light to exposure to green light of comparable brightness. The blue light suppressed melatonin for about twice as long as the green light and shifted circadian rhythms by twice as much (3 hours vs. 1.5 hours).

The American Medical Association noted this research, and called for cities to install LED streetlights of 3000K or less, though there's been pushback from the Municipal Solid-State Streetlighting Consortium, which argues that the lower light output of LEDs makes up for its higher blue content.

Chicago followed the AMA's guidelines and is getting 3000K LEDs. It's close to the 2700K lights the city of Davis, California, got after its citizens revolted against the "prison lighting" of their new 4000K LEDs, or Phoenix, which switched to warmer lights under public pressure, not the only city to field complaints about cool-temperature lights. Again, Ralf Kelman, the artist, called it: “And when I say orange, I mean orange. It washes everything with orange. It’s the lesser evil… better than blue. It’s warmer.”

What does the difference look like? On the left is a high-pressure sodium light. On the right is a 4000K light. In the middle is approximately what we’re getting.

PHOTO: CITY OF TEMPE, ARIZONA

It’s a compromise. Incandescent lights are beloved because they’re warm and their color-rendering is excellent, so they feel natural and have a good warmth for nighttime lighting–but, they’re extremely inefficient. High-pressure sodium lights are warm, but their color rendering is terrible (“the ugliest light known to the cinematographer”). LED streetlights have much better color rendering, but it’s unnatural to have the night lit like the day–in ways we can perceive, and perhaps in ways we can’t. Chicago’s 3000K LEDs are an attempt to have it both ways: familiar enough in rendering colors to not look like “frightening futurism,” warm enough to be appropriate for the night. Somewhere, Paul Gapp is nodding.

/

AFFIDAVIT

I, Paula Maville of Lebanon, New Hampshire, do state the following to be true and accurate to the best of my knowledge and belief:

1. I am the Deputy City Manager of the City of Lebanon, New Hampshire.
2. I was born and raised in Lebanon, NH where I graduated from Lebanon High School in 1985, and I have lived here ever since.
3. I began working for the City in June, 1986 and have been continuously employed by the City ever since, including 22+ years working in the Planning Department.
4. While the City may have had a different type of street light in the past, to the best of my knowledge, recollection, and belief, the vast majority of street lights in the City of Lebanon are a yellow-toned street light (which from my understanding is a high pressure sodium light), and have been since I began working for the City in 1986 (and perhaps earlier).

Signature: [signature] Date: December 6, 2019

STATE OF NEW HAMPSHIRE
COUNTY OF GRAFTON, SS.

Subscribed and sworn to before me, this 6 day of December 2019, by the above-named Paula Maville, known to me as such and acknowledged that it was her free act and deed.

[signature]
Justice of the Peace / Notary Public (Affix Seal)
My commission expires: 2/7/2023

KRISTIN M. KENNISTON
MY COMMISSION EXPIRES FEB. 7, 2023
NOTARY PUBLIC
NEW HAMPSHIRE

AFFIDAVIT

I, Timothy J. McNamara of Lebanon, New Hampshire, do state the following to be true and accurate to the best of my knowledge and belief:

1. I am an elected City Councilor and the Mayor of the City of Lebanon, New Hampshire.
2. From birth I was raised in Lebanon, NH where I graduated from Lebanon High School in 1974 and more specifically, I grew up in the village of West Lebanon in what is now part of Ward 1 of the City.
3. I left Lebanon to attend Dartmouth College in 1974 in neighboring Hanover, NH.
4. I lived in nearby Norwich, VT from 1979 to 1987.
5. I returned to live in Lebanon in 1987, and with the exception of a few months in 2007, have lived there ever since.
6. While the City may have had more mercury vapor street lights at some point in its past and in my youth and still is paying for a few from Liberty today, to the best of my knowledge, recollection, and belief the vast majority of street lights in the City of Lebanon have been high pressure sodium vapor street lights since the mid-1990s or earlier.

Signature: ______________________ Date: December 6, 2019

STATE OF NEW HAMPSHIRE
COUNTY OF GRAFTON, SS.

Subscribed and sworn to before me, this 6th day of December 2019, by the above-named Timothy J. McNamara, known to me as such and acknowledged that it was his free act and deed.

____
Justice of the Peace / ~~Notary Public~~ (Affix Seal)
My commission expires: 1-15-2022

GRANITE STATE ELECTRIC COMPANY

OUTDOOR LIGHTING SERVICE RATE M

AVAILABILITY

Public Lighting

Available for Street or Highway lighting to any town, city or fire district.

Private Lighting

Available to private customers for outdoor lighting where necessary fixtures can be supported on existing poles and where such service can be supplied from existing street light circuits.

In special circumstances outlined in the rate portion below, the Company will install poles for certain size lights.

RATE

Size of Street Light Lumens	Annual Price Per Unit
Incandescent Lights	
1000	$ 25.00
2500	35.00
Mercury Vapor Lights	
3500	40.00
7000	55.00 *
21000	100.00 *
60000	210.00 *

The above prices are for street lights supplied with electricity through overhead conductors. The annual price of each size of street lights, supplied with electricity through underground conductors, will be determined by adding $30.00 to the price of such size as set forth in the above schedule.

* For private lighting the Company will furnish wood poles for this size light for an additional $24.00 per year provided such light is not more than 150 feet from Company's overhead distribution system, and permanent easements for poles on private property are furnished by the Customer at no charge.

Traffic protection for poles on private property must also be provided by the Customer at the Company's request.

Effective July 1, 1967.

GRANITE STATE ELECTRIC COMPANY

OUTDOOR LIGHTING SERVICE RATE M

AVAILABILITY

Public Lighting

Available for Street or Highway lighting to any town, city or fire district.

Private Lighting

Available to private customers for outdoor lighting where necessary fixtures can be supported on existing poles and where such service can be supplied from existing street light circuits.

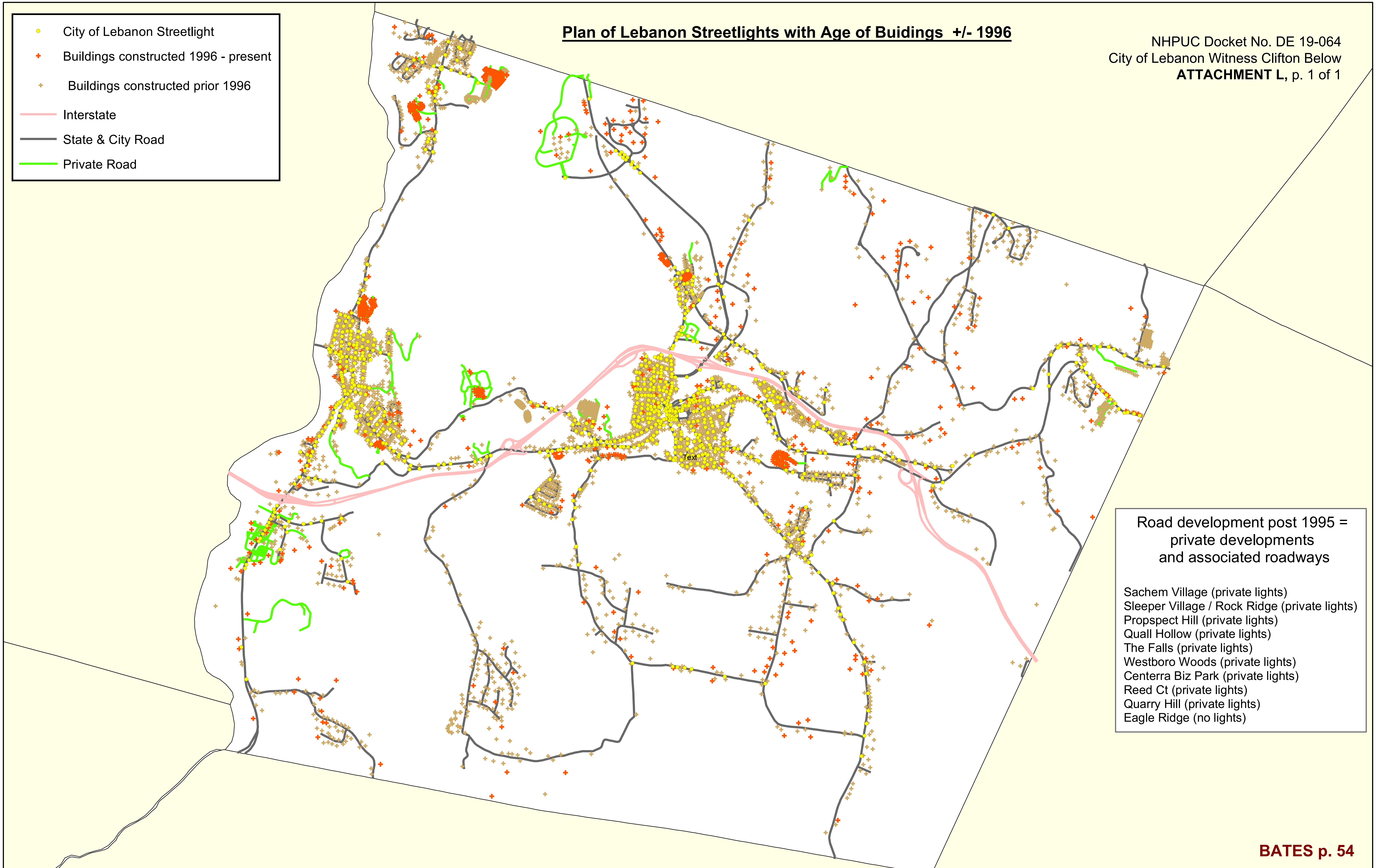
In special circumstances outlined in the rate portion below, the Company will install poles for certain size lights.

RATE

Size of Street Light Lumens	Annual Price Per Unit
Incandescent Lights	
1000	$ 25.00
2500	35.00
Mercury Vapor Lights	
3500	40.00
7000	55.00 *
21000	100.00 *
60000	210.00 *
Sodium Vapor Lights	
25000	105.00
47000	126.00
47000 (Floodlight)	144.00
130000	234.00
130000 (Floodlight)	276.00

The above prices are for street lights supplied with electricity through overhead conductors. The annual price of each size of street lights, supplied with electricity through underground conductors, will be determined by adding $30.00 to the price of such size as set forth in the above schedule.

Effective February 1, 1973.


City of Lebanon Streetlight
Buildings constructed 1996 - present
Buildings constructed prior 1996
Interstate
State & City Road
Private Road
Plan of Lebanon Streetlights with Age of Buidings +/- 1996
NHPUC Docket No. DE 19-064
City of Lebanon Witness Clifton Below
ATTACHMENT L, p. 1 of 1
Text
Road development post 1995 = private developments and associated roadways
Sachem Village (private lights)
Sleeper Village / Rock Ridge (private lights)
Propspect Hill (private lights)
Quall Hollow (private lights)
The Falls (private lights)
Westboro Woods (private lights)
Centerra Biz Park (private lights)
Reed Ct (private lights)
Quarry Hill (private lights)
Eagle Ridge (no lights)
BATES p. 54

clifton.below@gmail.com

From:	Heather Tebbetts <Heather.Tebbetts@libertyutilities.com>
Sent:	Friday, May 25, 2018 12:37 PM
To:	clifton.below@gmail.com; Melissa Samenfeld
Cc:	'Montgomery, Tad'; 'Goodwin, Mark'; Jill Fitzpatrick
Subject:	RE: Undepreciated value for existing streetlights to convert to LED
Attachments:	City of Lebanon Street Light - Plant Accounting Records.xlsx
Flag Status:	Flagged

Good afternoon.

Please the attached document from our plant accounting records, it's from mid-2017. We can give you an update in the next couple of weeks, but we are unable to by the end of today. Understand that we are billing you for 880 lights and we only have 335 in our plant records. If the information had come over from Grid correctly, you would be paying for the undepreciated value of 880 lights, plus cost of removal of 880 lights.

The numbers in column C are from Grid and we don't know what they represent. We assume they may be types of lights, but have nothing to confirm. Some items in column B have notes so you can tell what they are. We don't have information on the direct embedded fiberglass poles, so we have left the poles are in the list (lines 181 and 182) as a proxy.

If you decide you want to purchase your own bracket, that may cause you to be a pole attacher as the rules provide that Puc 1302.01 "Attaching entity" means a natural person or an entity with a statutory or contract right to attach a facility of any type to a pole, including, but not limited to, telecommunications providers, cable television service providers, incumbent local exchange carriers, excepted local exchange carriers, wireless service providers, information service providers, electric utilities, and governmental entities. You would be subject to the costs for pole attachers for the brackets.

As for the removal of the fixtures, I need to find out if we would allow you to remove our property.

Missy will look into the recycling/disposal of the used fixture to find out what exactly the process is.

Have a good weekend.

Heather Tebbetts | Liberty Utilities (New Hampshire**) |** Senior Analyst, Rates & Regulatory Affairs
P: 603-216-3563 | C: 603-___-____ | E: Heather.Tebbetts@libertyutilities.com

	A	B	C	D	E	F	G	H	I
1									
2									
3						Values			
4	**Asset Class ID**	**Location ID**	**Asset Description**	**Place in Service Date**	**Fully Depreci**	**Sum of Qty**	**Sum of Cost Basis**	**Sum of LTD Depreciat**	**Sum of Net Book Value**
5	**8830-3730**	**LEBANON**	1973003185	**6/1/1973**	Y	1	371.05	371.05	0.00
6			1973003192	**6/1/1973**	Y	1	110.51	110.51	0.00
7			1973003197	**6/1/1973**	Y	1	8.94	8.94	0.00
8			1973003199	**6/1/1973**	Y	1	14.77	14.77	0.00
9			1973003262	**6/1/1973**	Y	1	35.39	35.39	0.00
10			1979001593	**6/1/1979**	Y	1	19.33	19.33	0.00
11			1980001602	**6/1/1980**	Y	1	60.25	60.25	0.00
12			1982002210	**6/1/1982**	Y	1	863.19	863.19	0.00
13			1983001668	**6/1/1983**	Y	1	919.04	919.04	0.00
14			1984001316	**6/1/1984**	Y	1	408.45	408.45	0
15			1984001319	**6/1/1984**	Y	1	518.9	518.90	0
16			1984001337	**6/1/1984**	Y	4	963.01	963.01	0.00
17			1985001614	**6/1/1985**	Y	1	294.44	294.44	0
18			1985001619	**6/1/1985**	Y	1	2822.03	2,822.03	0
19			1985001628	**6/1/1985**	Y	1	631.53	631.53	0
20			1985001648	**6/1/1985**	Y	1	24562.62	24,562.62	0
21			1986001593	**6/1/1986**	Y	1	137.65	137.65	0
22			1986001594	**6/1/1986**	Y	1	76.08	76.08	0
23			1986001598	**6/1/1986**	Y	1	1354.21	1,354.21	0
24			1986001608	**6/1/1986**	Y	1	212.46	212.46	0
25			1986001620	**6/1/1986**	Y	1	1604.97	1,604.97	0
26			1986001624	**6/1/1986**	Y	1	1646.12	1,646.12	0
27			1987001696	**6/1/1987**	Y	1	528.57	528.57	0
28			1987001698	**6/1/1987**	Y	1	710.59	710.59	0
29			1987001705	**6/1/1987**	Y	1	283.58	283.58	0
30			1987001721	**6/1/1987**	Y	1	3307.18	3,307.18	0
31			1988001265	**6/1/1988**	Y	1	275.71	275.71	0
32			1988001285	**6/1/1988**	Y	1	2316.82	2,316.82	0
33			1989001397	**6/1/1989**	Y	1	1,452.76	1,374.28	78.48
34			1989001404	**6/1/1989**	Y	1	964.71	912.60	52.11
35			1989001406	**6/1/1989**	Y	1	278.73	263.67	15.06
36			1989001411	**6/1/1989**	Y	1	485.32	459.10	26.22
37			1989001423	**6/1/1989**	Y	1	3,574.25	3,381.17	193.08
38			1990001490	**6/1/1990**	Y	1	346.91	308.84	38.07
39			1990001492	**6/1/1990**	Y	1	1,406.25	1,251.93	154.32
40			1990001497	**6/1/1990**	Y	1	1,955.20	1,740.64	214.56
41			1990001499	**6/1/1990**	Y	1	442.47	393.91	48.56
42			1990001510	**6/1/1990**	Y	1	1,497.54	1,333.20	164.34
43			1990001524	**6/1/1990**	Y	1	3,905.20	3,476.64	428.56
44			1990001528	**6/1/1990**	Y	1	834.58	742.99	91.59
45			1991003075	**6/1/1991**	Y	1	452.32	452.32	0.00
46			1991003077	**6/1/1991**	Y	1	1,064.64	891.31	173.33
47			1991003082	**6/1/1991**	Y	1	4,507.20	3,773.40	733.8
48			1991003084	**6/1/1991**	Y	1	1,082.85	906.56	176.29
49			1991003091	**6/1/1991**	Y	1	1,528.86	1,279.95	248.91
50			1991003103	**6/1/1991**	Y	1	4,819.92	4,035.21	784.71
51			1991003105	**6/1/1991**	Y	1	145.19	121.55	23.64
52			1991003113	**6/1/1991**	Y	1	4,626.40	3,873.20	753.20
53			1991003117	**6/1/1991**	Y	1	2,348.80	1,966.40	382.40
54			1992002641	**6/1/1992**	Y	1	154.95	154.95	0.00
55			1992002645	**6/1/1992**	Y	1	2,654.40	2,090.11	564.29
56			1992002647	**6/1/1992**	Y	1	794.92	625.93	168.99
57			1992002650	**6/1/1992**	Y	1	286.71	225.76	60.95
58			1992002659	**6/1/1992**	Y	1	2,733.50	2,733.50	0.00
59			1992002667	**6/1/1992**	Y	1	2945.35	2,319.20	626.15
60			1992002670	**6/1/1992**	Y	1	1420.02	1,118.14	301.88
61			1993000312	**6/1/1993**	Y	1	4,261.56	3,500.88	760.68
62			1993010112	**6/1/1993**	Y	1	1,348.81	1,348.81	0.00
63			1993010120	**6/1/1993**	Y	1	8,804.62	7,233.03	1,571.59
64			1993010124	**6/1/1993**	Y	1	4,394.61	3,610.19	784.42
65			1993010130	**6/1/1993**	Y	1	2251.63	1,729.26	522.37
66			1993019473	**7/1/1993**	Y	1	1,059.78	875.43	184.35
67			1994001054	**1/1/1994**	Y	1	3,797.85	3,267.65	530.20
68			1994001060	**1/1/1994**	Y	1	3585.95	2,893.52	692.43
69			1994002093	**2/1/1994**	Y	1	1,470.86	1,470.86	0.00
70			1994002097	**2/1/1994**	Y	1	3,599.15	3,111.49	487.66
71			1994003481	**3/1/1994**	Y	1	534.79	436.10	98.69
72			1994004610	**4/1/1994**	Y	1	**0.12**	0.12	0.00
73			1995010038	**6/1/1995**	Y	1	0.81	0.81	0.00
74			1995010039	**5/1/1995**	Y	1	3,936.98	3,936.98	0.00
75			1995010040	**4/1/1995**	Y	1	2,835.34	2,371.06	464.28
76			1995010041	**4/1/1995**	Y	1	2,959.18	2,474.61	484.57
77			1995010042	**4/1/1995**	Y	1	4549.38	3,804.42	744.96
78			1995010043	**5/1/1995**	Y	1	1461.42	1,461.42	0
79			1995013555	**9/1/1995**	Y	1	2.75	2.34	0.41
80			1996013657	**9/1/1996**	Y	1	3,193.68	3,335.78	-142.10
81			1996013658	**5/1/1996**	Y	1	12,464.87	10,739.60	1,725.27
82			1996013659	**5/1/1996**	Y	1	1,186.38	1,022.18	164.20
83			1996013660	**5/1/1996**	Y	1	1,972.78	1,699.77	273.01
84			1996013661	**5/1/1996**	Y	1	5,961.69	5,136.55	825.14

	A	B	C	D	E	F	G	H	I
85	**8830-3730**	**LEBANON**	1996013662	**9/1/1996**	Y	1	7286.79	6,408.21	878.58
86			1996016122	**1/1/1996**	Y	1	0.47	0.47	0.00
87			1996016124	**3/1/1996**	Y	1	1,755.28	1,496.74	258.54
88			1997018057	**5/1/1997**	Y	1	22.84	20.22	2.62
89			1997018058	**5/1/1997**	Y	1	3,084.73	2,733.60	351.13
90			1997018059	**7/1/1997**	N	**1**	**13,407.22**	11,882.12	1,525.10
91			1997018060	**5/1/1997**	Y	1	6,438.36	5,705.53	732.83
92			1997018061	**2/1/1997**	Y	1	1,672.89	1,459.96	212.93
93			1997018062	**7/1/1997**	N	1	5266.17	4,667.17	**599.00**
94			1997018063	**3/1/1997**	Y	1	1227.86	1,077.09	150.77
95			1998014535	**1/1/1998**	N	1	5,120.81	4,407.72	713.09
96			1998014536	**1/1/1998**	N	1	2,433.05	2,094.30	338.75
97			1998014537	**1/1/1998**	N	1	1,628.77	1,401.94	226.83
98			1998014538	**1/1/1998**	N	1	2,522.42	2,171.24	351.18
99			1998014539	**1/1/1998**	N	1	2,906.16	2,501.54	404.62
100			1998014540	**1/1/1998**	N	1	2,104.66	1,811.54	293.12
101			1998014836	**1/1/1998**	N	1	1,263.68	1,087.66	176.02
102			1999022553	**11/1/1999**	N	1	6,076.32	5,087.98	988.34
103			1999022554	**11/1/1999**	N	1	1,461.17	1,223.43	237.74
104			1999023488	**11/1/1999**	N	1	171.15	143.28	27.87
105			1999023489	**11/1/1999**	N	1	4,446.69	3,723.36	723.33
106			1999023490	**9/1/1999**	N	1	379.75	317.95	61.80
107			1999023491	**11/1/1999**	N	1	1,282.81	1,074.17	208.64
108			1999023492	**4/1/1999**	N	1	1,933.68	1,619.14	314.54
109			1999023493	**11/1/1999**	N	1	392.94	328.99	63.95
110			2000022508	**2/1/2000**	N	1	4,985.96	4,063.03	922.93
111			2000022509	**2/1/2000**	N	1	7,356.36	5,994.69	1,361.67
112			2000022510	**1/1/2000**	N	1	884.28	720.56	163.72
113			2000022511	**4/1/2000**	N	1	1,548.69	1,261.92	286.77
114			2000022512	**4/1/2000**	N	1	3,591.00	2,926.28	664.72
115			2001021415	**2/1/2001**	N	1	2,012.76	1,594.12	418.64
116			2001021416	**5/1/2001**	N	1	5,019.72	3,975.85	1,043.87
117			2001021417	**2/1/2001**	N	1	2,162.06	1,712.45	449.61
118			2001021418	**1/1/2001**	N	1	2,987.59	2,366.31	621.28
119			2001024523	**6/1/2001**	N	1	2,036.04	1,612.67	423.37
120			2001024524	**12/1/2001**	N	1	550.58	436.02	114.56
121			2002010649	**2/1/2002**	N	1	293.40	225.23	68.17
122			2002010650	**2/1/2002**	N	1	3,587.61	2,753.50	834.11
123			2002010651	**2/1/2002**	N	1	1,919.10	1,473.01	446.09
124			2002010652	**1/1/2002**	N	1	4,261.88	3,271.06	990.82
125			2002010653	**2/1/2002**	N	1	3,377.73	2,592.50	785.23
126			2002020403	**7/1/2002**	N	1	2,554.64	1,960.73	593.91
127			2002021497	**10/1/2002**	N	1	508.94	390.64	118.30
128			2003010035	**3/1/2003**	N	1	1,355.23	1,003.15	352.08
129			2003010036	**3/1/2003**	N	1	1,792.40	1,326.79	465.61
130			2003010037	**3/1/2003**	N	1	2,771.61	2,051.72	719.89
131			2003015713	**6/1/2003**	N	1	879.18	650.83	228.35
132			2003018822	**8/1/2003**	N	1	1,210.92	896.38	314.54
133			2003019389			1	888.54	657.73	230.81
134			ST LIGHT, ROADWAY, HPS, 250W	**5/21/2015**	N	1	98.95	8.64	90.31
135			STREET LIGHT, HORIZ ROADWAY, CUTOFF	**1/14/2015**	N	4	2,147.33	216.98	1,930.35
136				**1/31/2015**	N	5	3,292.64	332.65	2,959.99
137				**4/28/2015**	N	3	2,840.30	256.24	2,584.06
138			STREET LIGHT, HORIZONTAL ROADWAY	**9/1/2015**	N	1	982.57	70.99	911.58
139			STREET LIGHT, HPS FLOOD 400W	**9/1/2015**	N	2	5,412.69	390.60	5,022.09
140			STREET LIGHT, HPS, 100W	**6/30/2015**	N	2	10,698.85	965.19	9,733.66
141			STREET LIGHT, HPS, ROADWAY 100W			1	979.02	70.60	908.42
142			STREET LIGHT, ROADWAY 50W	**9/8/2015**	N	1	1,322.94	95.41	1,227.53
143			STREET LIGHT, ROADWAY HORIZ	**7/24/2013**	N	2	5,894.89	978.43	4,916.46
144			STREET LIGHT, ROADWAY HPS	**3/31/2015**	N	1	537.41	50.42	486.99
145			STREET LIGHT, ROADWAY, HPS, 50W	**10/12/2015**	N	3	7,777.89	533.27	7,244.62
146			Work Order Addition	**1/1/2002**	N	2	1,454.00	1,115.94	338.06
147				**1/1/2003**	N	3	9,620.29	7,121.39	2,498.90
148				**1/1/2004**	N	1	300.03	212.88	87.15
149					Y	3	6,039.50	6,039.50	0.00
150				**1/1/2005**	N	23	7,725.10	5,210.94	2,514.16
151				**1/1/2006**	N	19	11,555.60	7,349.28	4,206.32
152					Y	1	322.18	322.18	0.00
153				**1/1/2007**	N	22	6,879.92	4,115.61	2,764.31
154				**1/1/2008**	N	3	1,006.22	546.56	459.66
155				**1/1/2009**	N	8	7,493.38	3,684.15	3,809.23
156				**1/1/2010**	N	9	9,780.28	4,241.41	5,538.87
157				**1/1/2011**	N	15	87,335.37	31,026.53	56,308.84
158				**1/1/2012**	N	6	8,238.93	2,754.74	5,484.19
159	**8830-3731**	**LEBANON**	1973003223	**6/1/1973**	Y	1	401.98	401.98	0.00
160			1973003224	**6/1/1973**	Y	1	4,400.88	4,400.88	0.00
161			1973003230	**6/1/1973**	Y	1	785.40	785.40	0.00
162			1976003135	**6/1/1976**	Y	1	10.25	10.25	0.00
163			1977002470	**6/1/1977**	Y	1	59.00	59.00	0.00
164			1979001602	**6/1/1979**	Y	1	152.80	152.80	0.00
165			1980001610	**6/1/1980**	Y	1	184.14	184.14	0.00
166			1981001438	**6/1/1981**	Y	1	65.54	65.54	0.00
167			1982002172	**6/1/1982**	Y	1	243.84	243.84	0.00
168			1983001624	**6/1/1983**	Y	1	254.98	254.98	0.00

	A	B	C	D	E	F	G	H	I
169	**8830-3731**	**LEBANON**	1984001306	**6/1/1984**	Y	1	310.80	310.80	0.00
170			1985001602	**6/1/1985**	Y	1	381.16	381.16	0.00
171			1986001580	**6/1/1986**	Y	1	631.80	631.80	0.00
172			1987001679	**6/1/1987**	Y	1	1,263.08	1,263.08	0.00
173			1988001251	**6/1/1988**	Y	1	734.58	734.58	0.00
174			1989001384	**6/1/1989**	Y	1	116.28	110.00	6.28
175			1990001479	**6/1/1990**	Y	1	916.64	816.05	100.59
176			1991003064	**6/1/1991**	Y	1	544.68	456.00	88.68
177			1998023701	**6/1/1998**	Y	1	7,126.93	7,126.93	0.00
178			1999023486	**6/1/1999**	N	1	2,608.12	2,263.63	344.49
179			2000022507	**4/1/2000**	Y	1	4919.74	4,919.74	0
180			2000025882	**6/1/2000**	N	1	661.11	538.77	122.34
181			ST LGT BKT 12' AL WOOD POLE 120V	**2/25/2013**	N	9	1,745.78	284.78	1,461.00
182			ST LGT BKT 30" AL FLOOD TWIN WOD POL120V	**10/26/2012**	N	1	2,475.19	728.39	1,746.80
183			ST LGT BKT 6' AL WOOD POLE 120V	**7/30/2013**	N	1	701.03	112.86	588.17
184			ST LGT LUM RDWY HOR 50WHPS 120VREA GRY	**7/30/2013**	N	1	103.06	22.97	80.09
185			ST LGT LUM RDWY HOR CO 100WHPS 120VREAGY	**2/25/2013**	N	9	132.94	35.68	97.26
186			ST LGT LUM SCURTY FLD 400WHPS 120VREGGRY			1	3,162.77	930.64	2,232.13
187			Work Order Addition	**1/1/2002**	N	1	4,830.24	3,707.24	1,123.00
188				**1/1/2003**	N	1	1,448.52	1,072.31	376.21
189				**1/1/2005**	N	1	110.69	74.60	36.09
190				**1/1/2006**	N	6	13,979.81	8,883.01	5,096.80
191				**1/1/2008**	N	2	2,162.50	1,174.73	987.77
192				**1/1/2009**	N	1	1,092.79	534.22	558.57
193				**1/1/2011**	N	6	3,564.17	1,266.21	2,297.96
194	**Grand Total**					**335**	**564,244.72**	**385,738.75**	**178,505.97**
195						335			
196									
197									
198			average 2017 cost of bracket - deduction from undepreciated value				total salvage		
199						169.95	56,933.25		
200									
201						total value to charge Lebanon			
202						$ 121,572.72	$ 362.90		
203									
204						conversion cost			
205						$ 16,750.00			
206									
207						total			
208						$ 138,322.72			

From: Nichole Thibodeau <Nichole.Thibodeau@libertyutilities.com>
Sent: Wednesday, November 6, 2019 2:21 PM
To: Montgomery, Tad <Montgomery@lebanonnh.gov>; Jill Fitzpatrick <Jill.Fitzpatrick@libertyutilities.com>
Cc: Donison, James <donison@lebanonnh.gov>; Heather Tebbetts <Heather.Tebbetts@libertyutilities.com>
Subject: RE: Lebanon Streetlight Removal

Good Afternoon Tad

In the file attached you have column J which provides the net book value. Column E, Extended Asset Description has descriptions of lights, but due to the fact that the data coming over from National Grid during the transfer was incomplete, this column may not be correct. When the transfer occurred back in 2012, we received incomplete information, thus we only have approximately 335 lights on our books for all accounts in Lebanon.

To calculate an undepreciated value of the lights we have taken the oldest fixtures on the books up to 76 and summed the total undepreciated value, as seen on line 64 in column J in the amount of $12,284.50. Please note the information does not include brackets so assuming there's undepreciated value for them, you are not being charged for it.

I hope this is helpful, if you have any further questions please let me know.

Nichole

Nichole Thibodeau | Liberty Utilities (New Hampshire**) |** Electric Service Rep
P: 603-952-2919 | C: 603-___-____ | E: Nichole.Thibodeau@libertyutilities.com

---

From: Montgomery, Tad [mailto:Montgomery@lebanonnh.gov]
Sent: Friday, November 1, 2019 12:18 PM
To: Nichole Thibodeau <Nichole.Thibodeau@libertyutilities.com>; Jill Fitzpatrick <Jill.Fitzpatrick@libertyutilities.com>
Cc: Donison, James <donison@lebanonnh.gov>; Heather Tebbetts <Heather.Tebbetts@libertyutilities.com>
Subject: Re: Lebanon Streetlight Removal

Dear Nichole,

Could you please provide us with a detailed calculation and explanation of how you-all arrived at the unamortized balance on the fixtures.

Thanks,
Tad Montgomery

From: Nichole Thibodeau <Nichole.Thibodeau@libertyutilities.com>
Sent: Wednesday, October 30, 2019 1:20 PM

To: Montgomery, Tad <Montgomery@lebanonnh.gov>; Jill Fitzpatrick <Jill.Fitzpatrick@libertyutilities.com>
Cc: Donison, James <donison@lebanonnh.gov>; Heather Tebbetts <Heather.Tebbetts@libertyutilities.com>
Subject: RE: Lebanon Streetlight Removal

Good Morning Tad

I have discussed scheduling with the operations supervisor to determine a timeline for us to be able to remove the requested streetlights. We should be able to have these lights removed for you by the end of January 2020.

Of the list you have provided us, 2 of the lights were previously scheduled to be removed and relocated (highlighted on the list below). For the cost purposes of this request I have reduced your removal count to 74.

The unamortized value of the lights comes to $12,284.50. Cost for removals is $50 per light (74 x $50 = $3,700). Total cost due to Liberty Utilities comes to $15,984.50.

Please send your check in the amount of $15,984.50 made payable to Liberty Utilities to:

Liberty Utilities
P.O. Box 909
Londonderry, NH 03053-0909

Important: Please include WR# 301910-01117 on your check.

Also, please sign and return the attached agreement via email or mail to me at:

Liberty Utilities
Nichole Thibodeau
9 Lowell Road
Salem, NH 03079

As soon as we are in receipt of your payment and signed service agreement this request will be released to Operations.

Any questions please do not hesitate to reach out to me.

Regards,
Nichole

Nichole Thibodeau | Liberty Utilities (New Hampshire**) |** Electric Service Rep
P: 603-952-2919 | C: 603-___-____ | E: Nichole.Thibodeau@libertyutilities.com

	A	B	D	E	F	G	H	I	J	N	U
1											
2	Date Added	Asset ID	Asset Description	Extended Asset Description	Asset Class ID	Location ID	Cost Basis	LTD Depreciation Amount	Net Book Value	Place in Servi	Asset Quantity
3	2/7/2012	8830-20854477	1984001337	DISTRIBUTION PLANT: STREETLT ASM S PE-40	8830-3730	LEBANON	481.5	481.5	0	6/1/1984	2
4	2/7/2012	8830-20854495	1984001319	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 1	8830-3730	LEBANON	518.9	518.9	0	6/1/1984	1
5	2/7/2012	8830-20854498	1984001316	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 4	8830-3730	LEBANON	408.45	408.45	0	6/1/1984	1
6	2/7/2012	8830-20854513	1985001619	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 1	8830-3730	LEBANON	2822.03	2,822.03	0	6/1/1985	1
7	2/7/2012	8830-20854534	1985001614	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 4	8830-3730	LEBANON	294.44	294.44	0	6/1/1985	1
8	2/7/2012	8830-20854537	1985001648	DISTRIBUTION PLANT: STREETLT ASM S PE-40	8830-3730	LEBANON	24562.62	24,562.62	0	6/1/1985	1
9	2/7/2012	8830-20854555	1985001628	DISTRIBUTION PLANT: STREETLT ASM S PE-58	8830-3730	LEBANON	631.53	631.53	0	6/1/1985	1
10	2/7/2012	8830-20854573	1986001620	DISTRIBUTION PLANT: STREETLT ASM S PE-40	8830-3730	LEBANON	1604.97	1,604.97	0	6/1/1986	1
11	2/7/2012	8830-20854588	1986001594	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 4	8830-3730	LEBANON	76.08	76.08	0	6/1/1986	1
12	2/7/2012	8830-20854591	1986001593	DISTRIBUTION PLANT: HEAD ASSEM-MV W/EG 1	8830-3730	LEBANON	137.65	137.65	0	6/1/1986	1
13	2/7/2012	8830-20854600	1986001608	DISTRIBUTION PLANT: STREETLT ASM S PE-58	8830-3730	LEBANON	212.46	212.46	0	6/1/1986	1
14	2/7/2012	8830-20854603	1986001598	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 1	8830-3730	LEBANON	1354.21	1,354.21	0	6/1/1986	1
15	2/7/2012	8830-20854867	1986001624	DISTRIBUTION PLANT: STREETLT ASSEM-INCAN	8830-3730	LEBANON	1646.12	1,646.12	0	6/1/1986	1
16	2/7/2012	8830-20854624	1987001705	DISTRIBUTION PLANT: STREETLT ASM S PE-58	8830-3730	LEBANON	283.58	283.58	0	6/1/1987	1
17	2/7/2012	8830-20854627	1987001698	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 1	8830-3730	LEBANON	710.59	710.59	0	6/1/1987	1
18	2/7/2012	8830-20854633	1987001721	DISTRIBUTION PLANT: STREETLT ASM S PE-40	8830-3730	LEBANON	3307.18	3,307.18	0	6/1/1987	1
19	2/7/2012	8830-20854639	1987001696	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 4	8830-3730	LEBANON	528.57	528.57	0	6/1/1987	1
20	2/7/2012	8830-20854675	1988001285	DISTRIBUTION PLANT: STREETLT ASM S PE-40	8830-3730	LEBANON	2316.82	2316.82	0	6/1/1988	1
21	2/7/2012	8830-20854702	1988001265	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 1	8830-3730	LEBANON	275.71	275.71	0	6/1/1988	1
22	2/7/2012	8830-20855140	1989001423	DISTRIBUTION PLANT: STREETLT ASM S PE-40	8830-3730	LEBANON	3574.25	3,381.17	193.08	6/1/1989	1
23	2/7/2012	8830-20855143	1989001397	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 1	8830-3730	LEBANON	1452.76	1,374.28	78.48	6/1/1989	1
24	2/7/2012	8830-20855146	1989001406	DISTRIBUTION PLANT: STREETLT ASM S PE-58	8830-3730	LEBANON	278.73	263.67	15.06	6/1/1989	1
25	2/7/2012	8830-20855194	1989001411	DISTRIBUTION PLANT: STREETLT ASM S PE-95	8830-3730	LEBANON	485.32	459.1	26.22	6/1/1989	1
26	2/7/2012	8830-20855203	1989001404	DISTRIBUTION PLANT: STREETLT ASM S PE-50	8830-3730	LEBANON	964.71	912.6	52.11	6/1/1989	1
27	2/7/2012	8830-20855227	1990001492	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 1	8830-3730	LEBANON	1406.25	1,251.93	154.32	6/1/1990	1
28	2/7/2012	8830-20855233	1990001490	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 1	8830-3730	LEBANON	346.91	308.84	38.07	6/1/1990	1
29	2/7/2012	8830-20855251	1990001510	DISTRIBUTION PLANT: STREETLT ASM S PE-95	8830-3730	LEBANON	1497.54	1,333.20	164.34	6/1/1990	1
30	2/7/2012	8830-20855257	1990001524	DISTRIBUTION PLANT: STREETLT ASM S PE-40	8830-3730	LEBANON	3905.2	3,476.64	428.56	6/1/1990	1
31	2/7/2012	8830-20855293	1990001497	DISTRIBUTION PLANT: STREETLT ASM S PE-25	8830-3730	LEBANON	1955.2	1,740.64	214.56	6/1/1990	1
32	2/7/2012	8830-20855302	1990001499	DISTRIBUTION PLANT: STREETLT ASM S PE-50	8830-3730	LEBANON	442.47	393.91	48.56	6/1/1990	1
33	2/7/2012	8830-20855433	1990001528	DISTRIBUTION PLANT: FLOODLT ASSEM-HP S-5	8830-3730	LEBANON	834.58	742.99	91.59	6/1/1990	1
34	2/7/2012	8830-20855311	1991003091	DISTRIBUTION PLANT: STREETLT ASM S PE-95	8830-3730	LEBANON	1528.86	1,279.95	248.91	6/1/1991	1
35	2/7/2012	8830-20855314	1991003082	DISTRIBUTION PLANT: STREETLT ASM S PE-25	8830-3730	LEBANON	4507.2	3,773.40	733.8	6/1/1991	1
36	2/7/2012	8830-20855320	1991003077	DISTRIBUTION PLANT: HEAD ASSEM-PE CTRL 1	8830-3730	LEBANON	1064.64	891.31	173.33	6/1/1991	1
37	2/7/2012	8830-20855338	1991003103	DISTRIBUTION PLANT: STREETLT ASM S PE-40	8830-3730	LEBANON	4819.92	4,035.21	784.71	6/1/1991	1
38	2/7/2012	8830-20855377	1991003084	DISTRIBUTION PLANT: STREETLT ASM S PE-50	8830-3730	LEBANON	1082.85	906.56	176.29	6/1/1991	1
39	2/7/2012	8830-20855448	1991003113	DISTRIBUTION PLANT: FLOODLT ASSEM-HP S-2	8830-3730	LEBANON	4626.4	3,873.20	753.2	6/1/1991	1
40	2/7/2012	8830-20855475	1991003117	DISTRIBUTION PLANT: FLOODLT ASSEM-HP S-5	8830-3730	LEBANON	2348.8	1,966.40	382.4	6/1/1991	1
41	2/7/2012	8830-20855478	1991003105	DISTRIBUTION PLANT: STREETLT ASSEM-INCAN	8830-3730	LEBANON	145.19	121.55	23.64	6/1/1991	1
42	2/7/2012	8830-20856197	1992002645	DISTRIBUTION PLANT: STREETLT ASM S PE-25	8830-3730	LEBANON	2654.4	2,090.11	564.29	6/1/1992	1
43	2/7/2012	8830-20856200	1992002659	DISTRIBUTION PLANT: STREETLT ASM S PE-40	8830-3730	LEBANON	2733.5	2,733.50	0	6/1/1992	1
44	2/7/2012	8830-20856230	1992002650	DISTRIBUTION PLANT: STREETLT ASM S PE-95	8830-3730	LEBANON	286.71	225.76	60.95	6/1/1992	1
45	2/7/2012	8830-20856233	1992002647	DISTRIBUTION PLANT: STREETLT ASM S PE-50	8830-3730	LEBANON	794.92	625.93	168.99	6/1/1992	1
46	2/7/2012	8830-20856581	1992002667	DISTRIBUTION PLANT: FLOODLT ASSEM-HP S-2	8830-3730	LEBANON	2945.35	2,319.20	626.15	6/1/1992	1
47	2/7/2012	8830-20856587	1992002670	DISTRIBUTION PLANT: FLOODLT ASSEM-HP S-5	8830-3730	LEBANON	1420.02	1,118.14	301.88	6/1/1992	1
48	2/7/2012	8830-20856660	1993010130	DISTRIBUTION PLANT: FLOODLT ASSEM-HP S-2	8830-3730	LEBANON	2251.63	1,729.26	522.37	6/1/1993	1
49	2/7/2012	8830-20856681	1994001060	DISTRIBUTION PLANT: FLOODLT ASSEM-HP S-2	8830-3730	LEBANON	3585.95	2,893.52	692.43	1/1/1994	1
50	2/7/2012	8830-20857388	1995010042	FLOODLT ASSEM-HP S-22000-27500	8830-3730	LEBANON	4549.38	3,804.42	744.96	4/1/1995	1
51	2/7/2012	8830-20857400	1995010043	FLOODLT ASSEM-HP S-50000	8830-3730	LEBANON	1461.42	1,461.42	0	5/1/1995	1
52	2/7/2012	8830-20857190	1995013555	HEAD ASSEM-GROUNDS/METAL POSTS	8830-3730	LEBANON	2.75	2.34	0.41	9/1/1995	1
53	2/7/2012	8830-20857427	1996013661	FLOODLT ASSEM-HP S-22000-27500	8830-3730	LEBANON	5961.69	5,136.55	825.14	5/1/1996	1
54	2/7/2012	8830-20857448	1996013662	FLOODLT ASSEM-HP S-50000	8830-3730	LEBANON	7286.79	6,408.21	878.58	9/1/1996	1
55	2/7/2012	8830-20857454	1997018063	FLOODLT ASSEM-HP S-50000	8830-3730	LEBANON	1227.86	1,077.09	150.77	3/1/1997	1
56	2/7/2012	8830-20857475	1997018062	FLOODLT ASSEM-HP S-22000-27500	8830-3730	LEBANON	5266.17	4,713.91	**552.26**	7/1/1997	1
57	2/7/2012	8830-20858005	1998014540	FLOODLT ASSEM-HP S-50000	8830-3730	LEBANON	5,485.43	4,973.75	511.68	1/1/1998	1
58	2/7/2012	8830-20858011	1998014539	FLOODLT ASSEM-HP S-22000-27500	8830-3730	LEBANON	6,286.93	5,692.38	594.55	1/1/1998	1
59	2/7/2012	8830-20857807	1999023488	HEAD ASSEM-PE CTRL 4200-8600L	8830-3730	LEBANON	3,551.92	3,526.18	25.74	11/1/1999	1
60	2/7/2012	8830-20858041	1999023493	FLOODLT ASSEM-HP S-50000	8830-3730	LEBANON	3,773.71	3,744.79	28.92	11/1/1999	1
61	2/7/2012	8830-20858056	1999022554	FLOODLT ASSEM-HP S-22000-27500	8830-3730	LEBANON	4,841.94	4,797.86	44.08	11/1/1999	1
62	2/7/2012	8830-20858071	2000022512	FLOODLT ASSEM-HP S-22000-27500	8830-3730	LEBANON	6,971.77	6,762.65	209.12	4/1/2000	1
63	2/7/2012	8830-11234572	2000022507	STLGTPOST-METAL OVER 25'	8830-3731	LEBANON	4919.74	4,919.74	0	4/1/2000	15
64							157,701.17		$ 12,284.50		76

Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities

DE 19-064
Distribution Service Rate Case

City of Lebanon (CoL) Data Requests - Set 2

Date Request Received: 9/26/19 | Date of Response: 10/10/19
Request No. CoL 2-3 | Respondent: Heather M. Tebbetts

REQUEST:

Generally referencing proposed rates M, LED-1, and LED-2, there are provisions that reference "the customer paying the undepreciated value of the light installation," or "payment of the undepreciated value of the existing light" for discontinuance or conversion (replacement) of existing lights. Does the "value of the existing light" or the "value of the light installation" refer to the specific light or installation being removed or replaced or the average of the undepreciated costs of all outdoor lights per fixture in service located within the municipality or some other specific geographic area. In other words, exactly how is the "undepreciated value" of existing lights to be determined under these tariffs and is that determination done consistently across Liberty's service area, within each municipality, and for all outdoor lighting customers on a uniform basis, or on a case by case basis that may vary?

RESPONSE:

The undepreciated value of the fixture includes the original installation costs for labor and materials. The Company does not have an average of undepreciated value because, during the changeover from National Grid to Liberty Utilities, the street lighting data in FERC account 373 was incomplete. Therefore, when a customer requests a light to be removed or replaced to install an LED fixture, the Company tries to match the billing information, such as an install date, to its plant accounting records to charge an undepreciated value that is reasonable and appropriate. When there is a request for many lights to be removed or replaced with LED lights, the Company will identify the oldest of the requested lights for which there are records and use the remaining value of those lights as the basis to charge any undepreciated value as to the entire group of requested lights.

Each month, the Company's plant accounting group applies depreciation of all costs in FERC account 373 at the rate of 4.33%, as approved in Docket No. DE 16-383.

Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities

DE 19-064
Distribution Service Rate Case

City of Lebanon (CoL) Data Requests - Set 2

Date Request Received: 9/26/19 | Date of Response: 10/10/19
Request No. CoL 2-4 | Respondent: Heather M. Tebbetts

REQUEST:

Under the proposed LED-1 tariff the customer is to be obligated to pay for an initial term of five years. If at the end of that term the customer requests a discontinuance of a light, the Company proposes that they be required to pay "the undepreciated value of the light installation." If that is the case, would the Company dispose of the light, give it to the customer, or considering that it may have 10 to 15 or more years of useful life, might it place it back into service for the same customer or a different customer requesting such an LED light, with a zero cost basis, while still collecting a rate that assumes recovery of original cost? Please explain how the Company intends to handle such situations.

RESPONSE:

If after the five-year term the customer requests discontinuance of the light, the Company will put the light back into inventory, assuming it still has a remaining life. The recovery of original cost is not calculated over a five-year period. The depreciation is 4.33% annually, thus providing for a 23-year life, not a five-year life. If the light is put into inventory and eventually back into service, the Company will collect the remaining 18 years of original cost through the monthly rate.

FINLiberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities

DE 19-064
Distribution Service Rate Case

City of Lebanon (CoL) Technical Session Data Requests - Set 1

Date Request Received: 10/24/19 | Date of Response: 11/6/19
Request No. CoL TS 1-6 | Respondent: Heather M. Tebbetts

REQUEST:

Reference the response to CoL 2-3, "[w]hen there is a request for many lights to be removed or replaced with LED lights, the Company will identify the oldest of the requested lights for which there are records and use the remaining value of those lights as the basis to charge any undepreciated value as to the entire group of requested lights." Recognizing that the transfer of data from National Grid was incomplete, how far back does Liberty typically have reliable records for such purpose? What if a significant portion or even a large majority of lights to be removed or replaced are more than 23 years old, which may often be the case with municipal street lights, and hence may be completely depreciated, may have been completely depreciated even before the changeover from National Grid, and hence there may not even be a record of the original cost or date of installation, would the Company still seek to use the oldest available record, which may be significantly more recent than the average age of a group of street lights?

RESPONSE:

The information transferred from National Grid to Liberty Utilities included vintage years potentially back to the 1970's through to 2012, the year of the transfer. The issue of missing information is that a number of fixtures installed over the years prior to the transfer did not come over in the transfer, or were never recorded when installed prior to 2012.

The Company is using the data it has on hand for calculating the undepreciated value. For example, the City of Lebanon is currently billed for over 800 lights. The Company has on record, for all street light customers in Lebanon, about 335 lights. If the Company had received full information during the transfer of data from National Grid, the City would be potentially paying the undepreciated value of 800+ lights as a result of its request to convert the lights to LED. Instead, the Company has said it will charge the City an average undepreciated value for a prorated number of the 335 lights (not all are billed to the City) to be converted due to the lack of data received from National Grid, potentially saving the City tens of thousands of dollars.

Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities

DE 19-064
Distribution Service Rate Case

City of Lebanon (CoL) Data Requests - Set 2

Date Request Received: 9/26/19
Request No. CoL 2-5

Date of Response: 10/10/19
Respondent: Heather M. Tebbetts

REQUEST:

Referencing the proposed Rate EV, does Liberty intend to use the specific Time of Use values set forth on page 140 of Attachment TRF-Perm, or does the Company intend to update those values based on more recent underlying cost data (e.g. default service rates) as called for on page 7 of Exhibit #20, "Technical Statement Regarding Time-of-Use (TOU) Model" in DE 17-189, Tab 44.?

RESPONSE:

The rates provided on page 140 were illustrative as the TOU rates to be used in Docket No. DE 17-189 had not been updated at the time of filing. Those rates will be updated periodically as the different rate components are approved using the model approved in that docket.

CLIFTON C. BELOW
1 Court Street, Suite 300 ❖ Lebanon, NH 03766
(603) 448-5899 (o) ❖ clifton.below@gmail.com ❖ www.linkedin.com/in/clifton-below

BACKGROUND & EXPERIENCE with Focus on Energy

- **Managing General Partner of One Court Street Associates**, 1985-present, responsible as a sweat equity partner for the development and ongoing management of One Court Street, a commercial building in downtown Lebanon, home of Three Tomatoes and various offices.
- **Vice President, Ardent Realty Services, Ltd,** 1992-present (with greatly reduced direct activity 2006-2/2012 while a PUC Commissioner), provides ongoing property management services to One Court Street Associates including leasing, property maintenance and financial management.
- **Lebanon City Councilor,** March 2015-present, **Assistant Mayor** since March 2019, and Chair, Lebanon Energy Advisory Committee (LEAC) which is also Lebanon's Electric Aggregation Committee pursuant to RSA 53-C. In additional to usual Councilor duties, authorized to represent the City as advocate and expert witness in a several PUC proceedings, including Grid Modernization Investigation, development of new Net Metering tariffs, and Liberty's proposed residential battery and time-of-use rate pilot.
- **New Hampshire Public Utilities Commission, Commissioner,** 12/27/2005 – 2/6/2012: Participated in approximately 360 adjudicatory and rulemaking proceedings with public hearings and over 1,000 published adjudicatory orders and decisions. Often served as agency point person in legislative hearings and proposed administrative rules, as well as representing and advocating for New Hampshire in various regional and national forums.
  - **National Association of Regulatory Utility Commissioners** (NARUC) Energy Resources & Environment Committee; 2006-2011; **Co-Vice-Chair**, 2009-2011.
  - FERC-NARUC Smart Grid/Demand Response Collaborative, 2008-2011.
  - **New England Conference of Public Utility Commissioners** (NECPUC), Vice President, 9/09-9/10; **President,** 9/10-9/11.
  - **Electric Power Research Institute (EPRI)**, Advisory Council to the Board of Directors, 2009-2011; Energy Efficiency/Smart Grid Public Advisory Group, 2008-2010.
  - Regional Evaluation, Measurement & Verification (EM&V) Forum, Steering Committee, Northeast Energy Efficiency Partnership, 2007-2011; Co-Chair, 2011.
  - RGGI (Regional Greenhouse Gas Initiative) one of two NH agency head representatives and **RGGI, Inc.; Secretary** (2007-2009); **Vice-Chair** (2009-2011).
  - NH Energy & Climate Collaborative, 2009-2011.
  - Governor's Climate Change Policy Task Force, NH's Climate Action Plan, 2008.
  - Northeast International Committee on Energy (NICE) and Climate Change Steering Committee of the Conference of New England Governors and Eastern Canadian Premiers, 2007-2008.
  - NH Site Evaluation Committee, 2006-2011 and Energy Planning Advisory Board, 2006.
  - ISO-New England Scenario Analysis Steering Committee Co-Chair (for NECPUC, 2007).
  - Speaker and panel moderator at various meetings or conferences of NECPUC, NARUC, ISO-NE, NEEP, ACEEE, NEPPA, NECA, NESEA Building Energy, ACI New England, Restructuring Roundtable, and other forums.
- **NH State Senator,** District 5, 1998-2004:
  - **Senate Finance Committee**, 1998-2004, over the course of 3 state budget cycles worked on detailed review and recommendations for each of the 3 divisions of the state's approximately $4 billion annual budget.
  - **Senate Energy & Economic Development Committee**, 1998-'04; **Chair**.'00-'02; **VC** '02-'04.

- Senate Environment Committee, 1998-2004, Transportation Committee, 1998-2000, 2003-'04.
- **Joint Legislative Committee on Administrative Rules**, 2001-2004; **Chair**, 2001-2002.
- **Electric Utility Restructuring Oversight Committee**, 1998-2004; **Co-Chair**, 1998-2000.
- Telecommunications Planning and Development Advisory Committee, 2001-2004.
- **Nuclear Decommissioning Finance Committee,** 2003-2004.
- **State Wireless Communications Policy Study Committee,** 2000, **Chair.**

- **NH State Representative,** 1992-1998:
  - **Science, Technology & Energy Committee,** 1992-1998; dealt with utility, energy, telecommunications, and air quality policy; Chair of Electric Utilities Subcommittee.
  - Small Power Producers and PSNH Renegotiations Legislative Oversight Committee, 1994.
  - Retail Wheeling and Restructuring Study Committee, 1995, Chair of Policy Principles, Social and Environmental Issues Subcommittee whose report became the foundation for NH's Electric Utility Restructuring statute, RSA 374-F.
  - **Electric Utility Restructuring Oversight Committee,** 1996-1998.
  - Member of state's negotiating team with Public Service Company of NH and prime sponsor of securitization (debt refinancing) legislation that ended litigation resulting in a reduction of average NH electric rates from the highest in the nation to the regional average. Sponsor of over a dozen bills dealing with energy policy and electric utilities, most of which became law, including prime sponsorship of NH's first solar/renewable net energy metering law and an update of the energy facility siting statute.
  - **Testified on State-Federal issues related to electric utility restructuring before the Energy & Power Subcommittee of the U.S. House Committee on Commerce,** February, 1996.

- **Legislative Regional and National Policy Work:**
  - **Council of State Governments, Eastern Regional Council (CSG/ERC):**
    - **Energy and Environment Committee,** member, 1997-2004; **Vice-Chair,** 2001-2003.
  - **National Conference of State Legislatures (NCSL):**
    - **Advisory Council on Energy,** 1997-2004; **Chair,** 2001-2004.
    - **Energy and Transportation Committee, Assembly on Federal Issues, (and successor Energy & Electric Utilities Committee),** 1998-2004; **Chair,** 2000-2001. As Chair facilitated a consensus based comprehensive update of NCSL's National Energy Policy (and other policies) used for lobbying the federal government on behalf of all state legislatures.
    - **Testified before the United States Senate Committee on Energy and Natural Resources** on "Electric Industry Restructuring," with a particular focus on transmission issues, on behalf of NCSL, April 2000.
  - **National Council on Electricity Policy, Steering Committee, member, 2001-2004.**

EDUCATION:

- **Dartmouth College, class of 1978**, **B.A.** with Distinction in major of Geography and Environmental Studies, **1980.**
- **M.S. in Community Economic Development, Southern NH University, 1985,** with course work in such areas as accounting, financial and organizational management, financing, and housing and business development.

COMMUNITY SERVICE:

- City of Lebanon: served on a dozen boards and committees since 1980.
- Sustainable Energy Resource Group, Board of Directors, 2013 – 2015 (merged into Vital Comm.).
- Vital Communities, Board of Directors, May 2012 – June 2018; Advisory Council, 2002-2012.