

Memorandum

TO: Town of Essex Selectboard
Patrick C. Scheidel, Essex Town Manager

FROM: Reed Parker, Chair, Energy Committee,
J.C.McCann, Energy Committee
Tom Tailer, Energy Committee
Roger Gamache, Energy Committee
Dennis Bouldin, Energy Committee
Sue Cook, Energy Committee
Irene Wrenner, Energy Committee (Ex Officio)
Dennis Lutz, Public Works Director

DATE: May 28, 2014

SUBJECT: Conversion of Older Street Lights to LED Lighting to Save Energy & Money

ISSUES: Shall the Selectboard approve a plan to convert existing high-pressure sodium and mercury vapor streetlights to Light-Emitting Diode (LED) lights under a municipal street lighting program grant offered by Efficiency Vermont (EVT) and Green Mountain Power Corporation (GMP)? Shall the Selectboard approve several “housekeeping” items related to improving street lighting in certain critical areas?

DISCUSSION: This issue was introduced to the Selectboard by Dennis Lutz, in April 2011. In a memorandum from January 2012 (attached), required steps were outlined to bring the issue to a decision point. Those steps have since been completed, as detailed below.

Members of the Energy Committee and Town staff undertook a field inventory of all streetlights in the Town (outside of the Village). This effort identified over 600 streetlights within the Town. The field data was then compared to information in the GMP database and differences noted. More fieldwork was undertaken to resolve discrepancies which had surfaced. In addition, lights were identified that were either not needed, inoperable, damaged, obscured by tree cover, or were being charged to the Town but served private property. (See Housekeeping Items section at the end of this memo for details and costs.)

Bob Kennedy, a former Town employee now employed by GMP, was especially helpful in developing a final and more accurate GMP inventory. In addition, work orders were established within GMP to correct the above-identified deficiencies as well as to issue customer notification for billing on private lights.

PROJECT SCOPE, TIMING AND COSTS

Scope:

This investigation found that of the 604 lights validated on the GMP inventory, 496 streetlights qualify for the EVT/GMP LED Light Conversion Program: (490) mercury-vapor and (6) sodium vapor lights. The lights included in the program are typically located on power poles or individual tall lamp poles and are known as “cobra-head lights” because of their shape. (See pictures below.) In all, 82% of the streetlights validated on the GMP inventory are eligible for the LED Conversion Program.

The Town pays for the operation, maintenance and energy of its streetlights through the lighting tariff approved by the Vermont Public Service Board (PSB). Included in this charge-per-light is a cost for depreciation. As most Town streetlights are fairly old, a significant amount has been paid over time toward their depreciation, leaving their individual undepreciated values quite low. Nevertheless, the total of undepreciated values for the lights identified for conversion is \$29,400.00.

This number is significant because GMP must be paid the undepreciated value of lights by the Town before it will convert or remove them. Fortunately, EVT provides incentives to communities like ours to convert to LEDs by fully reimbursing the undepreciated costs to GMP.

Therefore, if the Selectboard approves this proposal to convert 496 streetlights to LEDs, the Town can enter into an agreement with EVT, which will issue a grant to the Town to completely cover GMP’s undepreciated costs. A copy of this agreement is attached.

Out of scope items:

Lights not included in the proposal for the EVT/GMP LED program include:

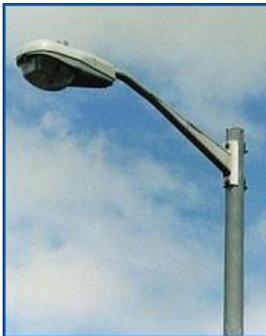
1. Any streetlight for which it is not economically feasible to convert to an LED. These include lights on shorter poles, which commonly have a decorative look known as “shoe-box” lights or “Town-n-Country” lights (see pictures below). Lights of this type contain a wiring structure, which is incompatible with LED fixtures. The cost to remove and replace the light, pole and wiring is prohibitive. (75) Town-n-Country lights were identified across Essex Town.
2. Town streetlights with higher-wattage ratings than the Mercury or Sodium lights in this proposal. Lights of this type include those that are attached to a building (ex: parking lot spotlights). This type accounted for approximately 15 lights.
3. Lights on private property.
4. Streetlights owned and maintained by VTRANS such as at some of the Circumferential Highway locations or the VT15/Susie Wilson Road intersection. In these instances, the State owns the lights, which are fed with shared power going to the traffic signals.
5. Lights that have already been converted to LED fixtures.

The table below summarizes the Essex Town street lighting inventory. The cells marked in green comprise the 496 lights that will be included in the conversion to LED fixtures.

Essex Town Street Lighting Inventory - Analysis by Type and Wattage

Count of WATTAGE	Column Labels							Grand Total
	20	70	100	106	150	175	250	
Row Labels	20	70	100	106	150	175	250	Grand Total
LED	15		1					16
COBRA	2							2
LIGHT_COBRA	9		1					10
Municipal LED	4							4
MH		4	5					9
COBRA			1					1
LIGHT_TOWNCNTRY		4	2					6
TOWNCNTRY			2					2
MV		5	563	1	1	1	2	573
COBRA		4	55		1			60
LIGHT_COBRA		1	415				2	418
LIGHT_COBRA_MUNICIPAL			14	1				15
LIGHT_TOWNCNTRY			68			1		69
TOWNCNTRY			11					11
SV		2			2		2	6
COBRA		2			2			4
LIGHT_COBRA							1	1
LIGHT_FLOOD							1	1
Grand Total	15	11	569	1	3	1	4	604

Cobra-head, Shoebox and Town-n-Country light fixtures ¹



¹ Street light pictures sourced from Google Search - Internet

Project Timing:

We propose that Phase 1 of the project commence during the summer of 2014 with the conversion to LED of the 496 Sodium/Mercury streetlights. GMP personnel will be responsible for the switchover to LED fixtures and bulbs. Timing is critical, as other towns are developing similar proposals and vying for the same grant funding from EVT and resources to be allocated by GMP. If the Town of Essex hesitates, it may lose the opportunity to leverage the monies currently set aside by EVT toward our project. The total time to complete the project will be determined by GMP as they allocate resources.

In Phase 2, town staff will concurrently look at lighting locations with higher-wattage fixtures for potential conversion as a follow-on project. This item will be expanded upon in a future memo. In addition, a prior lighting study for the Susie Wilson Road corridor indicated the potential need for more street lights. The need for these lights will be reviewed by Public Works against current conditions and if needed they will be added through the normal budget processes.

In Phase 3, GMP may revisit the LED conversion issue, once the initial work has been completed, to verify that all the lights that are appropriate for conversion have been done. Public Works will work with GMP on this issue.

Project Cost:

There will be no cost to the Town for participation in the program to convert 496 Sodium/Mercury streetlights to LED lighting.

REASONS FOR CONVERTING TO LED STREETLIGHTS

Reasons for moving from older Mercury/Sodium vapor lights to LEDs:

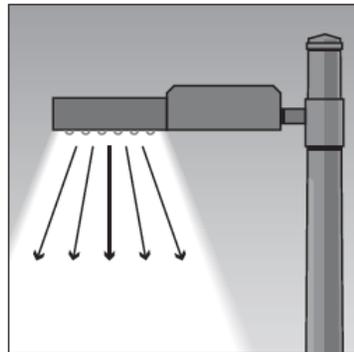
1. Cost Savings
2. Energy Savings
3. Environmental conservation
4. Aesthetics

What LED lighting is and why it is the right solution for Town street lighting

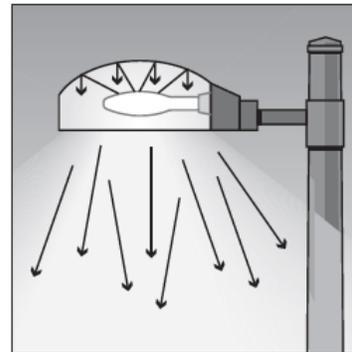
LED lighting technology offers a radical departure from traditional lighting systems. Exterior lighting has been historically provided by singular, high-output light sources. In contrast, LED lighting systems are based on clusters of individual LED lights grouped into modules, which operate as a unified system. Unlike other lighting technologies, LEDs are inherently directional, which improves efficiency by directing all of the light out from the fixture without having to rely on a reflector. In all other lighting technologies, a significant percentage of the light produced by the bulb is often trapped within the light fixture housing. LED light can be directed precisely where it is needed, thereby eliminating wasted light and its associated cost. When directional properties are accounted for, LED lights can provide a more even illumination pattern delivered to the area being lighted with less overall light. LED fixtures with lower wattage and light output can effectively match the performance of a higher-wattage, single-lamp fixture using traditional sodium or mercury vapor technology. Typically, LED lighting can save

between 50-80% of electricity use compared to existing equipment, depending on the specific application.² Finally, the solid-state technology of LED lighting has superior color rendering as well as directionality. As a result the LED light produces a more natural white light eliminating the orange glow associated with traditional lighting.

LED street lights provide more uniform illumination with less wasted light.



LED Street Light



Traditional Street Light

Cost Savings

As noted above, the undepreciated value of the current Sodium/Mercury light fixtures and bulbs is **\$29,400,000**. This will be completely offset by a grant from EVT. This is an immediate win in that it is real dollar savings for the Town. Funding for the EVT grants is obtained through the monthly Energy Efficiency Charge, which all residents and businesses pay to their local utility company. As the residents of Essex Town have already contributed to this fund, the Town should recoup this cost/benefit via the EVT grant for the benefit of the community.

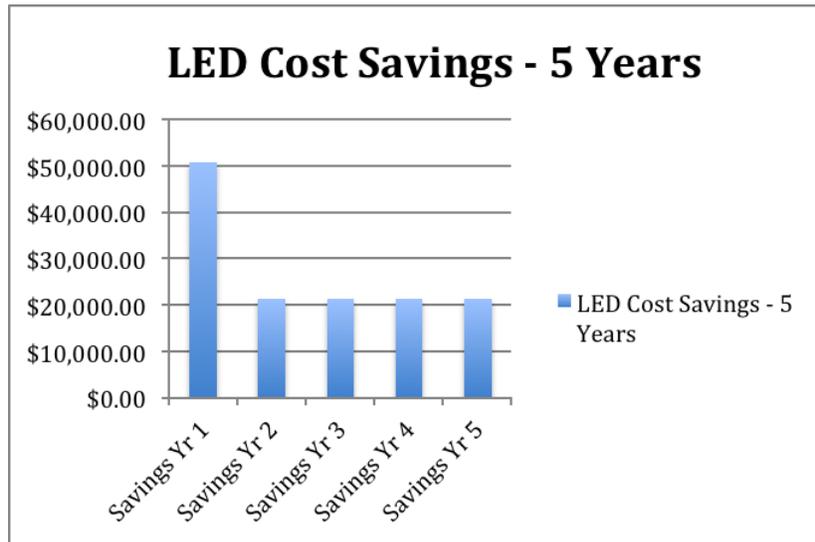
The tariff established by the PSB for the monthly cost of street lighting is significantly less for LED fixture/bulbs than for existing lighting. Based on PSB tariffs and the number of bulbs to replace, we estimate an annual cost savings of \$21,359. This represents an annual savings of 25% for the 496 bulbs to be replaced. When compared to the total lighting charge (for all lighting types), which Essex paid to GMP in FY2013, the savings is 18% annually. See the spreadsheet and chart below for details.³

² Improving Efficiency in Municipal Street and Public Space Lighting – Efficiency VT

³ http://www.greenmountainpower.com/upload/photos/308Outdoor_Lighting_new_05_19_2014.pdf

Cost comparison for Mercury/Sodium lights VS LED lights using VT PBS Tarriff - GMP Rate 18 charges

Type of Light	Wattage	Count	Current Tariff/Month	Monthly cost	Annual Cost	% Cost / %Savings
Mercury Vapor	100	485	\$14.16	\$6,867.60	\$82,411.20	
Sodium & Merury Vapor	70	7	\$14.43	\$101.01	\$1,212.12	
Mercury Vapor	106	1	\$14.16	\$14.16	\$169.92	
Mercury Vapor	150	3	\$18.26	\$54.78	\$657.36	
Total Current Lights		496		\$7,037.55	\$84,450.60	100.00%
LED-20	37	496	\$10.60	\$5,257.60	\$63,091.20	74.71%
Savings				Montly Savings \$1,779.95	Annual Savings \$21,359.40	25.29%
Depreciation savings					<u>\$29,400.00</u>	
Total Savings Year 1					<u>\$50,759.40</u>	
Essex Full Year Light Charge (all lights) FY2013					\$114,908.00	18.59%



Cost Savings – Longevity

As an LED doesn't have filaments that quickly burn out, the light can last 100,000 hours, reducing the effective maintenance cost for the life of the bulb. While the LEDs are leased items from GMP and maintenance is not a direct cost to the Town, we should consider the value of a long-life LED bulb in terms of both the reduced tariff and the quality of service we provide to the citizens of Essex by not having dimmed or burned out lights in the Town.

Energy Savings

This proposal calls for replacing 496 Mercury and Sodium vapor lamps with 37-watt LED-20 lamps. To make this an even comparison, the lighting industry uses Lumens to

compare the light output of the current bulbs to LEDs. In the table below⁴ the lumen-per-watt values are compared for sodium vapor, mercury vapor and LED bulbs. Based on these assumptions of efficiency and light output (lumens), the energy savings for conversion to LED bulbs are on the order of 50%-60% per fixture.

For this 496-bulb proposal, the vast majority of the lights to be replaced are the 100-watt Mercury vapor type, which makes up 98% of the replacement inventory. Using these bulbs in comparison to the LED bulbs results in an immediate savings in energy use is approximately 63%, (37 watts vs. 100 watts expended) placing Essex high on target for this type of installation.

Street Light Technology	Percent Market Share ¹	Typical Source Efficacy (lumens per Watt)	Typical Luminaire Efficiency	Typical Net Efficacy ² (lumens per Watt)
High-pressure sodium	59%	70 – 150	45%	32 – 68
Low-pressure sodium	10%	68 – 177	25%	17 – 44
Mercury vapor	20%	34 – 58	30%	10 – 17
Metal halide	5%	61 – 85	35 – 40%	21 – 34
Compact fluorescent	2%	50 – 70	60%	30 – 42
Incandescent	4%	10 – 17	60%	6 – 10
Induction	0%	60 – 80	60 – 80%	36 – 64
HE ceramic MH	0%	95 – 120	60 – 80%	57 – 96
LED	0%	60 – 100	60 – 90%	36 – 90

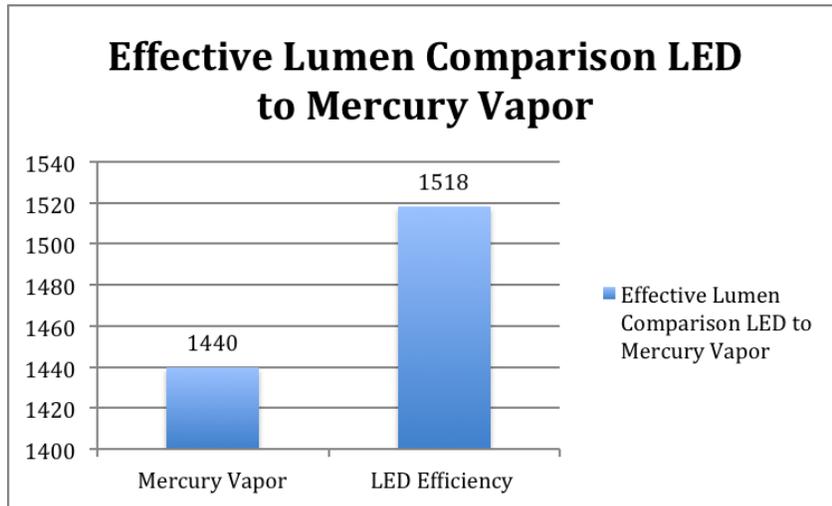
Source: Clinton Climate Initiative, 2010

Using the “Typical Luminaire Efficiency” factors above and street lighting lumen data from GMP⁵, we find that the proposed 37-watt LED-20 lights calculated at 60% efficiency produces an effective Lumen per Watt value which out performs the current mercury lamps. The net effect is more light is produced while far less energy is utilized.

Lighting Type	Wattage	Total Lumens*	Efficiency Rating	Effective Lumens	Efficiency Comparison
Mercury Vapor	100	3200	45.00%	1440	
LED Efficiency	37	2530	60.00%	1518	105.42%

⁴ A Win-Win-Win for Municipal Street Lighting: Converting Two-Thirds of Vermont’s Street Lights to LED by 2014 Efficiency VT

⁵ Green Mountain Power Corporation – “All Outdoor Lighting – Rate 18” – August 1, 2013



Environmental Conservation

In this proposal we have outlined the efficiency to be gained by converting to LED bulbs, resulting in real-dollar savings to the Town of Essex. We have also outlined the energy conservation gains of the LED bulb in that the electrical energy expended, as measured in wattage, is considerably less than with existing Mercury/Sodium bulbs. The value of our contribution to the cumulative effect on energy generation savings as we join the growing number of towns across VT converting to LEDs can't be understated. Additionally, anytime that we can remove harmful elements from our environment, such as halogens, we make an improvement in the town for our citizens. As LEDs don't contain toxins like mercury, removal of the 496 bulbs helps us achieve that goal.

Aesthetics

Aesthetics may be difficult to measure, but the pure white light produced by an LED bulb and the concentrated directional capability of the fixture emit a more natural light for anyone who encounters an LED. Additionally, the Dark Sky initiative in VT is working toward removing the orange glow in the sky, which has long been associated with non-directional Sodium and Mercury vapor lamps.⁶

In some instances LED bulbs have been criticized for being "too bright" and causing additional illumination in nearby homes. There are two primary factors of which one is an impression and the other is correctable.

1. Sodium/Mercury vapor lights fade slowly over time resulting in a less efficient light. As this is not a sudden event, people will usually not notice the change from one period of time to another, as they will after an LED is swapped in. Therefore, the impression is that the LED is brighter. In reality, one is simply observing light, as it should be emitted from a new bulb.

⁶ Chittenden County Regional Planning Commission - http://www.darksksociety.org/handouts/vermont_muni_lighting_manual.pdf

2. Some existing light fixtures are not optimally sited for illuminating streets and sidewalks. Installation of an LED may add additional light to residential property. It will be the responsibility of GMP to site the LED fixtures properly at the time of installation.

Housekeeping Items – Scope and Costs

The following items are not related to LED conversion, per se, but should be undertaken to improve inadequate lighting or overly lit locations:

- 1) GMP will trim a number of trees obscuring streetlights. The Town will investigate the potential for trimming in 5 other locations. As “landscape trees” obscure some of these lights, trimming may impact private property.
- 2) While it is desirable to remove unneeded streetlights, the Town has historically taken a very conservative approach to installing streetlights. Therefore, only one streetlight was identified for removal (pole #56966 on Old Colchester Road). The spacing is such that this light is not needed.
- 3) The Town identified two locations in which it recommends the addition of new lights for increased public safety: (pole #66591 at Old Stage Road and Cabot Drive; pole #69217 at Old Stage and Brigham Hill Roads). This cost for new lights will be borne by the Town. The Capital Fund has sufficient monies to cover these two new lights.

Summary

The Essex Town Energy Committee’s charge is to *provide leadership, advocacy and outreach in the areas of conservation, efficiency, and renewable energy*. As energy advocates for the Town, we believe that this proposal for replacing 496 existing sodium and mercury lights with LED lighting meets or exceeds the goals of our mission.

RECOMMENDATION: It is recommended that the Selectboard approve the plan to convert the Town’s 496 existing high pressure sodium and mercury vapor street lights to LED lights under a program offered by EVT and GMP by authorizing the Town Manger to enter into an agreement with EVT and/or GMP to effect this change with a commencement of the conversion to LED lights to begin no later than summer 2014.

It is further recommended that one streetlight be removed on Old Colchester Road and two streetlights be added along Old Stage Road at the intersections with Cabot Drive and Brigham Hill Road per the specifications in this memo dated May 28, 2014 and paid for (if necessary) via the appropriate Capital Budget line item.