

Findings and Recommendations of the Ad-Hoc Committee on LED Streetlights

January 26, 2016

Summary of Actions Recommended

- Initiate a 3-month Pilot to install LED streetlights on selected high traffic streets and “Town & Country” style¹ post-top streetlight locations.
- Seek resident feedback on the Pilot.
- Pending the results of the Pilot, complete LED streetlight installations on the selected high traffic streets and Town & Country streetlight locations by year-end 2016.

History and Charge of the Committee

Following a report from the Scarsdale Forum suggesting that the Village study LED streetlights and initiate a pilot study, the Village Board of Trustees established the Ad-Hoc Committee on LED Streetlights in April 2015. The Committee was to research LED streetlights to determine the appropriate light(s) for the pilot, as well as to identify locations for the pilot. The budget allocated for the pilot was \$25,000. Once installed, the Committee would study the lights and seek resident feedback. At the conclusion of the pilot the Committee would provide a written report to the Board on the pilot, and recommend how to move forward.

Update on the Committee’s work

The Committee has engaged in numerous activities to research LED streetlights, identify potential pilot locations and appropriate LED fixtures, and seek feedback from the community regarding the fixtures.

Researching LED Streetlights: The first phase of the Committee’s work was to research LED streetlights in order to determine the most appropriate types of fixtures to pilot in our community. Our research involved meeting with LED streetlight manufacturers, visiting installations in nearby communities, speaking with communities outside of Westchester with relevant experience, and engaging third party organizations involved in the streetlight industry. We met with representatives from five major LED streetlight manufacturers to review their technologies and experience with municipal streetlight projects. In order to review the lights in residential settings, the Committee made nighttime visits to neighboring communities around Southern Westchester that have installed LED streetlights. In addition to these site visits, we also reached out to communities in other parts of the country with experience installing LED streetlights relevant to our work. Lastly we reviewed independent research regarding various aspects of LED streetlights such as health concerns, light pollution and other relevant issues.

¹ Pictures of the three main types of streetlights (Cobra Head, Town and Country and Decorative) can be found in appendix B.

Testing Sample Lights: Based on our research, the Committee determined that we needed to sample LED streetlights of varying color and brightness prior to rolling out a larger scale pilot program in Scarsdale. We called this the “Mini-Test.” A key factor in this decision was that all of the installations in neighboring communities had similar specifications. The most significant similarity was that all of their LED streetlights are primarily bright white in color (4000 and 5000 Kelvin) and have a high light output. Thus in order to compare lights of varying color and brightness, we needed to install sample lights ourselves. Twenty-six lights of varying color and brightness were installed on Fox Meadow Road (12), Madison Road (8) and Heathcote Road (6) in Fall of 2015. We systematically installed fixtures with varying brightness and color. The fixtures we chose ranged from warmer in color (more orange: 3000 and 2700 Kelvin) to cooler in color (more white: 4000 Kelvin).²

Community Feedback: Community input is an important part of this program. It is needed to ensure that residents are aware of the project and how it may change the aesthetic characteristics of our Village, as well as to gauge their attitudes towards the new lights. During the Mini-Test the Committee communicated with residents through multiple channels including pole signs, the press, the Village website and electronic boards at Village Hall and our library to let them know about the project and seek their questions and comments.

The dedicated email address of LED@Scarsdale.com was created and distributed to residents via the aforementioned communication channels. A yellow pole sign was affixed to each pole on which an LED streetlight was installed, indicating the pole number and the email address to which comments could be sent.

In the four months since the Mini-Test lights have been installed, the Committee received 11 emails from residents. One dealt only with the lack of any light near his home. The other ten were split in their view of the lights: about half preferred the new LEDs and the other half found the sample lights too bright and/or harsh in color. Most of the responses, regardless of their view on the brightness and color, were in favor of the LED project as a direction for the Village. For the next phase of the LED pilot program recommended herein, additional measures will need to be considered on how to receive feedback from a larger percentage of residents.

Key Findings

There are a number of key findings from our research and from the Mini-Test related to (1) the light quality of current LED streetlights available on the market, (2) the LED fixtures themselves, (3) the installation process, (4) the experience of other communities that converted to LED streetlights and (5) the financial benefits of changing to LED streetlights.

Light Quality: There are three key concerns with the quality of light produced by the current generation of LED streetlights. They are color, light distribution and glare.

² Note: We have spent less than \$1,000 of our \$25,000 budget as we negotiated mostly free samples.

Color: Historically LED streetlights have utilized a cooler color light (white or bluish) akin to a fluorescent bulb. This has partially been due to the technical limitations of creating a softer color light for use in streetlights, as well as a loss of efficiency with softer colors. While the technology is improving and the efficiency gap is closing, a full range of color options is not readily available on the market at this time. For example, some of the sample lights installed in the Mini-Test had to be custom made for us.

Distribution: Distribution refers to the direction the light travels when leaving the fixture. A benefit of LEDs is the ability to control light distribution.³ However the lights we tested sometimes resulted in light on lawns and homes behind and across the street from the fixtures. To a certain extent the distribution of light can be controlled with the use of light shields that can be purchased as an add-on to a fixture, however, such a shield may not solve all such distribution issues. Further, there were often very bright spots directly under the lights which exacerbated the appearance of striping⁴ on the streets. It should be noted however that since our current lights are typically only on every other pole, there would be a dark spot between fixtures no matter what improvements in technology occur.

Glare: Glare from LED streetlights may cause a level of discomfort to drivers and pedestrians. Glare may be exacerbated on hilly streets as the lights are viewed from high or low angles. Currently available LEDs are designed to emit the same amount of light as conventional bulbs from a smaller area, which is the reason for this type of uncomfortable glare. In addition, white LEDs typically have more energy in the blue part of spectrum, which can also cause more glare because blue light is perceived brighter by the human eye.

The problem of glare is one of design, however, and not the result of an inherent weakness in LEDs themselves. Properly designed LED bulbs and fixtures can produce a uniformly bright and pleasing light that is all but indistinguishable from less efficient halogen and fluorescent bulbs, as is seen in LEDs available for indoor use. Moreover, manufacturers can control glare by using appropriate optics. The Committee believes that as LED technology develops, manufacturers will develop and make these optics standard for all LED streetlights.

Regarding health issues, the main concerns seem to stem from the brightness and color of LED lights impacting sleep cycles. This Committee has addressed this concern by

³ Our current sodium vapor lights are omnidirectional meaning light travels equally in all directions except where blocked by the fixture itself. This results in wasted light when the light travels upwards or in directions not wanted.

⁴ Striping occurs when the distance between two fixtures doesn't allow the light from the fixtures to completely fill the area between the fixtures. This occurrence of light underneath each fixture, followed by a patch of darkness in between, results in a striped appearance of light and dark called "striping."

recommending warmer light colors rather than the cooler (bluer) light colors (5000K and higher) which have the most reported impact in this area.

Fixtures: Aside from the issue of light quality, the fixtures available are impressive in many facets. Construction varies between manufacturers but overall a high quality product is available. Installation has become somewhat streamlined and should not be a problem. Although each manufacturer uses varying manufacturing techniques, it appears the current physical fixtures would be able to meet the specifications required by the Village.

It should be noted that there are many add-on options available, such as smart sensors⁵, if the Committee determines that such add-on technologies would be useful. There are also options available to address unique location issues, such as shields to block light in certain directions. Various manufacturers also presented us with certain custom options that the Committee would consider. Any customization however has the downside of adding to the cost of the fixture. In addition, certain options are first generation items which we would effectively be testing on a broad scale for the manufacturer.

Installation Process: There are two main options for installing a Village-wide upgrade to LED streetlights: (1) installing in-house with either current staff or current staff augmented by an additional installation crew(s) or (2) contracting the service to an outside vendor. When contracting with an outside vendor there is the option to have them install only, furnish the fixtures and install, or provide a complete turn-key solution. The turn-key solution would involve furnishing and installing the fixtures as well as financing the purchase, updating our database of streetlights and providing future maintenance of the fixtures.

Experience of other Communities: Most of the communities we have spoken with in Westchester have chosen the complete turn-key solution with financing where there is no upfront payment from the municipality. Annual payments are made through the municipality's yearly electricity savings. While this can be an attractive option, it is worth noting that they are paying a much higher price for these services and forgoing some of the financial benefit for the time period of contract with their installer.

Financial Benefits: Based on preliminary estimates, a full conversion to LED streetlights for Scarsdale would cost \$550,000 – \$650,000 in equipment, plus the cost for installation. Assuming installation was to be done in-house, these installation expenses are estimated at approximately \$100,000. Anticipated electricity savings are approximately \$105,000 per year, resulting in an investment payback of approximately 6 - 7 years. It should be noted that the payback period varies significantly by the type of fixture due to the wattage of each fixture type and pricing for an LED upgrade. On average Cobra Head Fixtures have an approximate payback time of 6.5 years, Town and Country Post-Top Fixtures approximately 4 years and Decorative Post-Top Fixtures approximately 10 years.

⁵ Examples include smart dimming (e.g. during the middle of the night) and GPS-based technology that gives notification of when a light goes out.

A conversion to LED streetlights on high traffic streets and Town & Country post-top locations only would cost approximately \$70,000 - \$100,000 for the LED fixtures⁶ and \$15,000 for installation expenses if done in-house. These two light types represent 287 of the total 1,996 streetlights in Scarsdale.⁷ For these 287 lights, anticipated electricity costs savings are approximately \$19,000 per year resulting in a payback of about 4.5 years.

The above estimates are based on initial indicative pricing from vendors at current costs, as well as conservative assumptions from the Committee. Maintenance savings, which are an important benefit of LEDs, were not included in the analysis. Fixture prices were also assumed to be on the higher end in order to account for any possible add-ons that the Village may wish to include.

A detailed financial analysis can be found in Appendix A.

Recommendations

Based on the above findings, the Committee recommends that the Village:

- 1. Move forward promptly with a pilot study (the “Pilot”) of LED streetlights in the following two areas: (1) on high traffic streets and (2) in locations with Town & Country post-top fixtures. A total of approximately 25 LED streetlight fixtures would be installed for the Pilot. The length of the Pilot would be 3 months.**

The Committee is proposing that high traffic streets include: Post Road, Mamaroneck Road, Heathcote Road (from Post Road to Five Corners) and Weaver Street. These total 214 streetlights. Scarsdale has Town & Country post-tops in various areas of the Village where no poles exist to support overhead wires. These total 73 streetlights. The Committee is proposing that 25 LED streetlights be installed on a portion of these high traffic streets and locations with Town & Country fixtures as part of the Pilot.

We believe that the LED fixtures currently available are well-suited for these two types of installation areas. They are well-suited for high traffic roads because these roads tend to need more light and have greater set-backs for homes. They are well-suited for Town & Country post-top locations because the LED Town & Country fixtures come with exterior lenses that block glare and excessive light distribution.

The Pilot would allow the Committee to finalize specifications for the LED fixtures, confirm assumptions about installation time, and obtain additional resident feedback.

⁶ The lower end of the equipment cost range represents a lower cost retrofit kit for the Town & Country post-top lights that will be tested in the Pilot.

⁷ There are 214 streetlights on high traffic streets and 73 Town & Country streetlights.

Upon completion of the Pilot, the Committee would report back to the Board to get specific authorization to proceed with full implementation of the balance of the LED lights on the Village's high traffic streets and Town & Country post-top fixtures.

2. Based on the results of the Pilot, install all lights on the Village's high traffic streets and in Town & Country post-top locations⁸ by year-end 2016.

Given the concerns previously noted about LED fixtures, we think additional installations on smaller residential streets should not be part of this initial effort. However, we encourage the Village staff to use LED's as appropriate to solve existing situations of inadequate lighting.

3. Plan for a staged approach, mostly likely over five years, for a complete rollout of LED streetlights.

A staged approach would allow the Village to:

- a. Start getting financial, as well as environmental, benefits as soon as possible.
- b. Spread the installation workload to allow for the option of the work to be done in-house.
- c. Allow for financing within the Village's operating budget.
- d. Avoid having to replace the entire inventory at one time as the products reach the end of their useful life⁹
- e. Introduce more appropriate LED fixtures, as they become available, on quieter residential roads. To this end the Committee should continue to research and monitor the LED industry to determine when each installation stage should begin.

The Committee strongly believes that the future of Scarsdale's streetlights lies with LED fixtures. The financial and environmental benefits are compelling and the lowered maintenance requirements are expected to be impressive.

Requested Board Action:

- a. Approve the proposed Pilot on high traffic streets and in Town & Country post-top locations.
- b. Charge the Committee with determining the appropriate Pilot fixtures, installation locations, and method of installation, as well as obtaining resident feedback.

⁸ 287 out of the 1996 streetlights in the entire Village.

⁹ Unlike the current High Pressure Sodium bulbs, LED fixtures are not expected to burn out completely at the end of their life. For most LED streetlights, the end of useful life is defined when the light output reached 70% of the initial light output. Therefore it is not expected that large numbers of lights will completely turn off at the end of the expected life of the fixture.

- c. Budget \$100,000 in the FY16-17 budget cycle to complete LED streetlight installation on selected high traffic streets and Town & Country post-top locations by year-end 2016, pending completion and results of the Pilot.

Ad-Hoc Committee on LED Streetlights

Victor J. Goldberg (Chair)

David Raizen

Benedict Salanitro

Ronald Schulhof

Michelle Sterling

January 26, 2016

Appendix A: Financial Analysis and Assumptions

Assumptions

Fixture Costs

Cobra Heads	\$250
Decorative Post-Top	\$1,200
Town & Country Post-Top	\$250

Energy and Labor Rates

Energy Rate (\$ per kWh - FY14/FY15)	\$0.23
In-house Labor Rate (\$ per Hr)	\$48

Other

Streetlight Burn Hours per year	4,270
Projected Maintenance Savings	0%

Realized maintenance savings will shorten the payback period

Executive Summary

		Upfront Costs			Annual Savings			Payback (years)	
		Fixture	Installation	Total Cost	Utility Costs	Maintenance	Total	Electricity only	Inc. Maintenance
Return Analysis (Full Rollout)									
Cobra Heads	1,791	\$447,750	\$86,106	\$533,856	\$83,431	\$0	\$83,431	6.4	6.4
Decorative	130	\$156,000	\$6,250	\$162,250	\$16,033	\$0	\$16,033	10.1	10.1
Town & Country	73	\$18,250	\$3,510	\$21,760	\$5,785	\$0	\$5,785	3.8	3.8
All Lights	1,994	\$622,000	\$95,865	\$717,865	\$105,249	\$0	\$105,249	6.8	6.8
<i>Note: 2 fixtures on inventory were already switched to LEDs (Total Fixtures 1,996)</i>									
Return Analysis (Year 1 Proposal)									
	Number								
High Traffic Locations	214	\$53,500	\$10,288	\$63,788	\$13,511	\$0	\$13,511	4.7	4.7
Town & Country	73	\$18,250	\$3,510	\$21,760	\$5,785	\$0	\$5,785	3.8	3.8
Total - Year 1 Proposal	287	\$71,750	\$13,798	\$85,548	\$19,296	\$0	\$19,296	4.4	4.4

Return Analysis Details - High Traffic Streets and Town & Country Style Post-Top Locations

High Traffic Locations Specific Assumptions

Installation Time per Fixture (Hrs) 0.5 Hours per crew
 Staff per installation crew 2

Return Analysis

	Number	Fixture	Upfront Costs		Annual Savings			Payback (years)	
			Installation	Total Cost	Utility Costs	Maintenance	Total	Electricity only	Inc. Maintenance
High Traffic Locations	214	\$53,500	\$10,288	\$63,788	\$13,511	\$0	\$13,511	4.7	4.7
Town & Country	73	\$18,250	\$3,510	\$21,760	\$5,785	\$0	\$5,785	3.8	3.8
Total	287	\$71,750	\$13,798	\$85,548	\$19,296	\$0	\$19,296	4.4	4.4

Details

Street	Fixture Type	Number	Current Setup (Annual)			LEDs (Annual)			Savings (Annual)		
			Wattage	kWh	Utility Costs	Wattage	kWh	Utility Costs	kWh	Utility Costs	Fixture Cost
WHITE PLAINS PO (Post Road) (117W)	Cobra Head	72	117	35,970	\$8,303	53	16,294	\$3,761	19,676	\$4,542	\$18,000
WHITE PLAINS PO (Post Road) (193W)	Cobra Head	4	193	3,296	\$761	80	1,366	\$315	1,930	\$446	\$1,000
HEATHCOTE RD (83W)	Cobra Head	29	83	10,278	\$2,372	25	3,096	\$715	7,182	\$1,658	\$7,250
HEATHCOTE RD (101W)	Cobra Head	3	101	1,294	\$299	53	679	\$157	615	\$142	\$750
HEATHCOTE RD (193W)	Cobra Head	1	193	824	\$190	80	342	\$79	483	\$111	\$250
MAMARONECK RD (83W)	Cobra Head	66	83	23,391	\$5,399	25	7,046	\$1,626	16,346	\$3,773	\$16,500
MAMARONECK RD (188W)	Cobra Head	2	188	1,606	\$371	80	683	\$158	922	\$213	\$500
WEAVER ST (117W)	Cobra Head	26	117	12,989	\$2,998	53	5,884	\$1,358	7,105	\$1,640	\$6,500
WEAVER ST (171W)	Cobra Head	11	171	8,032	\$1,854	80	3,758	\$867	4,274	\$987	\$2,750
Town and Country (SV 141W)	Town & Country	49	141	29,501	\$6,810	80	16,738	\$3,864	12,763	\$2,946	\$12,250
Town and Country (MV 200W)	Town & Country	24	200	20,496	\$4,731	80	8,198	\$1,892	12,298	\$2,839	\$6,000
Total		287	120.51	147,678	\$34,089	52.29	64,084	\$14,793	83,594	\$19,296	\$71,750

Street Light Inventory Overview / LED Wattage Conversion Assumptions

Street-Wide

Street Lights	Type	Number	%	Inventory Watts	kWh	Total Cost	% of Cost	LED Wattage
Sodium Vapor (58w)	Cobra Head	843	42%	58	208,777	\$48,193	28%	25
Sodium Vapor (64w)	Cobra Head	1	0%	64	273	\$63	0%	25
Sodium Vapor (83w)	Cobra Head	749	38%	83	265,453	\$61,275	36%	25
Sodium Vapor (88w)	Cobra Head	8	0%	88	3,006	\$694	0%	25
Sodium Vapor (100w)	Cobra Head	14	1%	100	5,978	\$1,380	1%	53
Sodium Vapor (101w)	Cobra Head	7	0%	101	3,019	\$697	0%	53
Sodium Vapor (117w)	Cobra Head	125	6%	117	62,449	\$14,415	8%	53
Sodium Vapor (119w)	Cobra Head	9	0%	119	4,573	\$1,056	1%	53
Sodium Vapor (141w)	Town & Country	49	2%	141	29,501	\$6,810	4%	80
Sodium Vapor (171w)	Cobra Head	11	1%	171	8,032	\$1,854	1%	80
Sodium Vapor (188w)	Cobra Head	2	0%	188	1,606	\$371	0%	80
Sodium Vapor (193w)	Cobra Head	7	0%	193	5,769	\$1,332	1%	80
Sodium Vapor (215w)	Cobra Head	5	0%	215	4,590	\$1,060	1%	80
Sodium Vapor (286w)	Cobra Head	1	0%	286	1,221	\$282	0%	100
High Pressure Sodium	Cobra Head	2	0%	250	2,135	\$493	0%	100
Metal Halide	Decorative	3	0%	92	1,179	\$272	0%	80
Metal Halide	Decorative	8	0%	95	3,245	\$749	0%	80
Metal Halide	Decorative	95	5%	215	87,215	\$20,132	12%	80
Metal Halide	Decorative	3	0%	325	4,163	\$961	1%	80
Mercury Vapor	Decorative	20	1%	200	17,080	\$3,943	2%	80
Mercury Vapor	Decorative	1	0%	290	1,238	\$286	0%	80
Mercury Vapor	Town & Country	24	1%	200	20,496	\$4,731	3%	80
Incandescent	Cobra Head	7	0%	92	2,750	\$635	0%	25
LED	Cobra Head	2	0%	36	307	\$71	0%	36
Total		1,996	100%	87.3	744,056	\$171,753	100%	33.6

Legend:

 Blue Sections: Model Calculations and Assumptions

 Green Sections: Input Data

 Yellow Boxes: User Inputs

Blue Blue Text: Hard coded numbers

Black Black Text: Formulas

Appendix B: Main Types of Streetlights in Scarsdale



Cobra Head
(Count: 1,791)



Town and Country Post-Top
(Count: 73)



Decorative Post-Top
(Count: 130)