February, 2022

Mayor Steven T. Noble

City of Kingston

Energy and Cost Savings Analysis

Traffic Signal Removals and the LED Street Lighting Project

Introduction

Following the City of Kingston's passage of the Climate Action Plan[1] in 2012, energy saving measures have been implemented across the City to reduce fossil fuel use and greenhouse gas emissions. These measures include LED lighting upgrades and the removal of high-energy consuming items from the City's portfolio of environmental assets.

This report reviews two such projects that reached completion in 2020 and 2021: **Traffic Signal Conversion and Removals** and the **LED Street Lighting Project**. Both projects were implemented to reduce citywide energy consumption and provide cost savings to the City of Kingston.

This report includes:

- Methodology
- Traffic signal conversion and removal information over the two year project period
- Traffic signal cost and energy use statistics and graph
- Citywide streetlight retrofit project information over the five year project period
- Citywide streetlight cost and energy use statistics and graph
- Conclusions

Methodology

The data used in this document was collected from the 2012 Climate Action Plan, the New York State Power Authority, the City of Kingston Comptroller's Office, and reports generated by *Portfolio Manager*. The City of Kingston benchmarks energy use through *Portfolio Manager*, a free online software developed by the United State Environmental Protection Agency (EPA), by imputing monthly usage per City meter. The software then catalogues the data for easy access. After collection, all data was aggregated in Excel spreadsheets.

Greenhouse gas emission rates are calculated using the EPA conversion factor[2] for the New York Upstate (NYUP) eGrid Region. Conversion rates are as follows:

GHG Conversion by Energy Source	Value
GHG Emission Rate for New York State Electricity eGrid NYUP (kgCO2e)/MBtu)	30.98

[1] https://kingston-ny.gov/filestorage/8399/8491/8495/10452/Kingston_Climate_Action_Plan_FINAL.pdf
[2] https://portfoliomanager.energystar.gov/pdf/reference/Emissions.pdf

Traffic Signals

Removals

Signal removals were completed after a study[3] done by the Ulster County Transportation Council found that traffic volume, crash history, and other factors did not warrant the operation of these signals. Further, these signals relied on older technology, lacked pedestrian features such as push buttons and pedestrian heads, and spare parts were becoming hard to source; therefore they did not meet modern standards.

Between August and December of 2020, 11 traffic signals were removed at the following intersections in the City of Kingston:

- Washington Avenue at Main Street, Linderman Avenue, and Pearl Street
- Pearl Street at Wall Street and Fair Street
- Clinton Avenue at Franklin Street, Henry Street, and St. James Street
- St James Street at Fair Street
- Foxhall Avenue at Schufeldt Street
- Lincoln Street at East Chester Street

Traffic signal removals have led to a decline in energy use during the last quarter of 2020. Maintenance effort is also reduced as a result of the removals, while safety is improved.

Conversions

In January of 2019, the City of Kingston began converting traffic signals to LED bulbs as they required repair. As of the time of this report, an estimated 60% of citywide traffic signals in Kingston have been fitted with LED bulbs. Additionally, many conventional three-bulb stoplights have been changed to a single blinking red light. These lights uses 50% of the energy of a three-bulb stoplight.

The conversion and removal of traffic signals in Kingston has led to significant reductions in energy use.

In 2010, as reported in the 2012 Climate Action Plan, citywide traffic signals consumed 262,791 kWh of energy, and cost the City $38,941. As of December 31st, 2021, annual energy consumption by traffic signals in the City of Kingston has been reduced to 39,756 kWh a year at a cost of $16,795 to the City.

This is an 85% reduction in overall energy use over the past 11 years.

Year ending December 31st	Citywide traffic signals (end of year count)	Total annual energy consumption	Annual associated energy cost	Associated annual GHG emissions
2010	77	262,791 kWh	$38,941	27.8 $MTCO_2e$
2019	63	58,951 kWh	$28,007	6.2 $MTCO_2e$
2020	52[4]	49,590 kWh	$20,969	5.2 $MTCO_2e$
2021	52	39,756 kWh	$16,795	4.2 $MTCO_2e$

[3] https://ulstercountyny.gov/transportation-council/active-studies/kingston-traffic-signal

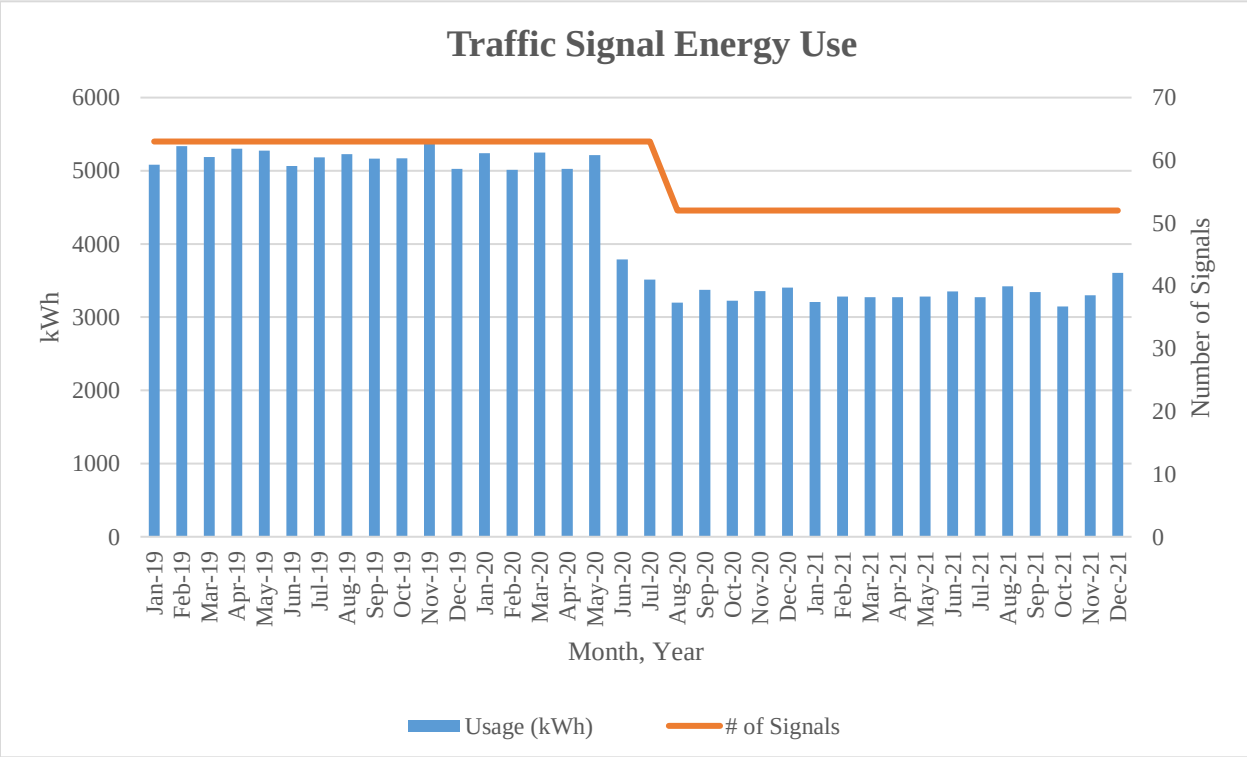
[4] Signals removed in August 2020; energy use for this period reflects 8 months of previous signal count and 4 months of reduced count. Energy use for 2021 reflects a full 12 months of energy use following signal removals.

Monthly Traffic Signal Energy Use Graph

The following graph represents citywide traffic signal statistics between January 2019 and December 2021. Blue bars depict monthly energy use, while the orange line represents the number of signals owned and operated by the City.

Central Hudson, which serves as the City's electrical provider, bills the City of Kingston's traffic signals in a conglomerate of 46 signals over three account numbers. 6 of the City's other traffic signals, which are not a part of this conglomerate, have individual metered accounts whose monthly electrical charge may occasionally fluctuate due to outages or other changes in use. The conglomerate of 46 traffic signals is billed a standard fee for a standard amount of electricity each month, regardless of actual usage. Although traffic signal removals began in August, discounts on the City's energy bill began appearing as early as June, 2020. It is for this reason that there exists a downward trend in energy use presented in the graph below, prior to the actual commencement of the project.

Following removals and conversions, the standard electric charge for the City's conglomerate of traffic signals dropped by approximately 32.5%.



Streetlights

City of Kingston LED Street Lighting Project

The City of Kingston began the process of evaluating street lighting in 2014, at which time a *Street Lighting Replacement Energy and Feasibility Analysis* was prepared for the City by C.T. Male Associates. The focus of this analysis was to evaluate the energy and cost savings from the upgrade of the existing street lighting in the City of Kingston with a more efficient light emitting diode (LED) lighting technology.

In October of 2015, the City of Kingston Common Council authorized the bonding in the amount of $2,100,000.00 for the LED Street Lighting Conversion Project. In March of 2017, the City purchased all streetlight poles and fixtures from Central Hudson for $470,808.00 in order to proceed with the retrofits.

Upon purchase of the poles and fixtures in 2017, the City of Kingston became responsible for maintenance, which now occurs almost entirely in house by the Department of Public Works. Additionally, pole rental fees were no longer applicable to the City and therefore dropped from monthly Central Hudson bills. Once no longer responsible for these costs, the City's overall allocated budget for Streetlights dropped substantially. Total budgeted amount in 2016 was $555,000, and in 2021, $171,236.

In April 2018, the City authorized the New York Power Authority (NYPA) to proceed with the City of Kingston LED Street Lighting Project which involved upgrading all non-LED street lights to LEDs, with a proposed annual savings of over $100,000 per year. This project was a turn-key initiative, led by Wendel Energy Services as the implementation contractor for NYPA.

Between September 2017 and April 2018, the City of Kingston converted 177 streetlights to LED fixtures; between April 2018 and March 2021, Wendel Energy Services converted the remaining 2,250.

Prior to the replacement of these fixtures, City of Kingston streetlights were consuming upwards of 1.88 million kWh of energy annually. LED fixtures have longer lifespans and use less energy when compared to conventional lightbulbs, and have led to significant cost and energy savings for the City. As reported in the 2012 Climate Action Plan, in 2010 Citywide streetlights consumed 1,884,320 kWh of energy, accounting for $471,715 in costs to the City. As of December 31st, 2021, annual energy consumption by streetlights in the City of Kingston has been reduced to 927,239 kWh a year at a cost of $120,966 to the City.

The average monthly streetlight energy consumption for 2021 was 77,270 kWh, which is down 23% when compared to that of 2020 (100,424 kWh), and down 47% when compared to pre-upgrades usage from 2016 (146,813 kWh).

Post-upgrades, the City of Kingston is saving an average of $29,229 a month or $350,748 a year on streetlight energy costs when compared to the period before September 2017 when upgrades began. This is over 3.5x the initial anticipated savings that had been projected by NYPA.

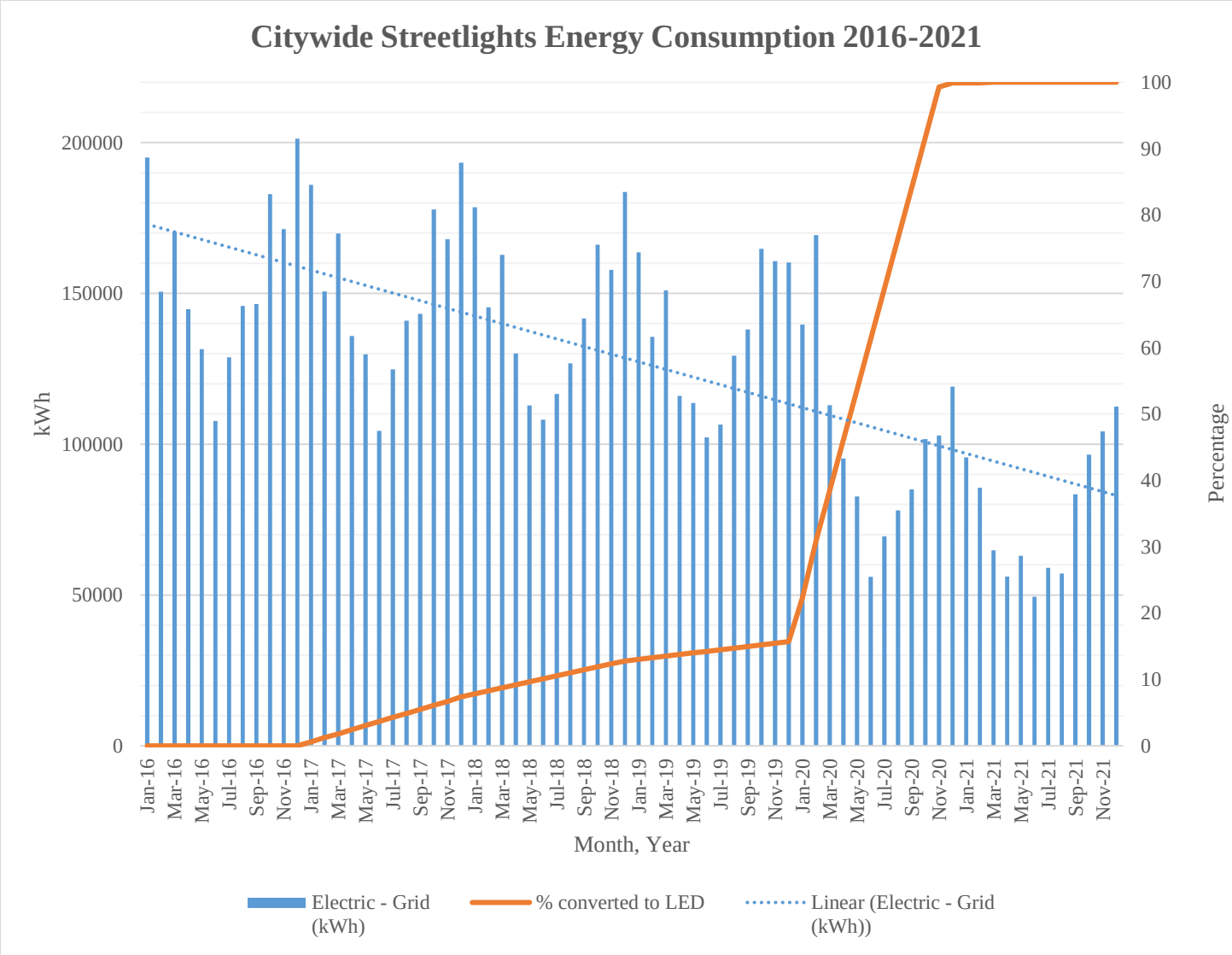
Year ending December 31st	Streetlights converted over the calendar year	Percentage of total streetlights converted to LED bulbs	Total annual energy consumption	Total annual greenhouse gas emissions	Annual associated energy cost	Total budgeted for streetlight expenses
2010	0	0%	1,884,320 kWh	199 $MTCO_2e$	$471,715	$463,500
2016	0	0%	1,876,405 kWh	198 $MTCO_2e$	$524,590	$555,000
2017	177	7.4%	1,824,504 kWh	192 $MTCO_2e$	$305,211	$530,000
2018	131	12.8%	1,730,499 kWh	183 $MTCO_2e$	$228,156	$250,000
2019	68	15.7%	1,649,632 kWh	174 $MTCO_2e$	$255,485	$240,000
2020	2049	99.9%	1,212,262 kWh	128 $MTCO_2e$	$169,716	$174,000
2021	2	100%	927,239 kWh	98 $MTCO_2e$	$120,966	$171,236

The total project cost for LED Streetlight Retrofits was $1,257,453.20. Based only on energy savings, with electricity rates at the time of this report, the estimated payback period of this project is approximately 4 years following completion in March, 2021.

Monthly Streetlight Energy Use Graph

The following graph represents citywide streetlights statistics between January 2016 and December 2021. Blue bars represent monthly energy use with an associated trend-line, and the orange represents percentage of streetlights converted to LED fixtures, with kilowatt hours on the left axis, and percentage on the right.

Monthly streetlight electricity use fluctuates relative to daylight hours, with the greatest usage occurring during winter months. Prior to LED upgrades, average monthly electrical use for citywide streetlights was 156,697 kWh, peaking at 198,158 kWh in the winter, and dipping to 106,077 kWh during the summer. Following upgrades, annual peaks have dropped to 111,648 kWh during winter months and lows to 49,444 kWh. This change is use demonstrates an average 44% reduction in energy use during winter months and 53% reduction in energy use during summer months.



Conclusions

Both the Streetlight and Traffic Signal projects have had significant impacts on the City of Kingston's energy use, as well as the costs from operating such municipal assets. Average cost savings are anticipated to increase in the years following upgrades due to the extended lifespan of LED fixtures. LED fixtures have a lifespan 25x that of less efficient models, and will result in up to 90% overall energy savings throughout their lifetime. Therefore this project will not only lead to savings from purchased electricity, but also cost savings from replacement of fixtures and reduced maintenance.

Many of the facilities owned and operated by the City of Kingston have received LED upgrades to further improve upon electrical efficiency. Since 2018, fifteen of the City's office buildings, community centers, and firehouses have received LED upgrades, including the top three with respect to overall energy use: the Wastewater Treatment Plant at 91 E. Strand St., the Department of Public Works Garage Campus at 478 Hasbrouck Ave., and City Hall at 420 Broadway. Additionally, City of Kingston staff regularly evaluates the operation of traffic intersections to evaluate additional signal removals.

Cost and energy use data from this report provides the City of Kingston with the information necessary to increase operational efficiently, effectively use taxpayer resources, and inform further energy conservation policy and program development. The City of Kingston continues to set progressive targets for energy reduction through strategic efforts focusing on energy conservation and sustainable operations.

It is forecasted that municipal electricity use will continue to decrease as these and other projects are put into play. Furthermore, the 2030 Climate Action Plan[5] includes more ambitious goals to be achieved for reductions in energy use, as well as strategies to reach those goals.

For more information on these and other sustainability initiatives in the City of Kingston please visit: https://www.kingston-ny.gov/Sustainability

[5] https://engagekingston.com/climate-action-plan