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June 30, 2009

Mayor Harry Lewis
Members of the Board of Trustees
Village of Johnson City
243 Main Street
Johnson City, NY 13790

Report Number: P4-9-30

Dear Mayor Lewis and Members of the Board of Trustees:

A top priority of the Office of the State Comptroller is to help local government officials manage government resources efficiently and effectively and, by so doing, provide accountability for tax dollars spent to support government operations. The Comptroller oversees the fiscal affairs of local governments statewide, as well as compliance with relevant statutes and observance of good business practices. This fiscal oversight is accomplished, in part, through our audits, which identify opportunities for improving operations and Village governance. Audits also can identify strategies to reduce costs and to strengthen controls intended to safeguard local government.

In accordance with these goals, we are conducting an audit of four municipalities to determine if local municipalities can have a positive impact on the environment and public safety, and realize cost savings by using light emitting diode¹ (LED) bulbs for traffic signals. We included the Village of Johnson City (Village) in our audit. Within the scope of this audit, we examined the Village's electricity bills and conducted interviews with employees to gain an understanding of traffic signal use and maintenance. Our audit period was January 1, 2006 to July 31, 2008.

This report of examination letter contains our findings and recommendations specific to the Village. We discussed the findings and recommendation with Village officials and considered their comments in preparing this report. The Village's response is attached to this report in Appendix A. Village officials generally agreed with our recommendation and indicated they planned to initiate corrective action. At the completion of our audit of the four municipalities, we prepared a global report that summarizes the significant issues we identified at all of the municipalities audited.

¹ Light emitting diode, or LED, traffic signals are an energy-efficient alternative to commonly used incandescent bulbs. Where incandescent bulbs use one large bulb, LED traffic signal lights are composed of hundreds of LEDs that from a distance appear as a single continuous light source.

Summary of Findings

If the Village replaced all of its incandescent traffic signals² with LED bulbs, our analysis shows that your Village could save more than \$42,000 over a five-year period, an average of more than \$8,400 annually, on its traffic signal electricity and maintenance costs.

Background and Methodology

Incandescent bulbs have long been used to illuminate traffic signals. Traffic signals are an integral part of smooth day-to-day operations within all municipalities. Signals operate 24 hours a day, 7 days a week and amount to an annual operating cycle of 8,760 hours. Opportunity exists for substantial cost savings if these devices could operate more efficiently. Recently, municipalities started to move from the traditional incandescent bulbs to LEDs.

Recent technological advances have catapulted LEDs into the forefront of efficient traffic signal devices. LED technology gained popularity in many municipalities' traffic signals because of their energy efficiency. This type of bulb has quickly become an area for reduced electric use and cost savings. Approximately 52 percent of the traffic signal market has already moved to LEDs, with red and green signals having the deepest market penetration at 65 percent and 59 percent, respectively.³ Yellow traffic signals have yet to experience the same adoption because they remain illuminated for only a fraction of the time.

In 2008, the U. S. Department of Energy commissioned a study⁴ to determine the effects of using LEDs in traffic signal applications. The study disclosed that municipalities who replaced their existing incandescent traffic signals with LED bulbs achieved immense savings. Another study done by the New York State Energy and Research Development Authority (NYSERDA) concluded that replacing incandescent bulbs with LEDs could result in estimated energy savings of 90 percent on average for traffic signals.⁵

The Village has 16 traffic intersections with signals. Nine of these intersections still have signals that use incandescent bulbs. Village officials spent an average of about \$12,600 for electricity and maintenance for their incandescent traffic signals annually. As part of our audit procedures, we examined the Village's traffic signal expenditures for a six-month period of the 2008 fiscal year to determine the amount and cost of electricity required to run the Village's traffic signals. We interviewed Village officials to determine whether the equipment and technical skills necessary to replace and maintain LED traffic signals were available. We also contacted appropriate third parties including staff of other New York State agencies⁶ and officials from municipalities that have recently replaced their incandescent traffic signals with LEDs within their municipal jurisdictions. We estimated the replacement price for the red and green traffic signals, as well as their

² The Village has nine traffic intersections that operate traffic signals with incandescent bulbs.

³ U.S. Department of Energy savings estimate.

⁴ Navigant Consulting Inc. prepared a report for the U. S. Department of Energy.

⁵ NYSERDA Energy Smart Pamphlet available at:

<http://www.lrc.rpi.edu/programs/transportation/LED/pdf/NYSLEDBrochure.pdf>

⁶ Third parties and agencies we contacted included New York State Electric & Gas (NYSEG), NYSERDA, NYS DOT and NYS Department of Public Service.

maintenance and repair costs, based on data obtained from State contracts and Village estimates. We then compared those cost estimates to current traffic signal expenditures to identify any savings.

We conducted our audit in accordance with generally accepted government auditing standards (GAGAS). Such standards require that we plan and conduct our audit to adequately assess those Village operations within our audit scope. Further, those standards require that we understand the Village's management controls and those laws, rules and regulations that are relevant to Village operations included in our scope. An audit includes examining, on a test basis, evidence supporting transactions recorded in the accounting and operating records and applying such other auditing procedures, as we consider necessary in the circumstances. We believe that our audit provides a reasonable basis for our findings, conclusions and recommendations contained in this report.

Audit Results

Cost Savings

The Village could realize significant cost savings if they replaced their current incandescent traffic signals with energy efficient and longer lasting LEDs.

According to our analysis, the Village's nine intersections with traffic signals still use 134 incandescent bulbs.⁷ We developed cost estimates⁸ for the purchase and installation of LED bulbs to replace these incandescent bulbs. Our analysis indicated that the Village's total costs to replace their existing incandescent bulbs would be about \$8,500, or an average of about \$63 per bulb.⁹

Our calculation of potential cost savings¹⁰ over a five-year period projected that Village officials could save approximately \$42,000, or about \$8,400 annually, by replacing existing incandescent bulbs to the more efficient LEDs.

Village officials have already replaced two existing incandescent traffic signal intersections¹¹ with LEDs; however, Village officials told us they have not continued with the replacement because of budgetary constraints.

Environmental Impact

Electricity usage in the United States has increased by 24 percent and emissions from the production of electricity have increased by 22 percent between 1994 and 2005.¹² A large

⁷ These signals use either a 116-watt or 69-watt long-life incandescent bulbs. Typically, an incandescent bulb can last for 8,000 hours, while an LED bulb can last for 50,000 hours. Our review of Village electric bills disclosed that the Village's average electricity cost was approximately \$0.18 per kilowatt-hour (kWh).

⁸ The total costs of replacing to LED bulbs included the purchase and installation of the LED bulbs by Village staff.

⁹ \$8,500/134 bulbs = \$63

¹⁰ The potential cost savings were reduced by the initial cost to replace the Village's existing incandescent traffic signals to LEDs of \$8,496.

¹¹ These two intersections were not part of the nine intersections that still use incandescent bulbs.

¹² Energy Information Administration's Annual Energy Review, 2006

percentage of electricity is generated from oil, natural gas, and coal, while the remainder is produced from nuclear, hydroelectric, and refuse. All of these sources, except for nuclear and hydroelectric (which some consider clean alternatives) produce certain pollutants that have a negative impact on the environment. Fossil fuels represent the majority of fuel used to produce power, emit pollutants into the atmosphere, and accounted for 85 percent of the nation’s greenhouse emissions in 2006.¹³

A study released by the National Academy of Sciences¹⁴ confirmed that greenhouse gases are accumulating in the Earth’s atmosphere as a result of human activities that contribute to global warming. Key pollutants that contribute to smog and acid rain include carbon dioxide (CO₂) nitrous oxide (N₂O) and sulfur dioxide (SO₂). Information about these gases follows.

- Carbon dioxide is a colorless, odorless gas that allows light from the sun’s rays to transmit to the Earth’s surface but blocks heat radiating from the Earth’s surface from escaping into the atmosphere, thus contributing to global climate change or warming due to the “greenhouse” effect.
- Nitrogen oxide is a compound of nitrogen and oxygen that once in the air may undergo a chemical transformation into nitrates and nitric acid, contributing to acid rain and ground-level ozone (photochemical smog).
- Sulfur dioxide is a heavy, colorless gas that once in the air may undergo a chemical transformation into sulfates and sulfuric acid, contributing to acid rain. Electric generation facilities are the largest source of SO₂ emissions. Federal and State environmental regulatory programs control and monitor SO₂ emissions.¹⁵

Village officials could potentially save approximately 39,254 kilowatt-hours of electricity each year if they replaced the remainder of their existing incandescent traffic signals with LEDs. In addition to lowering the Village’s electricity costs, officials could also reduce the amount of greenhouse gas emissions by reducing the Village’s demand for electricity. Depending on fuel source, size, and location, the generation of electricity may also cause other public health, environmental and socioeconomic impacts not disclosed above. Each kWh of traditional electricity consumed produces harmful emissions or byproducts. The following table illustrates the amount of pollution emissions (in pounds) that the Village could avoid producing by replacing the Village’s incandescent bulbs with LEDs.

	Pollution Emissions Equivalents (lbs)		
Potential kWh Savings	CO₂	N₂O	SO₂
39,254	32,188	39	165

¹³ Environmental Protection Agency report entitled “Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2006”

¹⁴ Entitled “Climate Change Science Report”, issued 2001

¹⁵ Environmental Disclosure, Consumer Guide, New York State Public Service Commission, 8/03

Recommendation

1. Village officials should replace existing incandescent traffic signals with LEDs to achieve energy and maintenance cost savings. Officials should also consider the environmental impact of their operations (electricity usage) and pursue methods to operate efficiently and in an environmentally sensitive manner.

The Board of Trustees has the responsibility to initiate corrective action. A written corrective action plan (CAP) that addresses the findings and recommendations in this report should be prepared and forwarded to our office within 90 days, pursuant to Section 35 of the General Municipal Law. For more information on preparing and filing your CAP, please refer to our brochure, *Responding to an OSC Audit Report*, which you received with the draft audit report. We encourage the Board to make this plan available for public review in the Village Clerk-Treasurer's office.

Our office is available to assist you upon request. If you have any further questions, please contact Patrick Carbone at (607) 721-8306.

Sincerely,

Steven J. Hancox
Deputy Comptroller
Office of the State Comptroller
Division of Local Government
and School Accountability

APPENDIX A

RESPONSE FROM VILLAGE OFFICIALS

The Village officials' response to this audit can be found on the following page.



OFFICE OF THE MAYOR

VILLAGE OF JOHNSON CITY

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April 8, 2009

Patrick A. Carbone
Chief Examiner
Division of Local Government and School Accountability
NY State Office Building
44 Hawley St.
Binghamton, NY 13901

RE: Report Number P4-9-30

Dear Mr. Carbone:

Thank you for the opportunity to respond to the draft report on the impact of converting to light emitting diode (LED) bulbs for traffic signals. The Village has the responsibility for the electricity and maintenance for 15 not 16 traffic signals. Any calculations should be based on 15 signals of which 6 have already been converted to LED's and 2 more are planned in the next fiscal year. It is not clear from the report whether the cost to upgrade the polycarbonate traffic signal section that houses the LED traffic signal module is included.

The Village realized a 37% cost savings (approximately \$300) for one traffic signal replaced in January 2005 when comparing energy costs between VFY 2003-2004 and VFY 2005-2006.

The Village will continue to seek funding to replace the incandescent traffic signals with LED's and appreciates the effort of your office in preparing the report.

Sincerely,



Harry G. Lewis
Mayor

cc: [REDACTED]