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March 5, 2008

Honorable Jeremy Wilber  
Supervisor  
Town of Woodstock  
45 Comeau Drive  
Woodstock, NY 12498

Report Number: S9-7-55

Dear Supervisor Wilber:

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 Town governance. Audits also can identify strategies to reduce costs and to strengthen controls intended to safeguard local government assets.

In accordance with these goals, we conducted an audit of six municipalities throughout New York State. The objectives of our audit were to determine whether municipalities have realized cost savings through the acquisition and usage of solar panels, and what is the environmental impact of using solar panels? We included the Town of Woodstock in this audit. Within the scope of this audit, we examined the acquisition and implementation costs of the solar panels, electric bills, system specification documents, and interviewed local officials for the period January 1, 2003 through July 31, 2007. Following is a report of our audit of the Town of Woodstock. This audit was conducted pursuant to Article V, Section 1 of the State Constitution, and the State Comptroller's authority, as set forth in Article 3 of the General Municipal Law.

This report of examination letter provides findings and recommendations specific to the Town of Woodstock. We discussed the finding and recommendations with Town officials and considered their comments in preparing this report. Town officials were given an opportunity to respond to this letter; the Town decided not to respond within this timeframe. At the completion of our audit of the six municipalities, we will prepare a global report that summarizes the significant issues we identified in all of the local governments audited.

## Summary of Findings

The Town of Woodstock's solar panel electrical system could save the Town as much as \$105,000, and will reduce their contribution of carbon dioxide, nitrous oxide and sulfur dioxide emissions by more than 488,000 pounds, over the life of the panels.

## Background and Methodology

Solar panels or photovoltaic devices installed on the roofs of buildings capture sunlight and convert it into electricity. This happens when the sunlight ("photo") causes a molecular reaction on specially treated semi-conducting material such as silicon. The reaction creates a small amount of electricity ("voltaic") which is gathered from all the cells on the panel and output as direct current (DC). This electricity is further converted into the standard alternating current (AC) through inverters, and then used to help power buildings or specific applications.

The New York State Energy and Research Development Authority (NYSERDA) provides many programs that administer government incentives to install energy efficient technologies, including grants and incentives to help offset the cost of installing solar panels. The NYSERDA funding can make the solar panels economically feasible.

The Town of Woodstock located in Ulster County has about 6,210 residents and covers 76 square miles with an annual operating budget of 7.2 million. The Town has about 11 municipal buildings and/or structures which use electricity. The following table (Table 1) illustrates total electricity usage and cost for the Town Hall where the solar panels have been installed.

	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>TOTAL</b>
Energy Usage (kWh)	51,680	52,160	53,040	47,400	204,280
Average Cost per (kWh)	\$ .06	.06	\$ .08	\$ .07	\$ .07
Total Annual Cost <sup>1</sup>	\$ 4,211	\$ 4,346	\$ 5,498	\$ 4,083	\$ 18,183

The Town installed a 16.8 kilowatt (kw) solar panel system on its Town Hall which became operational on August 5, 2005. Town officials decided to pursue the NYSERDA Grant for the PV project both to produce environmental and financial benefits for itself and to serve as an example for other towns in the region and across the state. We reviewed the system specification documents, payment vouchers for the solar panel system installed, incentives, and actual metered output. We also interviewed officials and reviewed the utility bills from January 2003 to the end of fieldwork.

We conducted this performance audit in accordance with generally accepted government auditing standards (GAGAS). Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and

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<sup>1</sup> These costs also include demand charges, surcharges, and basic supply charges not affected directly or could not be reasonably assessed to determine the impact on the solar electricity produced.

conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

**Audit Results**

**Cost Benefit Analysis**

Town officials conceived this idea after months of research. Based on the their evaluation, Town officials decided to install solar panels on the roof of the Town Hall and dedicate the electricity produced from the panels to the overall supply for the facility, reducing the amount needed to be purchased from the utility company. Traditional and solar panel produced electricity work together to meet the facility’s electrical demands. The system pulls first from the solar panel power, and then uses the traditional electricity for the remaining needs.

The system has a 25-year warranty and an estimated useful life of 40 to 50 years. The main components of the system include solar panels capable of 10.8 kw of electricity per year, special inverters, and miscellaneous fixtures. The total cost of the system including parts, installation, and consulting was \$108,831. NYSERDA provided funding of \$94,120 and the Town paid the remaining \$14,711 or 14 percent. The Town was reimbursed by NYSERDA at different milestone dates during the project.

The Town uses meters built into the inverters and a computer application to monitor the system’s output and functionality. We reviewed all output from the date of operation through July 2007. The cost per kWh averaged \$.08 during the first year of operation. Overall, the system produced an average of 45 kWh per day, or 16,425 kWh annually. Factoring in standard inflation<sup>2</sup> rates, we estimate that the municipalities’ payback period will be about nine years. The units come with a 25-year warranty on the panels and 5-10 years on the other parts with estimated useful life of the system between 40 to 50 years. The following table (Table 2) illustrates the potential accumulated cost savings to the Town from use of the system.

<b>TABLE 2. TOTAL ACCUMULATED SAVINGS</b>		
<b>Time Period</b>	<b>Accumulated Savings</b>	<b>Savings in Excess of Town Costs</b>
9 Years – (Return on Investment Period)	\$ 14,711	\$ 0
After 40 Years	\$ 85,213	\$ 70, 502
After 50 Years	\$ 119,396	\$ 104,685

**Environmental Impact**

The Town’s electrical energy needs are provided through Central Hudson Gas and Electric. About 43 percent is generated from oil, gas, and coal; the remainder is produced from nuclear, hydro and refuse. All these sources, except for nuclear and hydro, which are considered clean alternatives, produce certain pollutants and have negative impacts on the environment. Further, the Town purchases 28 percent of their electricity from Central Hudson that is produced from

<sup>2</sup> Analysis of NYS Commercial Energy Prices from 1991 – 2005.

wind power (clean electricity). A study released by the National Academy of Sciences<sup>3</sup> confirmed that greenhouse gases are accumulating in the Earth's atmosphere as a result of human activities contributing to global warming. Carbon dioxide (CO<sub>2</sub>) emissions contribute to global warming and nitrous oxides (N<sub>2</sub>O) and sulfur dioxides (SO<sub>2</sub>) are key pollutants that contribute to smog and acid rain. The total energy produced by the Town's solar panel system not only produces costs savings for the Town, but also has direct environmental benefits.

Electricity produced by the solar panels has no emission or byproduct that negatively affects the environment. Conversely, each kWh of traditional electricity produced has emissions or byproducts from the production of that electricity. For example, each kWh of electricity produced by the utilities, for consumption by its customers, results in .82 pounds of carbon dioxide emission, .001 pounds of nitrous oxide emission, and .0042 pounds of sulfur dioxide emission. Since the Town purchases 28 percent of their traditional electricity demand from clean energy normal coefficients are reduced by 28 percent to reflect this. The following table (Table 3) illustrates the avoided emission equivalents of the pollutants that would have been created from generating traditional power instead of using the solar panels:

<b>Pollutants</b>	<b>Emissions (lbs per kWh)</b>	<b>Annually</b>	<b>40 Years</b>	<b>50 Years</b>
Carbon Dioxide Emissions (lbs)	.59	9,697	388,000	485,000
Nitrous Oxide (lbs)	.0007	12	471	588
Sulfur Dioxide (lbs)	.0003	50	1,985	2,481

Because the Town of Woodstock installed the solar panels that produce about 16,425 kWh of electricity annually, it has directly contributed to the preservation of the environment through avoided emissions. Further, had the Town used traditional electricity, it would have contributed to releasing about 9,760 pounds of these pollutants annually, and over 488,000 pounds during the life of the panels, into the atmosphere. For perspective, since vehicles annually emit about 5.7 tons of carbon dioxide, over the 50-year life of the solar panels this would equate to the elimination of the carbon dioxide produced by about 43 vehicles.

**Recommendation**

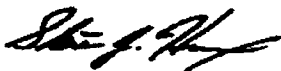
1. The Town should continue to explore alternative energy resources and expand the use of those technologies that reduce its energy costs and protect the environment.

The Town Board has the responsibility to initiate corrective action. Pursuant to Section 35 of the General Municipal Law, the Board should prepare a plan of action that addresses the recommendations in this report and forward the plan to our office within 90 days. For guidance in preparing your plan of action, you may refer to applicable sections in the publication issued by the Office of the State Comptroller entitled *Local Government Management Guide*. We

<sup>3</sup> Entitled "Climate Change Science Report," issued 2001.

encourage the Board to make this plan available for public review in the Town Clerk's office. If you have any further questions, please contact the Statewide and Regional Projects Unit at (607) 721-8306.

Sincerely,

A handwritten signature in black ink, appearing to read "Steven J. Hancox".

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

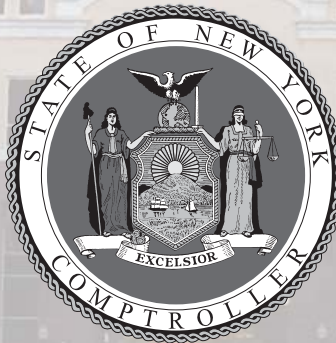


# Usage of Solar Panels in Municipalities

Period Covered:

January 1, 2003 — July 31, 2007

2008-MS-1



Thomas P. DiNapoli

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# State of New York Office of the State Comptroller

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## **Division of Local Government and School Accountability**

March 2008

Dear Local Officials:

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, through our audits, which identify opportunities for improving operations and general municipal governance. Audits also can identify strategies to reduce costs and to strengthen controls intended to safeguard local government assets.

Following is a report of our audit of six municipalities, entitled Usage of Solar Panels in Municipalities. This audit was conducted pursuant to Article V, Section 1 of the State Constitution, and the State Comptroller's authority as set forth in Article 3 of the General Municipal Law.

This audit's results and recommendations are resources for local government officials to use in effectively managing operations and in meeting the expectations of their constituents. If you have questions about this report, please feel free to contact the local regional office for your county, as listed at the end of this report.

Respectfully submitted,

*Office of the State Comptroller  
Division of Local Government  
and School Accountability*





## State of New York Office of the State Comptroller

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# EXECUTIVE SUMMARY

Governmental operations provide governance, public safety, transportation, health and human services, education, and other services to taxpayers. Delivering these services is expensive; one of the key expenditures is the cost of electricity. Electricity is a major expenditure due to the number of government service locations and the size of the necessary infrastructure. Governments have an opportunity to lead by example in the effort to reduce our reliance on traditional energy and oil. This involves researching alternative energy sources and implementing those options that provide cost and energy efficiencies. Governments have many options available to exercise this leadership role, including the utilization of solar panels.

We reviewed six municipalities that have installed solar panel systems on municipal buildings to supplement traditional electricity demand. The six municipalities are:

- Albany County
- Town of Hempstead, Nassau County
- Town of Lansing, Tompkins County
- Town of Woodstock, Ulster County
- Town of Rosendale, Ulster County
- Village of New Paltz, Ulster County

These municipalities have proactively taken steps to reduce their reliance on traditional electricity sources and have reduced their contribution of greenhouse gases into the atmosphere since installing the solar panels. Each municipality utilized State funding to complete the solar panel projects.

Solar panels, or photovoltaic devices, installed on the roofs of buildings capture sunlight and convert it into electricity. This happens when the sunlight (“photo”) causes a molecular reaction on specially treated semiconducting material such as silicon. The reaction creates a small amount of electricity (“voltaic”) which is gathered from all the cells on the panel and output as direct current (DC). This electricity is converted into the standard alternating current (AC) by inverters, and then used to help power buildings or specific applications.

The New York State Energy and Research Development Authority (NYSERDA) administers many programs that provide government incentives for energy efficient technologies, including grants and incentives to help offset the cost of installing solar panels. The NYSERDA funding helps make solar panels economically feasible.

## **Scope and Objective**

The objective of our audit was to assess the effects of installing solar panel systems in municipalities, for the period January 1, 2003 through July 31, 2007. Our audit addressed the following related questions:

- What is cost impact of the acquisition and usage of solar panels on the municipality?
- What is the environmental impact of using solar panels?

## **Audit Results**

By installing solar panel electrical systems, the six audited municipalities have realized immediate savings on their electrical bills and avoided environmental emissions. These municipalities could save as much as \$944,000, and reduce their carbon dioxide, nitrous oxide and sulfur dioxide emissions by more than 6.6 million pounds over the life of the panels. These proactive municipalities, among others, have improved the efficiency of their governmental operations through the use of alternative energy sources. Other municipalities should seek similar opportunities to implement alternative energy sources, including solar panels, which provide immediate cost savings and environmental benefits.

Each solar panel installation included funding from NYSERDA. On average, the six municipalities paid about 27 percent of the total project cost; the range was 14 to 36 percent of total costs. While installing solar panels is beneficial to municipalities for cost and environmental reasons, NYSERDA or State funding for these programs is essential. This funding stream has since closed and municipalities are eligible for general incentives that provide a lower percentage reimbursement of the costs. In addition, the pool of funds available to municipalities is shared with residential and commercial operations. Without governmental subsidy, the installation of solar panels is not cost-effective, although the environmental benefits might be worth the additional costs.

## **Comments of Local Officials**

The results of our audit and recommendations have been discussed with local officials and their comments have been considered in preparing this report. Each unit was provided an opportunity to respond to the draft report; only the Towns of Lansing and Hempstead chose to respond.

# Introduction

## Background

Governmental operations provide governance, public safety, transportation, health and human services, education, and other services to taxpayers. Delivering these services is expensive; one of the key expenditures is the cost of electricity. Electricity is a major expenditure due to the number of government service locations and the size of the necessary infrastructure. Governments have an opportunity to lead by example in the effort to reduce our reliance on traditional energy and oil. This involves researching alternative energy sources and implementing those options that provide cost and energy efficiencies. Governments have many options available to exercise this leadership role, including the utilization of solar panels.

Solar panels, or photovoltaic devices, installed on the roofs of buildings capture sunlight and convert it into electricity. This happens when the sunlight (“photo”) causes a molecular reaction on specially treated semiconducting material such as silicon. The reaction creates a small amount of electricity (“voltaic”) which is gathered from all the cells on the panel and output as direct current (DC). This electricity is converted into the standard alternating current (AC) by inverters, and then used to help power buildings or specific applications.



*Albany County Hockey Facility Solar Panels  
(with permission from Albany County)*

The New York State Energy and Research Development Authority (NYSERDA) administers many programs that provide government incentives for energy efficient technologies, including grants and incentives to help offset the cost of installing solar panels. NYSERDA funding was essential to make the implementation of solar panels economically feasible.

The solar panel funding examined in this audit came from the Virginia Electric Power Company (VEPCO) pursuant to a legal action where the State of New York alleged that VEPCO violated the federal Clean Air Act, resulting in increased emissions. This lawsuit provided funding for the installation of solar photovoltaic's (PV) in order to displace the need for more polluting sources of electricity generation. This source of funding and specific program has been closed. Currently, municipalities are eligible for general incentives that provide a lower percentage reimbursement of the costs. In addition, the pool of funds available to municipalities is shared with residential and commercial operations.

NYSERDA reviews and approves projects based on an application process. Since 2004, 59 applications were submitted for solar panel projects, 13 municipalities have installed solar panels on municipal buildings, and there are about 11 projects that have been approved and are under development.

We selected six municipalities to assess the impact of the installation and use of solar panels. The following table (Table 1) provides background information for each selected municipality:

<b>TABLE 1: BACKGROUND INFORMATION FOR SELECTED UNITS</b>				
<b>Municipality</b>	<b>County</b>	<b>Population</b>	<b>Annual General Fund Budget</b>	<b>Number of Municipal Buildings<sup>1</sup></b>
Albany County	Albany	295,000	\$566 Million	49
Town of Hempstead	Nassau	762,000	\$384 Million	150
Town of Lansing	Tompkins	10,500	\$5.8 Million	12
Village of New Paltz	Ulster	6,000	\$7.3 Million	11
Town of Woodstock	Ulster	6,210	\$7.2 Million	11
Town of Rosendale	Ulster	6,350	\$2.2 Million	16

Each municipality conducted studies of different alternative energy systems for its electrical needs and researched how it could optimize solar panels. Each unit indicated it did not undertake the project merely for cost savings. Each unit also sought to take a leadership role in reducing the country's reliance on traditional electricity.

<sup>1</sup> This includes municipal buildings and structures that use electricity.

## **Objective**

The objective of our audit was to assess the effects of installing solar panel systems in municipalities, for the period January 1, 2003 through July 31, 2007. Our audit addressed the following related questions:

- What is cost impact from the acquisition and usage of solar panels on the municipality?
- What is the environmental impact of using solar panels?

## **Scope and Methodology**

To assess the effects of installing solar panels in municipalities, we interviewed local officials and we examined the acquisition and implementation costs of the solar panels, electricity bills, and system specification documents for the period January 1, 2003 to July 31, 2007. We judgmentally selected six municipalities that utilized NYSEERDA funding to install solar panels. The municipalities included the Town of Hempstead in Nassau County, the Town of Rosendale, the Village of New Paltz, and the Town of Woodstock in Ulster County, Albany County, and the Town of Lansing in Tompkins County.

Our findings and results were based on calculations of average rates of electricity charged by the utilities, average daily output of the solar panels, returns on investment, and environmental effects. We used estimates and made objective judgments in determining how to proceed with our analytical analysis, which was consistently applied to the audited municipalities.

We conducted our audit in accordance with generally accepted government auditing standards (GAGAS). More information on such standards and the methodology used in performing this audit are included in Appendix B of this report.

## **Comments of Local Officials and Corrective Action**

The results of our audit and recommendations have been discussed with local officials and their comments have been considered in preparing this report. Each unit was provided an opportunity to respond to the draft report; only the Towns of Lansing and Hempstead chose to respond. Excerpts from their responses may be found in Appendix A.

The Governing Boards have the responsibility to initiate corrective action. Pursuant to Section 35 of the General Municipal Law, the Governing Board's should prepare a plan of action that addresses the recommendations in this report and

forward the plan to our office within 90 days. For guidance in preparing your plan of action, you may refer to applicable sections in the publication issued by the Office of the State Comptroller entitled *Local Government Management Guide*. We encourage the Board to make this plan available for public review in the clerk's office.

## Solar Panel Installations

A complete solar panel system has multiple components: solar panels, inverters, data collection systems, batteries, and other general electrical supplies. The most expensive components are the solar panels. These usually have a 25-year warranty with an estimated useful life of 40 to 50 years. The inverters, which are necessary to convert the direct current produced by the solar panels into standard alternating current, usually have a five- to ten-year warranty. The other general electrical supplies are standard equipment that is readily available and relatively inexpensive. Since solar panels are the most expensive component in the systems, we used their estimated useful life in our analysis.

Municipalities have flexibility in the size and type of solar panel purchased and installed. Each panel project reviewed used NYSERDA funding, which required a municipality to prepare an application with a project description. Two of the major project requirements included education of consumers and awareness of alternative energy sources. Each municipality had to include how it would meet these requirements in the application process in order to get approval for a solar panel project.

The solar panel output can be used for multiple purposes. Four of the municipalities decided to dedicate the electricity produced from the panels to the overall electricity supply needs of their facilities, thus reducing the amount purchased from the utility companies. Traditional and solar panel-produced electricity work together to meet the electrical demands of these municipalities. The system pulls first from the solar panel power, and then uses the traditional electricity for the remaining needs. Conversely, the Town of Hempstead dedicated all of its solar panel output for two specific purposes, and the Village of New Paltz dedicated a small portion for a specific function.

- Town of Hempstead installed the photovoltaic solar panel system to power two heating, ventilation, and air conditioning (HVAC) fan motors and the lighting in the Supervisor's office and adjacent conference room.
- New Paltz has directed some of its output to a battery bank that supplies power to radio chargers, garage doors and some lights in the event of a power failure. With this setup, the Village now has the ability to keep their emergency communication devices charged and lights on in key parts of the fire department.

## Costs of Implementation

The cost components for implementation varied from municipality to municipality. In addition to the cost of the panels, inverters, and general electrical supplies, some municipalities incurred installation expenses for consultants, grant writers, bonding and/or expert municipal staff who installed the solar panels and dedicated their output in multiple ways. The average total cost was about \$8,000 per kilowatt (KW) installed, with about 73 percent of the cost being offset by incentives from NYSERDA. The following table (Table 2) summarizes the costs of implementation.

<b>TABLE 2: COST OF IMPLEMENTATION</b>						
<i>Municipality</i>	<i>Date Installed</i>	<i>Size (KW)</i>	<i>Total Cost</i>	<i>Cost per KW</i>	<i>NYSERDA Incentive</i>	<i>Municipal Cost</i>
Albany County	1/01/05	40	\$ 376,830	\$ 9,421	\$ 240,000	\$ 136,830
Town of Hempstead	1/31/06	40	336,174	8,404	250,000	86,174
Town of Lansing	12/20/05	22	161,009	7,319	126,620	34,389
Village of New Paltz	9/21/05	15	131,435	8,762	91,390	40,045
Town of Woodstock	8/5/05	17	108,831	6,402	94,120	14,711
Town of Rosendale	6/10/05	10	76,063	7,606	56,575	19,487 <sup>2</sup>

The average costs per KW ranged from \$6,402 to \$9,421, depending on how the municipalities implemented the systems. The differences could be due to multiple factors such as installation locations, how the parts and services were purchased, and chosen installation methods. Some of the key differences are described below:

- Lansing used Town labor and equipment valued at about \$15,900 during slow periods. The Town conducted the installation work during normal hours, thus not requiring overtime wages.
- Woodstock achieved the lowest rate per kilowatt by directly purchasing its components. Officials properly researched and bid the components to ensure the best possible pricing. The other municipalities bid the entire installation job (including the components), resulting in the contractors handling the purchases.

<sup>2</sup> The Town of Rosendale did not pass its costs on to taxpayers, as will be discussed further in the report.



- New Paltz incurred an additional cost of \$4,700 for a grant writer because Village officials believed the grant writer was necessary to receive the funding from NYSERDA.
- Albany County's costs included \$12,500 for the work of a consultant that was over and above the general engineering services delivered by the installation company. In addition, Albany County will pay \$34,030 in bond interest over 20 years.

Five of the municipalities used taxpayer funds or included the project within a larger, locally funded capital project. NYSERDA reimbursed each at different milestone dates during the project. The Town of Rosendale arranged for an alternate energy trade show and a contractor training class that raised more than enough funds to cover the Town's portion of the costs. Thus, no cost was extended to the taxpayers.

Since the funding stream for the solar panel projects that the municipalities used has been closed, the installation of solar panels will require a larger percentage of municipal funds. There is currently a smaller incentive option available. While this may deter municipalities from implementing these technologies, any efforts towards implementing alternative energy sources should be explored since the environmental benefits could be worth the cost.

### **Return on Investment**

The six municipalities use computer applications, revenue grade meters, or a combination of both to track the output of their systems. We used information from these sources to analyze the average output of the panels in kilowatt-hours (kWh) over at least one year of operation.

The average costs of traditional electricity for all six municipalities ranged from 7 cents to 14 cents in 2006, depending on their location and supplier. Factoring in standard inflation<sup>3</sup> rates of 2 percent, we projected energy savings based on how much the estimated solar production would reduce the need for traditional electricity sources. Our calculations are based on historic factors and are conservatively presented. Actual savings could vary depending on future electrical supply and distribution systems. The following table (Table 3) illustrates the lifecycle cost savings and return on investment (ROI).

<sup>3</sup> Analysis of NYS Commercial Energy Prices from 1991 - 2005.

<b>TABLE 3: COST SAVINGS AND RETURN ON INVESTMENT*</b>				
<i>Municipality</i>	<i>Annual Solar Output (kWh)</i>	<i>Payback Period (years)</i>	<i>ROI after 40 Years</i>	<i>ROI after 50 Years</i>
Albany County	39,420	25	\$ 125,085	\$ 229,923
Town of Hempstead	35,405	15	213,226	333,061
Town of Lansing	26,280	13	105,519	161,585
Village of New Paltz	16,790	33	10,455	30,700
Town of Woodstock	16,425	9	70,502	104,685
Town of Rosendale	12,045	0	60,215	84,340
		<b>TOTALS:</b>	<b>\$ 585,002</b>	<b>\$ 944,294</b>

\*See Appendix B for the calculation basis

Some factors that affected the payback periods and savings included:

- The solar panel implementation in Rosendale did not use local tax dollars; therefore, the Town has no local payback period.
- New Paltz does not receive 100 percent of the solar output. The project was intended to be a joint project with the Town of New Paltz; however, the Village does not have a formal agreement specifying the cooperative cost and usage arrangements, nor has the Town contributed to the costs of the project. Since the Town has not shared the costs and the Village receives only 60 percent of the solar electricity output, the estimated payback period for the Village totals about 33 years. If the Town paid a proportionate share of the costs (\$16,018), the Village's payback period would decrease to 22 years and increase the return on investment savings to \$85,119. The Village is actively pursuing the money from the Town.

## Recommendations

1. Municipalities should review the potential panel size and location options available to them to ensure the most effective installation takes place.
2. Municipalities should review each project before finalizing the implementation process, and ensure that they are using incentives and taxpayer dollars in the most effective way.
3. Municipalities should continue to explore alternative energy resources and expand the use of those technologies to reduce energy costs and protect the environment.

## 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. A large percentage of electricity is generated from oil, gas, and coal, while the remainder is produced from nuclear, hydro and refuse. All these sources, except for hydro, produce certain pollutants and have negative impacts on the environment. The majority of the power produced is from fossil fuels that emit pollutants into the atmosphere, accounting for 85 percent of the nation's green house emissions in 2005.

A study released by the National Academy of Sciences<sup>4</sup> confirmed that greenhouse gases are accumulating in the Earth's atmosphere as a result of human activities contributing to global warming. Carbon dioxide (CO<sub>2</sub>) emissions contribute to global warming and nitrous oxides (N<sub>2</sub>O) and sulfur dioxides (SO<sub>2</sub>) are key pollutants that contribute to smog and acid rain. Information about these gases follows.

- Carbon dioxide is a colorless, odorless gas that allows light from the sun's rays to be transmitted 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.<sup>5</sup>
- Nitrogen oxides are compounds 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 (photo-chemical smog).<sup>6</sup>
- 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 SO<sub>2</sub> emissions. SO<sub>2</sub> emissions are controlled and monitored by Federal and State environmental regulatory programs.<sup>7</sup>

<sup>4</sup>Entitled "Climate Change Science Report", issued 2001.

<sup>5</sup> Environmental Disclosure, Consumer Guide, New York State Public Service Commission, 8/03.

<sup>6</sup> Ibid.

<sup>7</sup> Ibid.

Depending on fuel source, size, and location, the generation of electricity may also cause other public health, environmental and socioeconomic impacts not disclosed above. Municipalities must consider the environmental impact of their operations (electricity usage) and pursue methods to efficiently operate in an environmentally sensitive manner.

The electricity produced by solar panel systems not only produces costs savings, but also has direct environmental benefits. Solar electricity has no emissions or byproducts that negatively affect the environment. Conversely, each kWh of traditional electricity produces harmful emissions or byproducts. The following table (Table 4) illustrates the avoided emission equivalents of the pollutants from using solar panels instead of generating traditional power over 50 years:

<i>Municipality</i>	<i>CO<sub>2</sub></i>	<i>N<sub>2</sub>O</i>	<i>SO<sub>2</sub></i>
Albany County	1.6 million	2,000	8,300
Town of Hempstead	2.5 million	2,800	9,600
Town of Lansing	1.1 million	1,300	5,500
Village of New Paltz	400,000	500	2,000
Town of Woodstock	500,000	600	2,500
Town of Rosendale	500,000	600	2,500
<b>TOTALS:</b>	<b>6.6 million</b>	<b>7,800</b>	<b>30,400</b>

\*See Appendix B for the calculation basis

Because the municipalities installed the solar panels that produce about 130,000 kWh of electricity annually, they have directly contributed to the preservation of the environment through avoided emissions. Had they used traditional electricity, the municipalities would have contributed to releasing about 6.6 million pounds of CO<sub>2</sub> into the atmosphere during the life of the panels. For perspective, since vehicles annually emit about 5.7 tons of carbon dioxide, the emissions savings would equate to the elimination of the carbon dioxide produced by about 588 vehicles. Furthermore, since one acre of forest sequesters about 4 tons of CO<sub>2</sub> annually, the emissions savings from the solar panel clean electricity is equivalent to 825 acres of forest.

**Recommendation**

4. Municipalities should further reduce their environmental footprints through efforts that reduce the emission of pollutants.

## APPENDIX A

### RESPONSES FROM LOCAL OFFICIALS

We provided a draft copy of this global report to each of the units audited and requested responses. The following comments were excerpted from the two responses we received. The Towns of Woodstock and Rosendale, the Village of New Paltz, and Albany County were provided an opportunity to respond to the global report; however, they chose not to respond.

Town of Hempstead said ...“An integral part our ecological agenda has been the incorporation of photovoltaic energy into the town’s power network. Equally important, Hempstead has dedicated significant efforts to educating residents on how to harness the power of sun in their homes and businesses. We salute New York State Comptroller Thomas DiNapoli for increasing awareness and promoting increased use of technologies that reduce the carbon footprint of governments and residents in our state”.

Town of Lansing agreed with the audit findings.

## APPENDIX B

### AUDIT METHODOLOGY AND STANDARDS

Our findings and conclusions were based on calculations of average rate of electricity charged by utilities; average daily output of the solar panels, the return on investment, and environmental effects. We used estimates and made objective judgments in determining how to proceed with our analytical analysis, which was consistently applied to all of the audited municipalities.

Cost of Implementation — We calculated the actual cost by reviewing all applicable invoices to vendors, suppliers, and other incidental charges. These costs included the cost of grant writers, consultants and interest on bonding. We used auditing techniques to ensure that all amounts were complete and accurate; such testing included the tracing of invoices to canceled checks and the review of vendor history reports.

Average Solar Output — To calculate the average electrical output of the solar panels, we used either electronic data or meter readings from revenue grade meters. In each case, the meter readings we relied upon for calculations were from meters designed and built to be accurate to within 0.5 percent to 5 percent accuracy according to standards promulgated by the National Institute of Standards and Technology and the American National Standards Institute. Four of the six municipalities had meters that were designed and built to be revenue grade, which is accurate to within 2 percent. The remaining two units had computer generated metering functions built into their inverters, which were not revenue grade but designed and built to be 5 percent accurate. To determine the average daily output, we used readings taken by us during fieldwork. These were used to determine the total output from date of inception, which gave us the daily average based on days between the two dates. We were also able to obtain electronic data that provided additional details from the two units that did not have revenue grade meters. If necessary, we were able to exclude known down times which, if used, would have misconstrued our data. The average output calculation was the foundation for all other analysis including the return on investment and environmental savings.

Return on Investment — To calculate the return on investment or pay back period, we used the average daily output and applied it to actual first year costs for electricity. Although output might diminish over time, we did not factor decreased capacity into our analysis.

- The increase in cost of electricity through the life of the panels was forecasted at a rate of 2 percent inflation, which was based on the Commercial Energy Prices in New York from 1991 through 2005. Although the actual costs of electricity would be very difficult to predict, this figure is very conservative and greater increases in actual costs would only decrease the return on investment period.
- We used actual electrical costs from the utility bills. The energy costs per invoices from utility companies generally include a basic charge, supply charge, delivery charge, and also a demand charge. We made a determination that the systems are only effecting the overall consumption at minimal levels, and should be treated as a variable cost reduction with fixed costs not offset.

To divide the entire utility bill by the total kWh used would not be an appropriate way to determine the unit cost per kWh. We included the cost of the energy supply, delivery and any incidental cost which were based on kWh in our assessment. We did not include the fixed cost nor did we factor into the cost of the demand charges which will not be reduced by the solar output.

The demand charge is not based on actual energy consumption but on the overhead and infrastructure needed to support peak energy loads or needs at any given time. It is the highest average kW measured in an interval during the billing period. Utilities charge larger commercial customers for the capacity they must maintain in order to supply their customers with any demand that they might need, even if it is only for a short period of time. The demand charge made up over 35% of the costs. To include these costs would materially misstate the actual energy consumption costs and deflect the accuracy of any analysis that the solar panels could realistically effect.

Environmental Effect — To estimate the environmental effect, we used coefficients derived from *The Emissions and Generation Resource Integrated Database for 2006, (eGrid 2006) Support Documentation*, which was developed for the US Environmental Protection Agency. The coefficients for carbon, sulfur, and nitrous emissions per kWh of energy produced were based on New York State generation averages broken down for either Long Island or Upstate New York.

We conducted this performance audit in accordance with generally accepted government auditing standards (GAGAS). Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.



## APPENDIX C

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