



WOODSTOCK, N.Y.  
COLONY OF THE ARTS

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## Woodstock Carbon Neutral Report Carbon Dioxide Emissions for Fiscal Year 2016

In March, 2007 the Woodstock Town Board adopted the Carbon Neutral/ Zero Carbon resolution that committed the Town to implement policies resulting in no net emission of carbon dioxide and other greenhouse gases by the end of 2017. Based on a careful accounting of the Town's carbon dioxide emissions and the consequences of carbon sequestration by the Town's forests, Woodstock has achieved "Net Carbon Neutrality."

### Summary

The town's carbon dioxide emissions due to governmental operations continued to drop in 2016. Beginning in 2011 at about 700 metric tons, the town's carbon emissions are now below 600 metric tons. The replacement of fossil fuel heating systems at the Highway Garage, Town Hall, and Community Center with all-electric, geothermal heating and cooling and air-sourced heat pumps reduced the town's carbon dioxide emissions and the cost of energy, but increased electricity usage. The renovations also resulted in tighter, more energy efficient buildings.

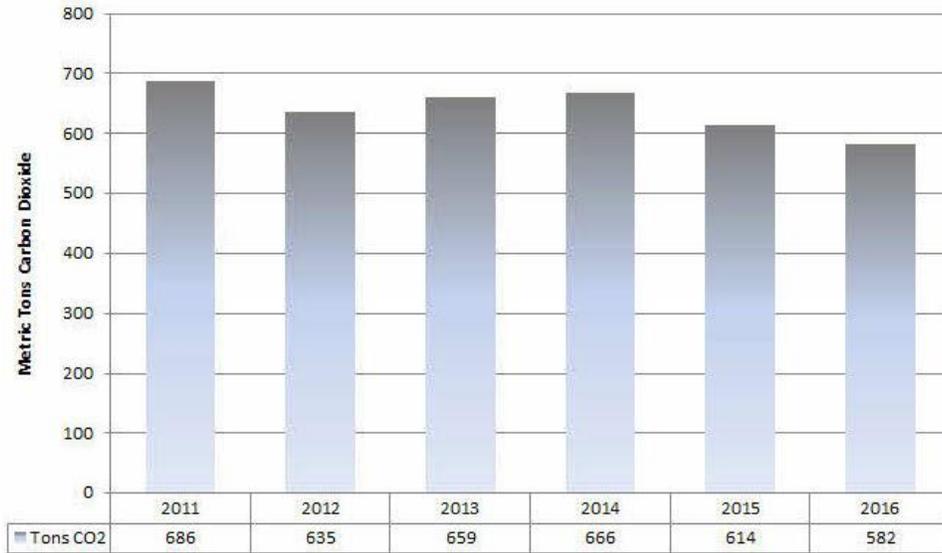
Another major action was the substitution of 6-cylinder police vehicles for 8-cylinder units. As existing police vehicles are retired, 6-cylinder units are acquired. These actions reduced the use of gasoline and carbon dioxide emissions from the police department, but further reductions in gasoline consumption will require certified hybrid police vehicles.

About 22% of the town's carbon footprint is attributed to the town's electrical supply. The proposed 600 KW solar array at Woodstock's Waste Water Treatment Facility (WWTF) would further reduce emissions attributed to the town.

Close monitoring of energy usage identified maintenance and repair actions that reduced the town's energy usage and carbon dioxide emissions.

Finally, 500 acres of town owned forest sequester about 500 metric tons of carbon each year, removing an estimated 1,833 metric tons of carbon dioxide from the atmosphere resulting in the town's governmental operations being "Net Carbon Neutral."

Carbon Dioxide Emissions, Metric Tons  
Town of Woodstock Governmental Operations



Energy Cost and Consumption in 2016

Each year, the Town reports to the Office of the New York State Comptroller its energy costs and consumption. Below is the 2016 report of the Town's energy use. From this report it is possible to calculate the carbon dioxide emissions by applying the appropriate CO<sub>2</sub> conversion factors to each energy source.

TOWN OF Woodstock  
Energy Costs and Consumption  
For the Fiscal Year Ending 2016

Energy Type	Total Expenditures	Total Volume	Units Of Measure	Alternative Units Of Measure
Gasoline	\$32,539	20,724	gallons	
Diesel Fuel	\$33,873	22,193	gallons	
Fuel Oil	\$4,231	2,454	gallons	
Natural Gas			cubic feet	
Electricity	\$110,398	732,875	kilowatt-hours	
Coal			tons	
Propane	\$4,296	4,808	gallons	

Note: Diesel Fuel contains kerosene usage.

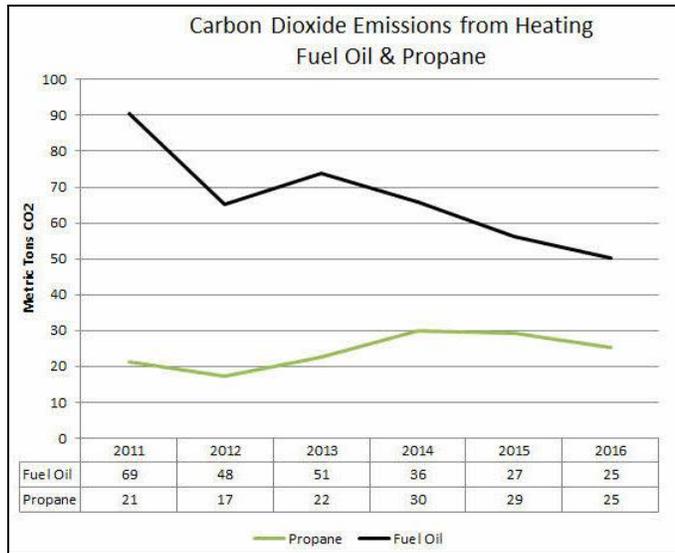
## Major Actions

### Reduced use of Fossil Fuels for Heating

The conversion of town buildings to geothermal heating & cooling and the use of air-sourced heat pumps reduced the use of fossil fuels for heating resulting in a drop of CO<sub>2</sub> emissions attributed to heating from 90 metric tons in 2011 to 50 metric tons in 2016.

Two years ago, an all-electric, geothermal heating & cooling system was installed at the Town Hall replacing the fossil fuel heating systems. In 2015, the Community Center's fossil fuel heating system was replaced with an all-electric, air-sourced heat pump heating & cooling system.

These actions have reduced the use of fossil fuels for heating town building.



Fuel oil and propane used for heating town buildings.

### Community Center Renovation

The renovation of the Woodstock Community Center replaced the existing fossil fuel heating system with an air source heat pump heating & cooling system and consolidated several electrical systems at Any Lee Field, which resulted in lower fixed service charges. The renovation reduced the Community Center's cost of energy by about 25% and its carbon footprint by about 50%.

### Reduced Town Hall Carbon Footprint

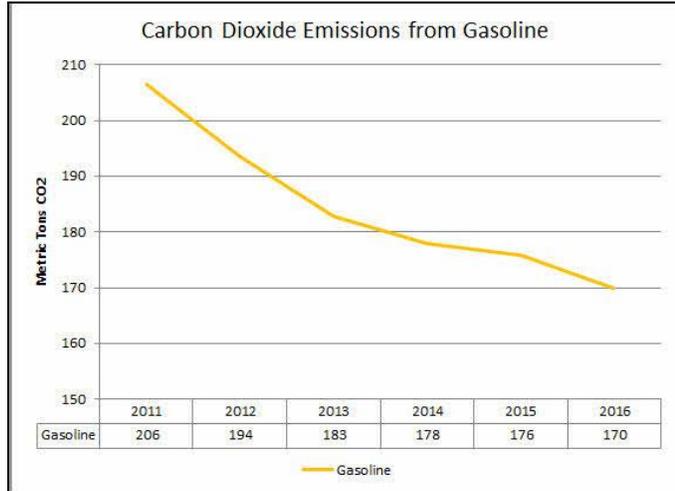
Fossil fuel heating systems were replaced during the renovation of the Woodstock Town Hall with geothermal heating & cooling reducing the Town Hall's carbon footprint from 40 to 15 metric tons of CO<sub>2</sub>.

### Reduced Highway Department Carbon Footprint

A long term analysis of the carbon footprint for the highway department extending back to the year 2000 was completed. This analysis took into account the reconfiguration of the Highway Garage and transfer of the sand and salt material to a new facility at the closed landfill. This analysis showed a drop of CO<sub>2</sub> by the Highway Department from 50 metric tons in 2000 to 35 metric tons in 2013.

## Reduced Gasoline Usage by Police

The police department is the town's major user of gasoline for its vehicles. As police cars are scheduled for retirement, they are replaced with 6-cylinder vehicles, a decision that has resulted in lower gasoline consumption and a reduced carbon footprint for the police department.



## Analysis of Electric Consumption

A thorough analysis of the town's electric usage was completed, which allows the Town to identify opportunities for savings. Significant reductions in electrical use were achieved at the Rock City Rd. restrooms, at the town's water wells, and at the Waste Water Treatment Facility. The town now has a computer model containing 5-years of detailed cost and usage information for every facility that allows comparison of alternatives and the cost/performance of offerings.

## Installation of LED Lighting

Central Hudson offers a turnkey LED lighting program through its business partner Lime Energy that covers up to 70% of the cost of installation. Woodstock took advantage of this program to install interior and exterior LED lighting at the Waste Water Treatment Facility and exterior lights at the Sand & Salt Shed located at the Town's closed landfill. It's hard to identify any definite reduction in electrical usage with LED lighting. The normal variations in electric usage caused by weather, events, etc. seem to obscure reductions from LEDs. It's the Town's policy to replace existing lighting with LED lighting whenever practical and necessary.

The Town has enrolled in Central Hudson's program that replaces defective sodium and mercury vapor street lights with LED units.

## 600 KW Solar Array

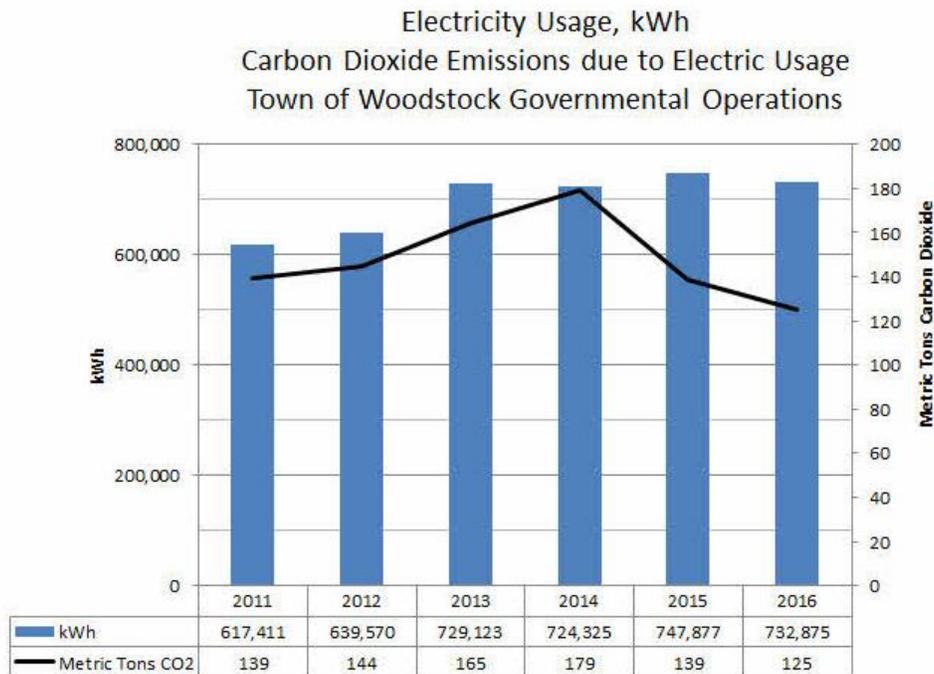
The Town released an RFP for a 600 KW solar array to be installed at the Waste Water Treatment Facility (WWTF). In early 2016, the Town Board authorized signing a Letter of Intent with OnForce Solar to proceed with the planning and necessary applications for the array. Since then, there have been contractual and regulatory issues that have delayed the project. Electricity accounts for 22% of the Town's carbon emissions and with the completion of the solar array, the Town's carbon footprint will drop substantially.

### Emissions from Electricity

The conversion of town building heating systems from fossil fuels to all electric geothermal heating & cooling and air-sourced heat pumps has substantially increased the town's use of electricity. The increases in electrical usage were initially offset by reductions in usage and efficiencies in other areas, but the opportunities for further reductions are limited.

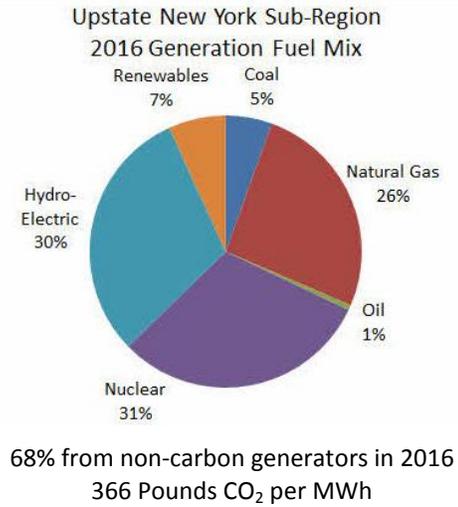
Although the Town's electric usage is increasing, the carbon dioxide emissions due to electricity have dropped. In 2014, there were 546 pounds of carbon dioxide emitted for each megawatt-Hour (MWh) generated; in 2016, the equivalent amount was 366 pounds of carbon dioxide per MWh.

This significant drop in CO<sub>2</sub> emissions for electric generation in the EPA's Upstate NY sub-region is due to the closure of coal-fired power plants. The Upstate NY sub-region now enjoys the lowest level of CO<sub>2</sub> emissions from electric generation of any region in the country.



The EPA maintains the Emissions & Generation Resource Integrated Database (eGRID), a comprehensive database of the environmental characteristics for all electric generators in the United States that includes emissions for nitrogen oxides, sulfur dioxide, carbon dioxide, methane, and nitrous oxide. It's from this database that the town obtains its figures for carbon dioxide associated with electricity usage. Almost 68% of our electricity supply is from zero-carbon sources.

Upstate New York Sub-Region Generation Fuel Mix - Percent				
Pounds CO2 per MWh	498	546	409	366
	2013	2014	2015	2016
Coal	14.5	15.3	5.5	5.5
Natural Gas	18.9	22.2	30.4	25.9
Oil	0.9	0.8	0.7	0.6
Nuclear	30.6	28.9	28.9	30.6
Hydro-Electric	30.8	28.2	29.2	30.4
Renewables	3.9	4.3	5.4	6.8



## Diesel Fuel

The highway department is the major user of diesel fuel for its vehicles, and the use of diesel fuel has essentially remained constant over the 5-year period. There is no obvious substitute for diesel fuel, and there is no expectation that the carbon contribution from diesel fuel can be eliminated.

Kerosene mixed with diesel fuel gains a couple of benefits. In winter time, kerosene is useful for changing the cold weather handling temperatures of diesel fuel. The rule of thumb is that mixing in ten percent kerosene will lower the cold filter plugging point of a diesel fuel blend by five degrees. In cold weather climates, it can be more cost effective to use kerosene as a mixer, rather than a cold flow polymer.

## Community Initiatives

### Solarize NY

In early 2015, the Woodstock Environmental Commission authorized Woodstock Transition, a local environmental group, to represent Woodstock in the NY Solarize program. Solarize campaigns are locally organized community outreach efforts aimed at getting a group of homes and businesses in an area to install solar. When groups of neighbors—including residents and businesses—learn about solar and the installation together, they can often get better pricing and share the tasks. NYSERDA provides technical assistance, marketing materials, and other support for these efforts. Solarize is part of the NY-Sun Incentive Program.

Enrolments	217
Proposals	84
Signed Contracts	32
Total Solar kWh	200,000
Average Array Size	6 KW

Solarize Woodstock closed on November 30, 2015. The results for Woodstock are shown in the table.

## Standardized Solar Permit

Woodstock adopted the Standardized Solar Permit, which is a key element to remove barriers to local economic development in the growing solar industry. The standardized permit is expected to cut costs by creating a uniform permitting process in municipalities across the State.

## Electric Vehicle Promotion & Charging Stations

Transition Woodstock, Woodstock Environmental Commission, and Sustainable Hudson hosted an electric vehicle workshop on December 10, 2016 at the Woodstock Community Center. Over fifty people attended, and Kingston Nissan and Central Hudson brought electric vehicles.

The Town applied for and received a grant to install electric vehicle charging stations adjacent to the Rock City Rd. municipal parking lot.



Picture provided by Hugo Jule

## 10% Challenge - Residential Energy Efficiency

In 2013, the 10% Challenge, a joint program of the Woodstock Environmental Commission, Woodstock Transition, and RUPCO was launched to improve residential energy efficiency. The 10% Challenge is based on NYSERDA's residential programs that help reduce energy costs through a comprehensive home energy audit, financial incentives, and low-interest loans.

Michael D'Arcy, RUPCO's NYSERDA Outreach Coordinator, reports the 10% Challenge is a call to make 30 homes more energy efficient! Step 1: Out of the 2,946 households in the town, 295 of these to receive a FREE or reduced cost whole house energy assessment! Step 2: Out of those 295 assessments, make 30 of them into safer, more comfortable, and more energy efficient homes. That's our goal, 295 audits, and 30 retrofits.

- Total number of residents in the program: 86 (Up from 65 in Oct)
- Number of Free or Reduced Cost Energy Assessments Approved: 81
- Number of Assessments completed: 58 (Up from 45 in Oct. 20% of the goal)
- Work approved – completed: 15 (Up from 9 in Oct. 50% of the goal!)

## Carbon Sequestration

The New York State Department of Environmental Conservation (NYSDEC) created its Climate Smart Communities program to encourage New York communities to reduce greenhouse gas emissions (GHG) and improve climate resilience. One element of NYSDEC's initiative is to "create permanent sinks that remove GHG from the atmosphere." The Town owns about 500 acres of undisturbed and stable forest that can be considered a carbon sink through forest carbon sequestration: 400 acres on the

south side of Guardian Mountain and three inaccessible parcels totaling about 100 acres between Zena Road and Morey Hill Road.

Using an estimate of 1 metric ton of carbon sequestered per acre per year, the 500 acres of Town owned forest will sequester about 500 metric tons of carbon each year. Based on the atomic weights of carbon and oxygen, each metric ton of carbon sequestered in a forest removes 3.666 metric tons of carbon dioxide from the atmosphere. It's estimated that each year the Town owned 500 acres of undisturbed forest will remove about 1,833 metric tons of atmospheric carbon dioxide. The amount of CO<sub>2</sub> sequestered by the Town's forest is almost three times the amount of CO<sub>2</sub> generated by Town governmental operations.

## Conclusions

Woodstock has achieved net carbon neutrality for governmental operations, which fulfills the objective of the 2007 Carbon Neutral Resolution. But the town has reached the end of what is possible with current technology. Further reductions in emissions from gasoline and diesel will require technical innovations that are not yet available.

The Town's zero-carbon initiative has focused on substituting electric heating & cooling systems for fossil fuel heating. This approach has resulted in reduced energy costs and carbon footprints for the Highway Garage, Town Hall, and Community Center. After the Community Center's renovation, heating fuel oil and propane remain a minor component of the Town's carbon footprint.

The switch from fossil fuels to all electric heating & cooling has substantially increased the Town's electrical usage, but has reduced the Town's carbon footprint because of the low carbon content of electric power obtained from upstate NY.

The substitution of 6-cylinder police vehicles for 8-cylinder units reduced the use of gasoline and carbon dioxide emissions from the police department, but further reductions in gasoline consumption will require certified hybrid police vehicles

The 600 KW solar array will supply all the town's electrical needs and further reduce the town's carbon footprint by about 22%. But once this reduction is achieved, the remaining sources of carbon dioxide attributed to the gasoline and diesel fuel used by the town's police and highway vehicles will remain.

The 500 acres of town owned undistributed forest absorb and sequester carbon dioxide released by the town's governmental operations, allowing Woodstock to proclaim it has achieved carbon neutrality as called for in the March 2007 resolution.

