



WOODSTOCK, N.Y.
COLONY OF THE ARTS

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Woodstock Climate Action Plan for Governmental Operations Fiscal Year 2017

In March 2007, the Woodstock Town Board adopted the Carbon Neutral, a.k.a Zero Carbon, resolution that committed the town to implement policies that would result in no net emission of carbon dioxide and other greenhouse gases by 2017. The town spent significant funds upgrading its buildings and improving energy efficiency, and considering carbon sequestration by the town's forests, achieved "Net Carbon Neutrality" by 2015 for governmental operations.

In recognition of this achievement, the town received an Outstanding Environmental Achievement award from the New York State Association of Conservation Commissions (NYSACC) at its November 17th annual conference.

2017 Summary

Since 2011, when the town began tracking carbon dioxide emissions, the town's emissions due to governmental operations have been reduced by about 15%.

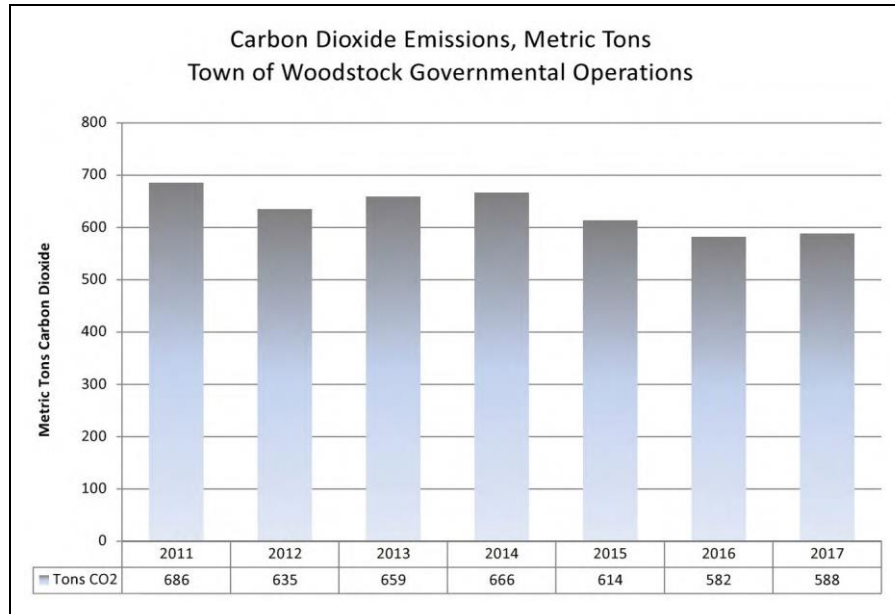
Beginning at about 700 metric tons in 2011, the town's carbon emissions are now below 600 metric tons. The replacement of fossil fuel heating systems at the Highway Garage, Town Hall, and Community Center with all-electric, geothermal heating and cooling and air-sourced heat pumps reduced the town's carbon dioxide emissions and the cost of energy. 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 governmental operations.

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."

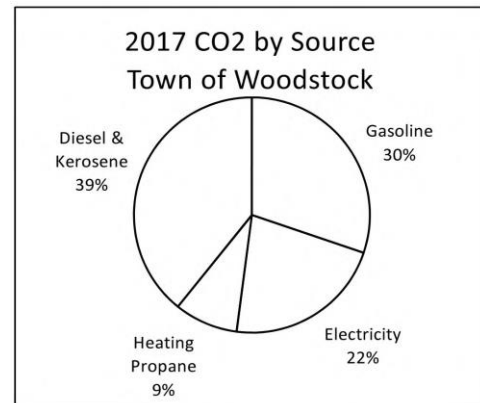


Carbon Dioxide Emissions by Sector

Although Woodstock achieved net carbon neutrality for governmental operations, the town has exhausted possible emission reductions using existing technology.

The installation of a 600 KW solar array will remove emissions due to electricity, and the conversion of the town offices to a heat-pump based heating and cooling system will further reduce fossil fuel usage.

But reductions in emissions attributed to gasoline and diesel fuel require technological innovations that are not yet available.



Energy Cost and Consumption in 2017

Each year, the Town reports to the Office of the New York State Comptroller its energy costs and consumption. Below is the 2017 report of the Town's energy use. From this report it is possible to calculate the carbon dioxide emissions by applying the appropriate CO₂ 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.

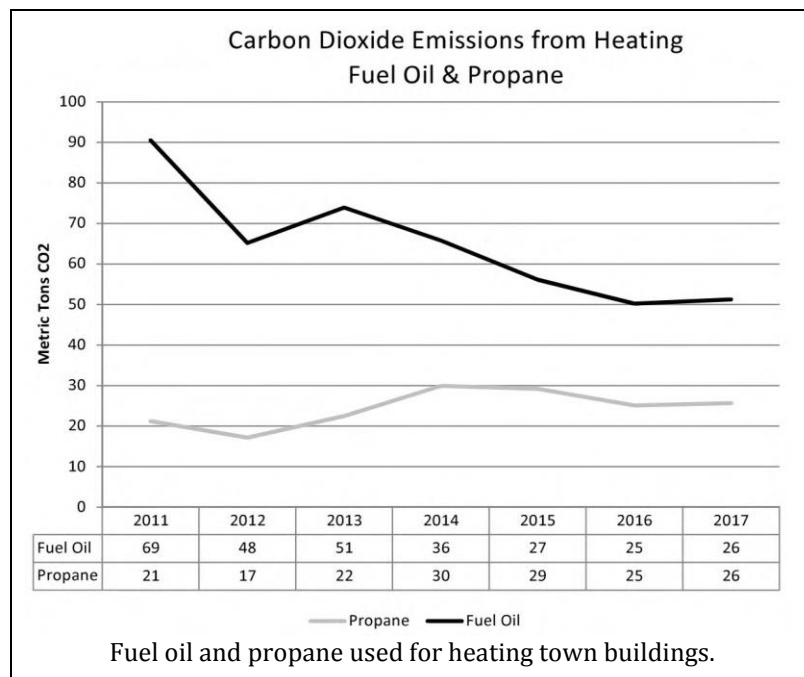
Reduced use of Fossil Fuels for Heating

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 CO₂ emissions attributed to heating from 90 metric tons in 2011 to 52 metric tons in 2017.

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.

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 thus lowering the 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 CO₂.

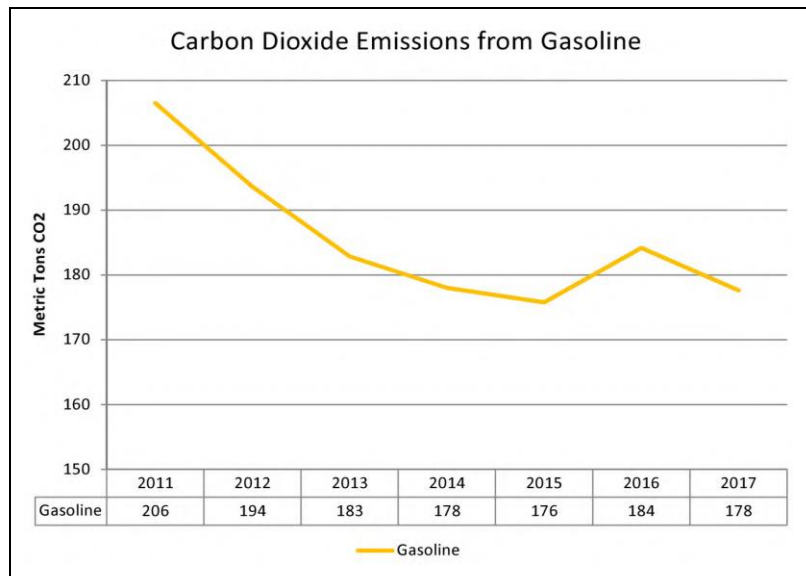
Reduced Highway Department Carbon Footprint

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 CO₂ 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.

Further reductions in carbon emissions from police vehicles will require the introduction of certified hybrid police cars.



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 reduced.

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.

Analysis of Electric Consumption

Each year a thorough analysis of the town's electric usage is performed that 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 performance model containing 6-years of detailed cost and usage information for every facility and 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 enrolled in Central Hudson's program that replaces defective sodium and mercury vapor municipal street lighting lights with LED units.

| Town of Woodstock LED Streetlights Year End 2017 | | | | | |
|--|---|----------|--------|----------|--------|
| | | 2013 | | 2017 | |
| | | Quantity | kWh | Quantity | kWh |
| Mercury & Sodium Vapor | 7000 Mercury Vapor | 13 | 10,816 | 7 | 6,622 |
| | 5800 Sodium Vapor | 64 | 22,016 | 56 | 20,128 |
| | 16000 Sodium Vapor | 48 | 34,560 | 43 | 32,101 |
| | 27000 Sodium Vapor | 2 | 2,528 | 2 | 2,528 |
| | Sum of Mercury & Sodium Vapor Fixtures | 127 | 69,920 | 108 | 61,379 |
| LED Fixtures | 2900 LED | | | 4 | 218 |
| | 3600 LED | | | 10 | 1,390 |
| | 7200 LED | | | 7 | 1,360 |
| | Sum of LED Fixtures | 0 | 0 | 21 | 2,968 |
| Utility Owned Fixtures | | 127 | 69,920 | 129 | 64,347 |
| Percent LED | | | | 19% | |
| lbs CO2/MWh | | 498 | | 366 | |
| CO2 Emmisions (Metric Tons) | | 16 | | 11 | |

Proposed 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), and in early 2015, 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, and alternative approaches are being investigated.

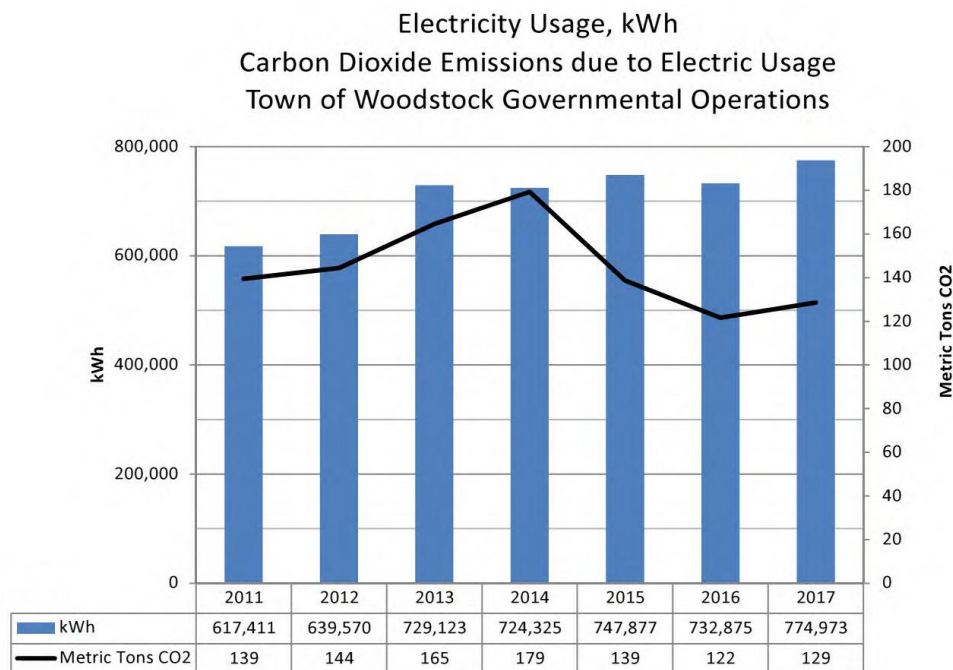
Electricity accounts for 22% of the Town's carbon emissions and with the completion of the solar array, the Town's carbon footprint will drop substantially.

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. These increases 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 been dropping. In 2014, the EPA's eGRID reported there were 546 pounds of carbon dioxide emitted for each megawatt-Hour (MWh) generated in the upstate New York region; in 2017, the equivalent amount was 366 pounds of carbon dioxide per MWh.

This significant drop in CO₂ emissions for electric generation was due to the closure of some coal-fired power plants. Because of the large presence of hydroelectric and nuclear power generation in upstate NY, the region now enjoys the lowest level of CO₂ emissions from electric generation of any region in the country.

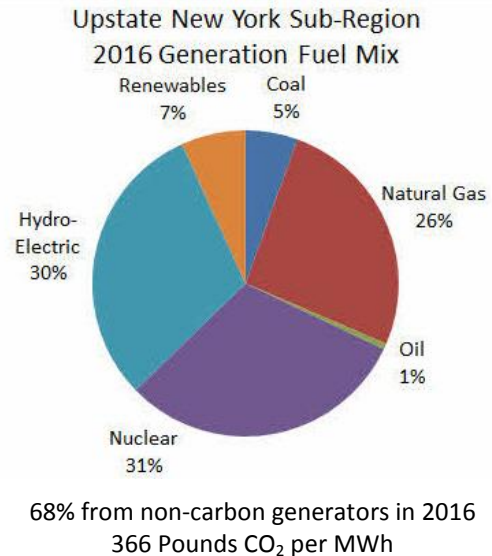


Emissions & Generation Resource Integrated Database (eGRID)

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.

Woodstock, Ulster County and upstate New York are located in EPA's Upstate New York Sub-Region, which because of the presence of large hydroelectric generation and nuclear power has some of the lowest emission electricity in the country.

| Upstate New York Sub-Region Generation Fuel Mix - Percent | | | | |
|--|-------------------------------|-------------|-------------|-----------------------|
| Pounds CO2 per MWh | 498 | 546 | 409 | 366 |
| | 2011, 2012, 2013 | 2014 | 2015 | 2016, 2017 |
| 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 |



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 CO₂ sequestered by the Town's forest is almost three times the amount of CO₂ generated by Town governmental operations.

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 above 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 and at the community center.



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!)

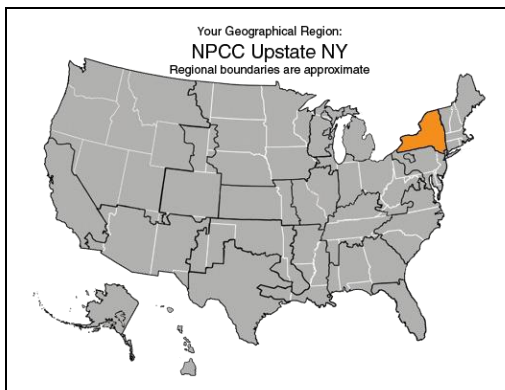
Indian Point Nuclear Power Plant Closure

Governor Andrew Cuomo in his 2017 State of the State address announced that Indian Point will close by April 2021 under an agreement that New York State reached with Entergy, the company that owns the facility. Under the terms of the agreement, one of the nuclear reactors will permanently cease operation by April 2020, and the other must close by April 2021.¹



The governor's announcement stated, "Several generation resources are also fully permitted and readily available to come online by 2021, after the plant's closure, including clean, renewable hydropower able to replace up to 1,000 megawatts of power. Together, these sources will be able to generate more than enough electrical power to replace Indian Point's capacity by 2021."

NYISO Indian Point Deactivation Report²



According to a NYISO analysis, New York State's power grid will operate reliably after the Indian Point nuclear plant closes early in the next decade. NYISO identified three "major generation facilities" currently under construction totaling 1,818 MW will replace 79% of Indian Point's nameplate capacity. These generators are the 120-MW Bayonne gas fired/oil fired simple cycle uprate, the 678-MW CPV Valley combined-cycle gas plant and the 1,020-MW Cricket Valley combined-cycle gas plant.

Two of the new natural gas plants are located in the Mid-Hudson Valley: the 690 MW CPV Valley Energy Center in Orange County and the 1,100 MW Cricket Valley Energy Center in Dutchess County within the Upstate NY EPA

¹ Governor Cuomo Announces 10th Proposal of the 2017 State of the State: Closure of the Indian Point Nuclear Power Plant by 2021, January 9, 2017, <https://www.governor.ny.gov/news/governor-cuomo-announces-10th-proposal-2017-state-state-closure-indian-point-nuclear-power>

² NYISO, Generator Deactivation Assessment, Indian Point Energy Center, December 13, 2017, http://www.nyiso.com/public/webdocs/media_room/press_releases/2017/Child-Indian-Point-Energy-Center-Retirement-Analysis/Indian_Point_Generator_Deactivation_Assessment_2017-12-13.pdf

eGRID sub-region. This means the emissions from these two plants will increase the carbon dioxide content in the electricity used by Woodstock, Ulster County, and upstate New York.

New Carbon Dioxide Emissions, Mid-Hudson Valley

| | Nameplate ³ Capacity MW | Capacity Factor | Generation GWh | Carbon Dioxide ⁴ Million Metric Tons |
|------------------------------|---------------------------------------|--------------------|-------------------|--|
| CPV Valley Energy Center | 690 | 80% | 4,836 | 2.1 |
| Cricket Valley Energy Center | 1,132 | 80% | 7,933 | 3.5 |
| Total | | | 12,769 | 5.7 |

Conclusions

In March 2007, the Woodstock Town Board adopted the Carbon Neutral, a.k.a. Zero Carbon, resolution that committed the town to implement policies that would result in no net emission of carbon dioxide and other greenhouse gases by 2017. The town achieved the objectives of the 2007 carbon neutral resolution, but there are some remaining open items.

Woodstock spent significant funds upgrading its buildings and improving energy efficiency, and considering carbon sequestration by the town's forests, has achieved "net carbon neutrality" for governmental operations. During the period beginning in 2011, Woodstock's carbon footprint from governmental operations dropped by over 100 metric tons, or about 15%.

The town owns about 500 acres of undisturbed and stable forest identified as a carbon sink: 400 acres on the south side of Guardian Mountain and three inaccessible parcels totaling about 100 acres between Zena Road and Morey Hill Road. Trees acquire carbon through photosynthesis by converting atmospheric CO₂ into carbohydrates and releasing oxygen. Based on the atomic weights of carbon and oxygen, each metric ton of carbon sequestered by a forest removes 3.666 metric tons of carbon dioxide from the atmosphere.

It's estimated each year the town owned 500 acres of undisturbed forest will remove about 1,833 metric tons of atmospheric carbon dioxide; almost three times the CO₂ generated by town governmental operations.

³ NYISO Interconnection Queue, http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Interconnection_Studies/NYISO_Interconnection_Queue/NYISO%20Interconnection%20Queue.xls

⁴ Sovacool, Benjamin K., "Valuing the greenhouse gas emissions from nuclear power: A critical survey," June 2008, Energy Governance Program, Centre on Asia and Globalisation, Lee Kuan Yew School of Public Policy, National University of Singapore, 469C Eukie Tcncah Road, Singapore 259772, Singapore, Table 8, 443 g/kWh, http://www.nirs.org/climate/background/sovacool_nuclear_ghg.pdf

Once these open items have been completed, the town has reached the current technological limits for reducing GHG emissions from governmental operations:

- 1) Continue to monitor and track the town's carbon dioxide emissions and electricity usage.
- 2) Formally recognize the role of town owned forests for carbon sequestration.
- 3) Complete the installation of solar arrays to supply the town government's electricity needs.
- 4) Convert the town offices (Comeau building) from fossil fuel heating to heat-pump based heating and cooling system.


NYSDEC Climate Smart Communities Program

Woodstock has not been an active participant in the Climate Smart Communities initiative, and suggestions have been made that Woodstock more fully embrace the program. By participating the Climate Smart Communities program, the town becomes eligible to receive technical and financial help in understanding and responding to climate problems.

The DEC Climate Smart Communities Program is an approach for New York communities to reduce greenhouse gas (GHG) emissions and improve climate resilience. Climate Smart Communities take action in two ways to minimize the risks of climate change and reduce its long-term costs:

Reducing GHG Emissions: Reduce GHG emissions and create permanent carbon sinks that remove GHG emissions from the atmosphere; actions that will help stabilize atmospheric levels of carbon dioxide at manageable levels and avoid severe climatic changes.

Adapting to a Changing Climate: Making changes to infrastructure and the natural environment that will alleviate the risks associated with changes in climate.



NEW YORK
STATE OF
OPPORTUNITY

**Department of
Environmental
Conservation**

A Guide to Local Action

Climate Smart Communities Certification

Members of the Climate Smart Communities Program are a network of New York communities engaged in reducing greenhouse gas (GHG) emissions and improving climate resilience. Climate Smart Communities can take action in two main ways to minimize the risks of climate change and reduce its long-term costs:

Reducing GHG Emissions: Starting now to reduce GHG emissions and create permanent carbon sinks that remove GHG emissions from the atmosphere - these actions will help stabilize atmospheric levels of carbon dioxide at manageable levels and avoid severe climatic changes.

Adapting to a Changing Climate: Altering the built and natural environment in anticipation of predicted climatic changes, or in response to actual changes, will alleviate the risks associated with unavoidable changes in climate.

Woodstock has achieved carbon neutrality for governmental operations by reducing carbon dioxide emissions and identifying 500 acres of town owned forest as a permanent carbon sink to remove carbon emissions from the atmosphere.

Next Steps, Climate Smart Communities Initiative

With its carbon neutral resolution, the town has made great progress reducing emissions in governmental operations, but much remains to be done to reduce GHG emissions for the entire town and mitigate its consequences. In cooperation with Woodstock Transition, pilot

programs sponsored by the Environmental Commission included the 10% Challenge to encourage household energy efficiency, Solarize Woodstock to incentivize homeowner solar installations, and a seminar on electric vehicles. Implementing programs that reduce the carbon footprint of the entire town should be an objective.

Little work has been done on understanding what needs to be done to adapt to climate change. The most obvious exposure for Woodstock is flooding caused by more frequent and severe rainstorms or other weather events. Sustainability in the face of climate change is an important consideration in the next few years.

Some recommendations:

- 1) Establish a Woodstock Climate Smart Communities Commission to manage and implement NY's Climate Smart Communities initiative with emphasis on:
 - a. Continuing focus on town governmental operations.
 - b. Reducing emissions for the entire town.
 - c. Preparing for extreme flooding events.
 - d. Achieve bronze level certification.
- 2) Recognize the importance of the March 2007 Woodstock Town Board Carbon Neutral Resolution, the progress that has been made, and recommend the few remaining open items be completed.
- 3) Endorse New York's Clean Energy Standard and the Paris Accords on Climate.
[done]