

Energy Upgrades at Taghkanic Town Hall and Highway Garage

TOWN HALL

Heat Pumps

In June, 2022 the Town of Taghkanic applied \$10,000 in NYSERDA grant funds to the installation of four air-source heat pumps at the Taghkanic Town Hall. These were installed to replace the existing oil furnace heating system and the use of window air-conditioning units for cooling. The installation was performed by RYCOR of New Paltz, NY. They installed the following systems:

- Two Mitsubishi Hyper-Heat Heat Pumps (18,000 BTU) were installed in the main room downstairs, with the evaporators mounted near the ceiling and individual wall-mounted condensers outside. (\$7,150 each).
- One Mitsubishi Hyper-Heat Heat Pump (18,000 BTU) was installed in the main room upstairs, with the evaporator mounted near the ceiling and the a wall-mounted condenser outside. (\$7,150).
- One Mitsubishi Hyper-Heat Heat Pump (12,000 BTU) was installed in the smaller office upstairs, with the evaporator mounted near the ceiling and the a wall-mounted condenser outside. (\$6,150).
- Four Kumo Cloud remote sensors (1 per system) were also installed (\$1180 total).
- Total cost to the town after NYSERDA grants (\$10,000) and rebates: \$11,311.

For each installation, all lines were covered in Line Hide Covering and the condensation was piped to the outside.

Performance

The town has been please with the performance of the heat pumps. During the first winter after installation, there was a day in February where the outside temperature plummeted to -10° . There was nobody in the town hall, but the Kumo remote app showed inside temperatures of 68° . I've since learned from experience with my home heat pump system that this represents the air temperature in the immediate vicinity of the wall unit, not necessarily the average room temperature. Nevertheless, it does indicate an acceptable interior temperature at this extreme outside temperature.

Lighting Upgrade

In 2023, the entire lighting system at town hall was converted from fluorescent bulbs to low wattage LED fixtures. After contributions/incentives from National Grid, the upgrade cost the town around \$850, and the conversion was projected to pay for itself in 18 months.

Energy Tracking

We have tracked the combined effects of these upgrades on energy use at the town hall by comparing the costs and KWh consumption for the 12-month period preceding heat pump installation and for two 12-month periods following heat pump installation in Table 1.

Table 1. Analysis of Energy Consumption at Town Hall for Three 12-Month Periods.

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- In the 12-month period before HP installation (Jul 2021-Jun 2022):
 - Total Electricity: 14,877 KWh (2.0 MTCO_{2e})¹
 - Fuel Oil: 520 gallons(12.4 barrels; 5.9 MTCO_{2e})²
 - Costs: Electric (\$2490), Oil (\$1558) → Combined Cost: \$4048
 - Total GHG Emissions: 7.9 MTCO_{2e}
 - In the 12-month period following HP installation (Jul 2022 – Jun 2023):
 - Total Electricity: 16,594 KWh (2.2 MTCO_{2e})
 - Fuel Oil: 190 gallons (4.5 barrels; 2.2 MTCO_{2e}) (*Someone did not get the memo about not using the furnace*)
 - Costs: Electric (\$3068), Oil (\$687) → Combined Cost: \$3755
 - Total Emissions: 4.4 MTCO_{2e}
 - In the most recent 12-month period following HP installation (Jul 2023 – Jun 2024):
 - Total KWh electrical: 15,835 (\$2963)(2.1 MTCO_{2e})
 - Fuel Oil: 3 gallons (0.1 barrel; 0.0 MTCO_{2e})
 - Costs: Electric (\$2963), Oil (\$9) → Combined Cost: \$2972
 - Total Emissions: 2.1 MTCO_{2e}

¹Metric Tons CO₂ equivalents: Calculated using the EPA Greenhouse Gas Equivalencies Calculator for ZIP code 12523 (<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results>). ²U.S. Energy Information Administration (EIA). "Carbon Dioxide Emissions Coefficients." Available at: https://www.eia.gov/environment/emissions/co2_vol_mass.php

The GHG Emissions data in the table are represented as Metric Tons of Carbon Dioxide equivalents (MTCO_{2e}), i.e., the number of metric tons of CO₂ emissions that would be required to produce the same climate warming effect as the electrical or oil-generated energy shown. Furthermore, the data have been generated using a conversion factor specific for Upstate New York. This takes into account that the generation of electricity in upstate New York produces lower CO₂ emissions (275lb CO₂/MWh) than in Westchester (885lb CO₂/MWh) or Long Island (1200lb CO₂/MWh), and is well below the national average (823lb CO₂/MWh). This is due large portion of electricity generation in upstate NY coming from hydro (30.9%) and nuclear (30.8%) power, with virtually no contribution from coal powered plants (<https://www.epa.gov/egrid/power-profiler#/NYUP>).

These data seem to indicate that with the switch to air source heat pumps at town hall to meet both heating and cooling demands, in combination with the upgrade to LED lighting, the town hall electrical usage has increased by only around 10%. At the same time, the town hall has now eliminated its annual

consumption of 520 gallons of heating oil. Together, these changes have reduced annual GHG emissions footprint of town hall from 7.9 to 2.1 MTCO₂e, a reduction in GHG emissions of around **5.8 MTCO₂e**.

It also appears there was a significant cost saving associated with these upgrades. With the caveats that the use of town hall can vary from year to year because it is not used for regular hours on a daily basis and that the cost of fuel oil and electricity tend to increase each year, our energy bills reflect an **overall decrease in combined cost for electricity and fuel oil from \$4048 in 2022 to \$2972 in 2024, following the upgrades – a annual savings of \$1076** – not corrected for changes in the costs of heating oil and electricity. *(The corresponding calculation for 2023 was not included because oil heating continued to be used upstairs, and some of the fuel oil charges in 2023 reflected refilling of the tank for oil that was burned in 2022.)*

What do the results mean?

These numbers sound good, but what do they mean? An annual cost saving of \$1076 is relatable. It means the \$10,000 the town paid for the heat pumps (\$10K came from grant funds) will be repaid in 10.5 years. But what about the reduction in energy use of 5.8 MTCO₂e; is that significant? According to the EPA (ref 1 in Table 1), a reduction of 5.8 MTCO₂e is equivalent to taking 1.3 gasoline-powered vehicles off the road for one year, or eliminating the consumption of around 650 gallons of gasoline.

Still, it's hard to visualize 5.8 metric tons of carbon dioxide (the stuff we breath out when we exhale; a gas a room temperature). But, it may be easier if you consider the CO₂ in another familiar form: **Dry Ice**. Dry Ice is the solid form of CO₂ which exists when the temperature of CO₂ is lowered to -109°F. You have probably encountered it used as a refrigerant in packaging or placed in water to produce a "smoke" effect. If 5.8 metric tons of CO₂ were compressed and frozen, the result would be a 3.72 cubic meter block of Dry Ice. That would be a block measuring 1m high X 1m deep X 3.72m wide (or roughly 3ft X 3ft X 10ft), weighing over 12,000 lbs.

HIGHWAY GARAGE

Heat Pumps

The town of Taghkanic has also made energy upgrades at the Highway Department garage. The window AC units and propane heaters serving the Supervisor's office and the break room were replaced with air-source heat pumps, installed by RYCOR of New Paltz, NY:

2 X Mitsubishi 9,000 BTU Hyper Heat (MUZ-FS09NA-U1 MSZ-FS09NA-U1)

The installation was completed only in October 2024, so we do not as yet have information regarding energy savings.

Solar Panels

An 18000 KW solar rooftop array was also installed at the highway garage. The panels have been installed, but the system is not yet active. Thus, we have no information regarding energy savings with this upgrade.