

Town Properties Energy Picture

(Updated June 1, 2024)

This ongoing report's purpose is to document and display the energy usage and expense for the major Charlotte Town Properties. Data were obtained from the 2024 Town Report, Green Mountain Power high resolution hourly usage and monthly cost data. Data for Heating Degree Days (HDD) and Cooling Degree Days (CDD) are from the [National Weather Service](#). Except for the Town garage, data spanned the time period 7/2022 – 6/2023.

Library

The Library is an all electric powered building. It's 4500 sqft are heated and cooled by 6 Daikin externally located compressor units serving 8 indoor heat pumps with a max combined heating/cooling power of 73 kW. A 400 Watt, 480 cuft/min, 65% efficiency Renewaire Heat recovery ventilator delivers fresh air. Other electrical loads are an electrical resistance hot water heater, internal and external lights, air purifiers, and office equipment. The ventilation system duty cycle has been reduced from 100%, 7 days a week, to 3 hours per day in half hour ON times per 2 hours as shown below, maintaining normal CO2 levels. During heating days the temperature settings are 71 deg and during cooling days 75 deg.

Library Fresh Air Ventilation Schedule

Time of Day	6:30	7:00	7:30	8:00	8:30	9:00	9:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30	15:00	15:30	16:00	16:30	17:00	17:30	18:00	18:30	19:00	19:30
Hourly Settings (old)	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
½ Hourly Settings	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
Heat ON (Mon-Sat)																											
Monday Hours																											
Tuesday Hours																											
Wednesday Hours																											
Thursday Hours																											
Friday Hours																											
Saturday Hours																											
Sunday Hours																											

The annual electricity consumption for 7/22 – 6/23 was 28992 kWh at a cost of \$5660.

Town Offices

The Town Offices are heated and cooled with a ducted HVAC system using electricity for cooling and oil for heating. No thorough evaluation of operation has as yet been done by the Energy Committee on this property. It was noticed though that the EV charger electricity is on the same GMP meter as this property.

From Chargepoint "Flex Billing Statements" it can be seen that the charger has been configured to charge \$0.19/kWh and an unspecified extra amount for charging longer than around 5 hrs. The administrative charge seems to be 10% for shorter charge times. It is recommended that the kWh rate be increased to at least \$0.23/kWh to cover the cost of the electricity being paid by the Town, and the 10% admin cost. Consideration for adding an amount to cover repair and eventual replacement of the charger should be discussed by maybe raising the rate to \$0.25/kWh.

The Town received \$1269 from Chargepoint for electricity charges minus the administrative charges for an estimated 6042 kWh. This cost was subtracted from the Town Hall's total annual expenditure of \$10613 leaving \$9344 for the Town Hall cost of energy. Subtracting the 6042 kWh from the GMP meter 28077 kWh leaves 22035 kWh of electricity usage.

The heating oil cost of \$4897 is approximately equivalent to 66263 kWh at \$3/gal, 138500 BTU/gal and 3412 BTU/kWh. Thus the total energy used by the Town Hall is around 88298 kWh.

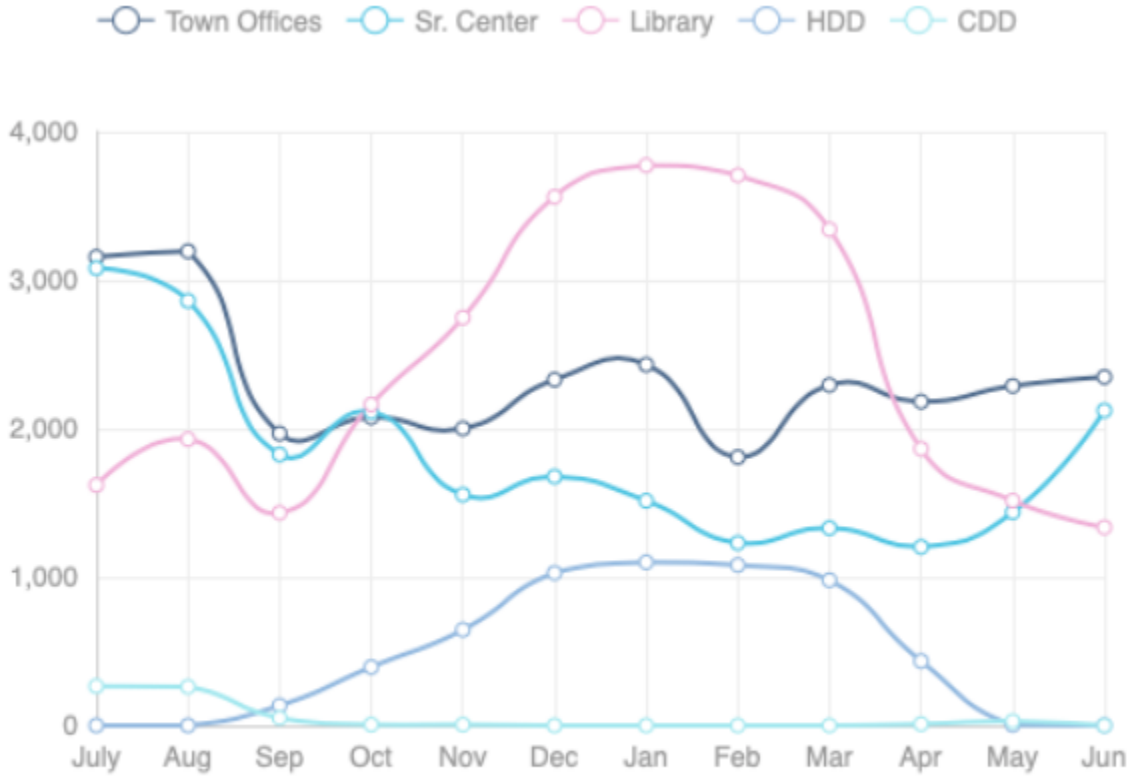
Senior Center

The Senior Center uses oil for heating the floor of the Senior Center during winter and electricity to cool during the summer. No thorough evaluation of operation has as yet been done by the Energy Committee on this property.

The Sr. Center reported a total energy expense of \$9016. GMP reported 21949 kWh used at a cost of \$4520.56, leaving \$4495.44 for the oil use . As no metered oil consumption data was available, the annual oil consumption was estimated using \$3.00/gal and 40.6 kWh/gal to compute an equivalent energy of 60838 kWh. Thus the total energy use was 82787 kWh.

Summary of Energy Costs and Usages

Shown in the graph below are the monthly electrical kWh consumptions of the three Town properties along with the HDD and CDD.

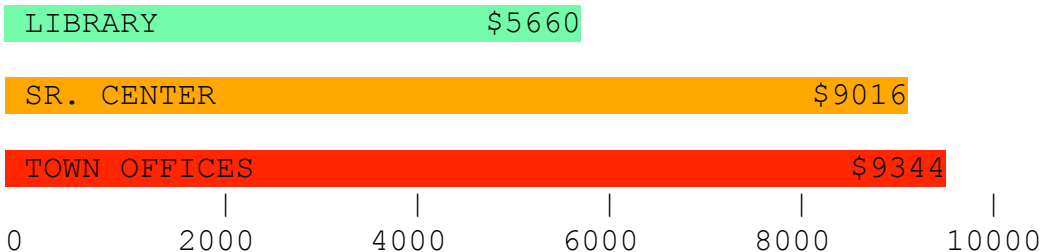


Town Properties Electricity Usage (kWh)

The largest electricity consumption for the Sr. Center and the Town Offices are during the brief cooling season of July and August. The library's largest consumption is during the long heating season when the other properties are using oil for heat.

The bar graphs below visualize the annual energy cost of the Town properties as well as the kWh equivalent of the electricity and oil used.

Town Properties Energy Expenditures (7/22 - 6/23)



Town Properties Energy Usages in MWh (7/22 - 6/23)

Electricity Oil

LIBRARY 28.992

SR. CENTER 82.787

TOWN OFFICES 88.298



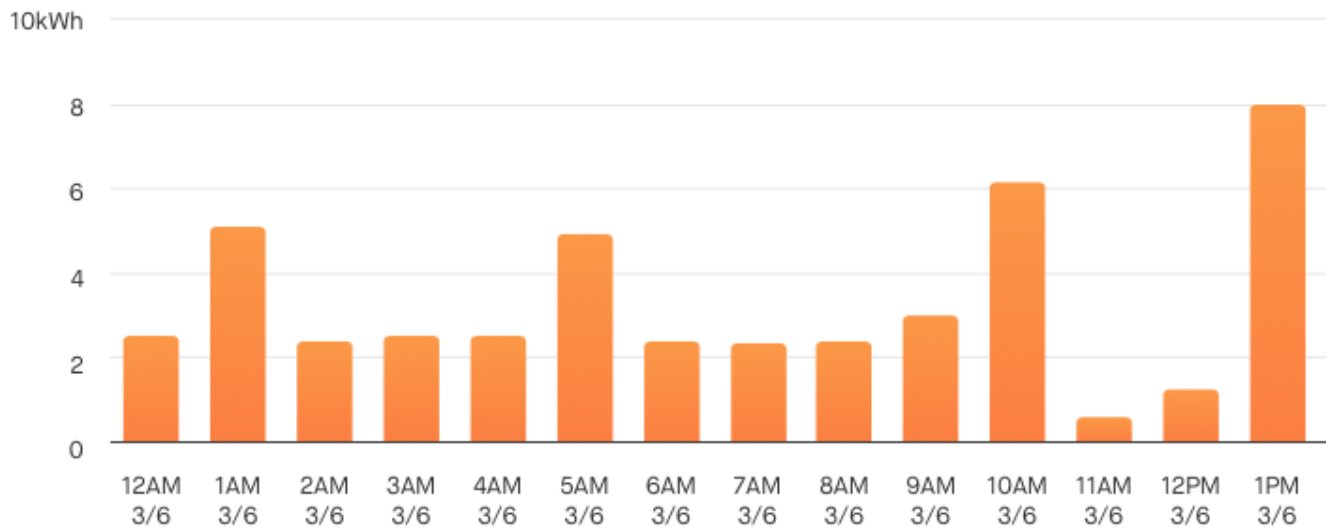
Town Garage

The new Town Garage data so far is limited to Jan - May. A total of 6492 kWh was consumed in January that typically represents 18% of the heating season. Thus a crude prediction for the year would be around 36 MWh which translates to an annual cost of \$7574 assuming \$0.21/kWh.

Billing for the first full month of production (4/23 – 5/23) showed a solar production, of 15569 kWh. The garage load was 1778 kWh of which 910 kWh was supplied directly from solar generation and the balance of 868 kWh supplied by GMP. It should be noted that there seems to be a “phantom” load of around 2 kW that should be investigated as that represents an appreciable continuous monthly load of around 1500 kWh.

Adding the predicted garage load to the loads from the other Town properties gives a total electrical load of 109000 kWh. The expected annual garage solar array production from the Sun Solar proposal is 131000 kWh leaving only around 22 kWh available, not enough for electrifying the Town and Sr. Center oil heat energy estimated at 128000 kWh. It should be noted that this estimate is more than the delivered heat as it neglects the oil burner's efficiency. Assuming an 80% efficiency and an electrical coefficient of performance of 3, replacement of the oil heaters with heat pumps should lower the electrical energy needed to replace the oil to around 34000 kWh.

So, it can be said that the garage solar energy production may be sufficient to supply the **current** electrical needs of the three Town properties but not their total energy needs. Any current extra production could be redirected to the Beach House and other loads.



Above graph shows the early hourly consumptions of electricity for the Town Garage on March 6.