Town of Yorktown

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Greenhouse Gas Emissions Report

For Municipal Only

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Town of Yorktown Greenhouse Gas Emissions Report for 2020

The Town of Yorktown is working to attain the status of Climate Smart Community as designated by New York State. Fundamental to that goal is understanding the sources of greenhouse gases (GHG). This includes direct emissions from fossil fuels (natural gas, gasoline, fuel oil, diesel) and indirect emissions such as those resulting from the production of electricity consumed. This information can provide impetus for future reductions and also be the basis for nest steps such as building energy efficiency assessments. This was a significant endeavor for the following reasons:

- The town has extensive facilities
- Electricity is purchased from NYPA, NYSEG and Constellation and there are an extensive number of electric meters
- The fleet has over 150 vehicles
- There is no central repository for energy information

Helpful in this assessment were:

- The vehicle fuel tracking tool
- Detailed input from NYSERDA and NYPA
- EPA factors for converting fuel used into CO2e
- The EPA State Inventory and Projection Tool
- The detailed ledger and vendor spending tracking system

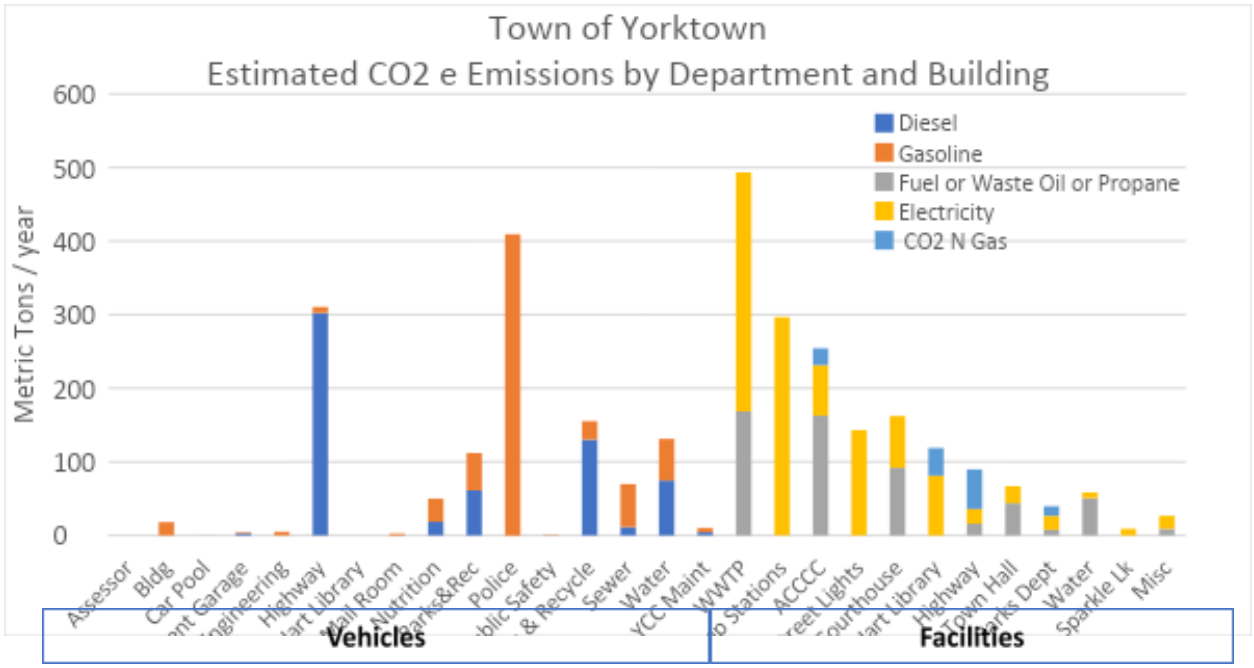
Town of Yorktown Background

The Town of Yorktown covers multiple zip codes and includes roughly 37,000 residents, and 13,000 households. The community is served by Con Ed and NYSEG. Much of the town does not have natural gas service and relies on fuel oil. The town owns and operates a wastewater treatment plant and water treatment facilities. About 27% of the population is connected to the wastewater treatment plant.

Findings

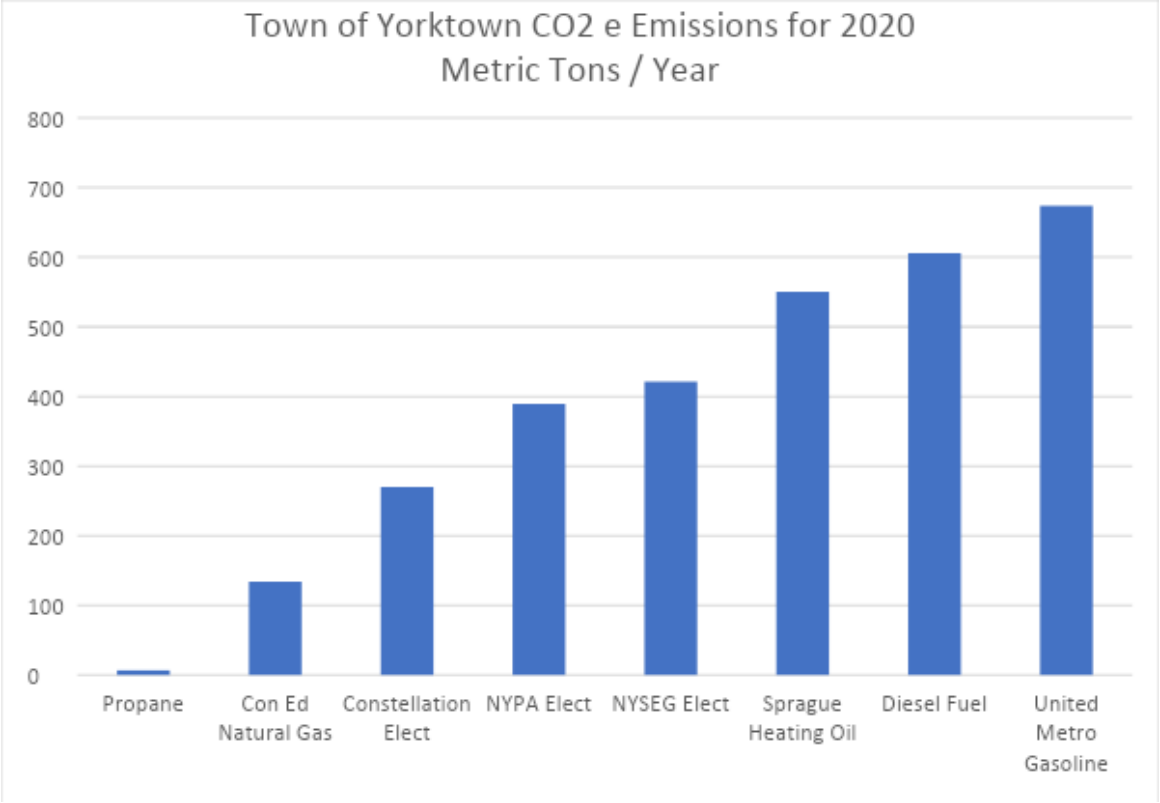
The overall emissions resulting from town activities and facilities are shown below in Figure 1. The results are shown as equivalent (other greenhouse gases are also included, albeit they are small in comparison to CO2):

Figure 1



This information will be leveraged to drive reductions. The total emissions are just over 3000 Metric Tons / Year of CO2 e for items depicted in this graph. It is interesting to note that the combined wastewater treatment and pumping account for a very significant amount of energy use and associated GHG emissions.

Figure 2 provides a breakdown of emissions by source:



It can be seen that the single largest supplier source is gasoline, which is primarily used by the police department. Note that if all electric sources were combined, they would be the single largest emitter.

Sources for Facilities

One of the challenges in this assessment was unwrapping the details of what is used in each facility. Table 1 below shows an overview of emissions by facility and by source/supplier:

Table1 – Metric Tons of CO2 e by User

	Electricity			Nat Gas	Fuel Oil	Waste	Propane	Total
Supplier:	Constellation	NYPA	NYSEG	Con Ed	Spragu e	Oil	Suburban & Paraco	Metric Tons CO2 e
WWTP & Osceola	146		178	7	169		7	507
Pump Stations		250	47					297
ACCCC	19		50	23	163			254
Street Lights	36	58	49					143
Police/Courthouse	28		42		92			162
J. C. Hart Library		81		38				119
Highway	6		14	54		16		90
Town Hall/Records	10		13		44			67
Parks Dept	6		13	13	8			40
Water	8				51			58
Sparkle Lk			9					9
Misc	11		7		9			27
	270	390	422	134	535	16	7	1,773

Methodology

Greenhouse gases were calculated using activity data multiplied by the appropriate emissions factors, as prescribed in the LGOP. In May of 2020, I did request a tool from NYS DEC, and a person named Willow Eyres from dec.ny.gov responded by email that CSC did not have a free tool available and recommended the EPA tool. Since our data was in so many different forms, it fit our needs better to use an Excel spreadsheet and I am very familiar with Excel. To illustrate how this methodology was used, let me give some examples:

For vehicles, the town has a system for tracking fuel used by every vehicle. There are two types of fuel: gasoline and diesel. For this example, I chose diesel. The source of the emission factor is listed, along

with the proper conversions. All original usage data was in pdf format, and had to be transcribed manually to a spreadsheet. For each calculation, I listed in the spreadsheet the source of the emission factor, and the conversions needed to arrive at the proper units (for example):

Vehicles https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle
https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-reference

diesel 10,180 grams CO_2/ gallon

10,180	grams CO_2 / gallon	1,000,000	metric ton / grams	0.01018	metric tons CO_2 / gallon	

Therefore, for vehicles, the spreadsheet is simply the gallons used multiplied by the appropriate emission factor and that result was totaled by functional area:

		January		February		March		April		May		June		July		August		September		October		November		December		Totals		
		Gallons	Dollars	Gallons	Dollars	Gallons	Dollars	Gallons	Dollars	Gallons	Dollars	Gallons	Dollars	Gallons	Dollars	Gallons	Dollars	Gallons	Dollars	Gallons	Dollars	Gallons	Dollars	Gallons	Dollars	Gallons	Dollars	
Assessor	Gas																									-	-	Assessor
Assessor	Diesel																									-	-	Assessor
Bldg	Gas	193.86	317.21	120.38	182.37	177.75	305.08	175.73	342.94	96.00	211.55	188.51	394.36	174.37	364.67	147.46	303.32	198.99	296.88	131.43	242.67	96.89	180.23	110.35	205.17	1,777.72	3,347.05	Bldg Gas
Bldg	Diesel																									-	-	Bldg Diesel
Car Pool	Gas			16.40	24.63																					16.40	24.63	Car Pool Gas
Car Pool	Diesel																									-	-	Car Pool Diesel
Cent Garage	Gas	28.00	44.32	14.40	22.15	16.90	28.43	14.30	27.67	17.00	38.39	16.70	32.18			15.90	33.17					16.70	30.98	16.90	31.64	156.80	289.89	Cent Garage Gas
Cent Garage	Diesel	63.19	132.18	48.06	106.80	48.06	106.80			32.63	73.78	29.30	61.82	33.28	65.40			32.76	65.09					20.59	43.30	309.87	655.37	Cent Garage Diesel
Engineering	Gas	13.30	21.49	15.20	23.38	14.40	26.56	85.40	166.63	67.29	147.48	85.08	177.56	15.30	31.99	50.32	102.88	67.00	163.38	28.40	52.51	14.50	27.14	12.40	23.21	489.19	963.95	Engineering Gas
Engineering	Diesel																									-	-	Engineering Diesel
Highway	Gas	120.84	191.55	106.04	161.09	126.66	213.77	93.10	182.75	71.20	156.48	71.10	147.94	80.00	163.69	48.37	98.75	31.80	53.20	27.20	48.93		84.10	38.14	70.47	814.45	1,584.79	Highway Gas
Highway	Diesel	4,638.09	9,709.48	3,582.01	7,952.23	3,582.01	7,952.23	1,610.85	3,553.99	1,776.46	4,016.56	1,462.37	3,081.33	1,465.12	2,678.99	1,793.37	3,650.36	1,623.33	3,246.29	2,161.03	4,326.62	1,580.41	3,267.71	4,417.33	9,269.53	29,692.98	62,930.39	Highway Diesel
J C Hart Library	Gas					15.00	24.09	13.90	26.90									14.40	26.81				9.60	17.81			95.61	J C Hart Library Gas
J C Hart Library	Diesel																									-	-	J C Hart Library Diesel
Mail Room	Gas	26.50	42.23	17.50	26.71	20.70	36.12	20.80	40.25	17.70	39.18	16.80	33.77	28.20	60.31	18.10	36.40	20.00	37.16	16.90	31.21	28.30	52.47	16.50	30.51	248.00	466.32	Mail Room Gas
Mail Room	Diesel																									-	-	Mail Room Diesel
Nutrition	Gas	264.95	464.05	139.60	213.57	300.90	513.36	332.90	654.24	273.30	601.38	338.90	705.59	197.70	412.56	176.60	362.61	190.90	355.48	312.70	577.30	214.40	393.09	322.50	591.89	3,086.35	5,941.32	Nutrition Gas
Nutrition	Diesel	106.01	221.67	133.52	430.32	133.52	430.32	64.70	142.33	116.67	263.79	124.08	262.67	218.62	423.60	253.32	525.95	204.98	426.46	100.23	200.88	144.66	296.62	102.16	214.64	1,629.13	3,628.50	Nutrition Diesel
Parks&Rec	Gas	383.52	616.80	313.14	475.37	468.96	763.93	383.06	753.43	353.26	788.04	678.50	1,407.56	746.11	1,565.30	508.20	1,042.21	267.89	483.33	365.15	675.43	222.33	413.54	237.95	546.88	4,930.07	9,568.42	Parks&Rec Gas
Parks&Rec	Diesel	527.19	1,103.20	488.34	1,063.72	488.34	1,063.72	337.02	744.82	642.64	1,463.03	722.35	1,527.40	453.38	830.86	610.98	1,233.78	489.33	935.68	446.47	894.61	474.20	975.32	320.64	674.32	6,010.58	12,633.06	Parks&Rec Diesel
Police	Gas	3,195.01	5,082.58	2,605.48	3,972.18	3,440.06	5,315.31	3,351.39	6,530.63	3,866.25	8,423.79	3,533.13	7,332.43	3,320.94	6,365.61	3,321.25	6,783.91	3,523.93	6,981.67	3,620.50	6,694.53	3,397.95	6,318.81	3,016.20	5,543.63	40,192.09	76,217.34	Police Gas
Police	Diesel																									-	-	Police Diesel
PublicSafety	Gas			20.50	31.04	15.50	24.89									30.10	58.88			11.10	20.38	2.00	3.75			79.20	138.90	PublicSafety Gas
PublicSafety	Diesel									14.73	33.30															14.73	33.30	PublicSafety Diesel
Refuse & Recycle	Gas	330.03	526.95	183.61	288.63	281.37	482.41	240.39	469.46	213.93	480.69	196.72	412.87	234.12	488.22	211.40	436.25	82.45	154.85	179.62	332.00	103.58	193.38	135.74	359.14	2,465.76	4,625.05	Refuse & Recycle Gas
Refuse & Recycle	Diesel	1,081.46	2,284.46	1,086.11	2,402.85	1,086.11	2,402.85	1,223.87	2,704.76	1,250.48	2,827.36	971.98	2,070.10	1,030.35	2,024.61	1,168.55	2,361.07	1,057.94	2,170.44	1,101.80	2,206.55	1,012.62	2,079.26	680.52	1,431.11	12,793.78	26,985.41	Refuse & Recycle Diesel
Sewer	Gas	568.34	905.23	516.59	765.07	583.26	934.92	481.56	968.21	395.79	862.39	403.43	837.46	522.28	1,096.68	468.12	964.94	404.85	765.00	452.40	836.57	433.19	806.60	493.67	906.42	5,729.48	10,719.49	Sewer Gas
Sewer	Diesel	142.85	298.76	81.93	178.04	81.93	178.04	105.19	232.47	76.09	172.04	64.39	140.77	85.29	167.60	71.00	144.38	32.92	185.85	102.01	203.33	156.21	325.29	54.02	113.61	1,112.83	2,342.76	Sewer Diesel
Supervisor	Gas	67.60	107.67	27.70	42.16	34.60	53.93	35.50	69.43	34.30	75.66	38.60	80.14	28.10	60.17	17.30	36.12	28.30	53.12	28.00	51.65	28.60	53.38	20.30	36.53	389.50	726.02	Supervisor Gas
Supervisor	Diesel																									-	-	Supervisor Diesel
Water	Gas	528.38	842.38	461.42	703.25	502.88	860.15	444.32	964.97	413.43	906.48	463.82	964.82	417.96	872.05	471.31	967.27	443.16	825.63	493.46	912.53	443.15	824.63	465.87	841.47	5,586.36	10,486.23	Water Gas
Water	Diesel	870.20	1,820.96	731.10	1,616.68	731.10	1,616.68	478.23	1,057.03	726.63	1,643.35	576.22	1,202.63	613.70	1,205.94	562.53	1,148.77	653.20	1,317.46	462.87	807.72	444.95	907.52	550.48	1,157.67	7,846.53	15,902.50	Water Diesel
YCC Maint	Gas	40.70	65.57	41.00	62.07	62.60	141.28	58.24	114.22	67.20	147.64	32.50	66.75	35.50	71.67	49.30	98.34	26.60	53.79	46.90	86.77	42.40	76.34	35.00	65.00	539.14	1,052.04	YCC Maint Gas
YCC Maint	Diesel	63.21	132.48	60.05	133.55	60.05	133.55	32.11	70.37	71.14	160.85	28.31	61.00	30.92	60.76			30.64	62.57					50.80	107.05	427.93	922.73	YCC Maint Diesel
Total	Gas	5,793.63	9,218.57	4,605.16	7,014.67	6,078.34	10,411.29	5,740.59	11,371.79	5,304.65	12,885.16	6,064.79	12,588.43	5,800.58	12,158.52	5,554.58	11,333.05	5,262.27	9,862.10	5,733.76	10,562.58	5,052.59	9,484.83	5,031.52	9,252.02	66,603.41	126,346.95	Total
Total	Diesel	7,552.19	15,703.32	6,272.12	13,890.19	6,272.12	13,890.19	3,852.03	8,513.03	4,707.67	10,644.06	3,979.20	8,419.98	3,930.66	7,723.76	4,466.11	9,084.91	4,229.10	8,450.86	4,334.47	8,639.71	3,813.05	7,842.32	4,136.64	8,081.49	58,527.36	125,833.62	Total
																											251,980.77	Total Spent

For natural gas, it came down to (usage) x (emission factor). All of the natural gas is from ConEd.

For #2 fuel oil which is used for heating, (no biodiesel is currently used) the calculation was (usage in gallons) x (emission factor). The below shows the usage in gallons:

Town of Yorktown Greenhouse Gas Emissions Report for 2020

Date	Year	Location	Gallons	Notes	AACCCC	Downing Park	Police / Court	PR	Records	Sewer (YS)	Town Hall (TH)	Water (SW)	DEP
9-Jan	2020	AACCCC	2,000.0		2,000	0	0	0	0	0	0	0	0
30-Jan	2020	AACCCC	1,500.3		1,500	0	0	0	0	0	0	0	0
3-Feb	2020	AACCCC	1,700.2		1,700	0	0	0	0	0	0	0	0
25-Feb	2020	AACCCC	3,500.2		3,500	0	0	0	0	0	0	0	0
26-Mar	2020	AACCCC	902.2		902	0	0	0	0	0	0	0	0
17-Nov	2020	AACCCC	4,418.4		4,418	0	0	0	0	0	0	0	0
18-Dec	2020	AACCCC	1,994.3		1,994	0	0	0	0	0	0	0	0
4-Jan	2021	Downing Park	50.8		0	51	0	0	0	0	0	0	0
4-Jan	2021	Downing Park	113.3		0	113	0	0	0	0	0	0	0
22-Jan	2020	Downing Park	21.6		0	22	0	0	0	0	0	0	0
12-Feb	2020	Downing Park	66.1		0	66	0	0	0	0	0	0	0
2-Mar	2020	Downing Park	185.0		0	185	0	0	0	0	0	0	0
2-Apr	2020	Downing Park	105.8		0	106	0	0	0	0	0	0	0
28-Oct	2020	Downing Park	87.8		0	88	0	0	0	0	0	0	0
1-Dec	2020	Downing Park	29.4		0	29	0	0	0	0	0	0	0
1-Dec	2020	Downing Park	31.5		0	32	0	0	0	0	0	0	0
1-Dec	2020	Downing Park	36.1		0	36	0	0	0	0	0	0	0
1-Dec	2020	Downing Park	38.7		0	39	0	0	0	0	0	0	0
16-Jan	2020	Police / Court	680.0		0	0	680	0	0	0	0	0	0
5-Feb	2020	Police / Court	848.8		0	0	849	0	0	0	0	0	0
28-Feb	2020	Police / Court	893.1		0	0	893	0	0	0	0	0	0
19-Mar	2020	Police / Court	950.8		0	0	951	0	0	0	0	0	0
22-Apr	2020	Police / Court	902.1		0	0	902	0	0	0	0	0	0
27-May	2020	Police / Court	380.7		0	0	381	0	0	0	0	0	0
19-Oct	2020	Police / Court	540.6		0	0	541	0	0	0	0	0	0
19-Oct	2020	Police / Court	560.4		0	0	560	0	0	0	0	0	0
23-Nov	2020	Police / Court	700.5		0	0	701	0	0	0	0	0	0
30-Nov	2020	Police / Court	455.6		0	0	456	0	0	0	0	0	0
30-Nov	2020	Police / Court	633.6		0	0	634	0	0	0	0	0	0
23-Dec	2020	Police / Court	1,000.1		0	0	1,000	0	0	0	0	0	0
30-Dec	2020	Police / Court	500.0		0	0	500	0	0	0	0	0	0
13-Nov	2020	PR	19.4		0	0	0	19	0	0	0	0	0
8-Jan	2020	Records	470.6		0	0	0	0	471	0	0	0	0
4-Jan	2021	Sewer (YS)	400.7		0	0	0	0	0	401	0	0	0
13-Jan	2020	Sewer (YS)	545.2		0	0	0	0	0	545	0	0	0
20-Jan	2020	Sewer (YS)	268.6		0	0	0	0	0	269	0	0	0
27-Jan	2020	Sewer (YS)	330.2		0	0	0	0	0	330	0	0	0
27-Jan	2020	Sewer (YS)	879.3		0	0	0	0	0	879	0	0	0
3-Feb	2020	Sewer (YS)	408.0		0	0	0	0	0	408	0	0	0
11-Feb	2020	Sewer (YS)	373.8		0	0	0	0	0	374	0	0	0
11-Feb	2020	Sewer (YS)	530.0		0	0	0	0	0	530	0	0	0
21-Feb	2020	Sewer (YS)	530.2		0	0	0	0	0	530	0	0	0
2-Mar	2020	Sewer (YS)	490.7		0	0	0	0	0	491	0	0	0
9-Mar	2020	Sewer (YS)	25.9		0	0	0	0	0	26	0	0	0
10-Mar	2020	Sewer (YS)	533.8		0	0	0	0	0	534	0	0	0
11-Mar	2020	Sewer (YS)	561.9		0	0	0	0	0	562	0	0	0
20-Mar	2020	Sewer (YS)	522.3		0	0	0	0	0	522	0	0	0
31-Mar	2020	Sewer (YS)	439.1		0	0	0	0	0	439	0	0	0
10-Apr	2020	Sewer (YS)	396.2		0	0	0	0	0	396	0	0	0
17-Apr	2020	Sewer (YS)	345.3		0	0	0	0	0	345	0	0	0
17-Apr	2020	Sewer (YS)	485.4		0	0	0	0	0	485	0	0	0
27-Apr	2020	Sewer (YS)	330.8		0	0	0	0	0	331	0	0	0
1-May	2020	Sewer (YS)	240.1		0	0	0	0	0	240	0	0	0
12-May	2020	Sewer (YS)	405.1		0	0	0	0	0	405	0	0	0
21-May	2020	Sewer (YS)	321.2		0	0	0	0	0	321	0	0	0
1-Jun	2020	Sewer (YS)	261.6		0	0	0	0	0	262	0	0	0
8-Jun	2020	Sewer (YS)	333.1		0	0	0	0	0	333	0	0	0
19-Jun	2020	Sewer (YS)	210.9		0	0	0	0	0	211	0	0	0
6-Jul	2020	Sewer (YS)	300.0		0	0	0	0	0	300	0	0	0
14-Jul	2020	Sewer (YS)	212.6		0	0	0	0	0	213	0	0	0
29-Jul	2020	Sewer (YS)	269.4		0	0	0	0	0	269	0	0	0
12-Aug	2020	Sewer (YS)	365.9		0	0	0	0	0	366	0	0	0
25-Aug	2020	Sewer (YS)	128.4		0	0	0	0	0	128	0	0	0
1-Sep	2020	Sewer (YS)	229.0		0	0	0	0	0	229	0	0	0
14-Sep	2020	Sewer (YS)	262.5		0	0	0	0	0	263	0	0	0
29-Sep	2020	Sewer (YS)	416.5		0	0	0	0	0	417	0	0	0
8-Oct	2020	Sewer (YS)	323.0		0	0	0	0	0	323	0	0	0
8-Oct	2020	Sewer (YS)	660.1		0	0	0	0	0	660	0	0	0
22-Oct	2020	Sewer (YS)	475.3		0	0	0	0	0	475	0	0	0
3-Nov	2020	Sewer (YS)	525.4		0	0	0	0	0	525	0	0	0
13-Nov	2020	Sewer (YS)	359.7		0	0	0	0	0	360	0	0	0
23-Nov	2020	Sewer (YS)	120.9		0	0	0	0	0	121	0	0	0
23-Nov	2020	Sewer (YS)	360.2		0	0	0	0	0	360	0	0	0
4-Dec	2020	Sewer (YS)	471.2		0	0	0	0	0	471	0	0	0
18-Dec	2020	Sewer (YS)	579.9		0	0	0	0	0	580	0	0	0
24-Dec	2020	Sewer (YS)	358.6		0	0	0	0	0	359	0	0	0
20-Jan	2020	Town Hall (TH)	291.8		0	0	0	0	0	0	292	0	0
5-Feb	2020	Town Hall (TH)	597.9		0	0	0	0	0	0	598	0	0
27-Feb	2020	Town Hall (TH)	315.5		0	0	0	0	0	0	316	0	0
26-Mar	2020	Town Hall (TH)	673.0		0	0	0	0	0	0	673	0	0
1-May	2020	Town Hall (TH)	261.4		0	0	0	0	0	0	261	0	0
26-Oct	2020	Town Hall (TH)	187.9		0	0	0	0	0	0	188	0	0
7-Dec	2020	Town Hall (TH)	792.6		0	0	0	0	0	0	793	0	0
18-Dec	2020	Town Hall (TH)	793.6		0	0	0	0	0	0	794	0	0
28-Dec	2020	Town Hall (TH)	394.8		0	0	0	0	0	0	395	0	0
20-Jan	2020	Water (SW)	31.2		0	0	0	0	0	0	0	31	0
20-Jan	2020	Water (SW)	303.0		0	0	0	0	0	0	0	303	0
20-Jan	2020	Water (SW)	387.8		0	0	0	0	0	0	0	388	0
7-Feb	2020	Water (SW)	45.9		0	0	0	0	0	0	0	46	0
7-Feb	2020	Water (SW)	245.7		0	0	0	0	0	0	0	246	0
7-Feb	2020	Water (SW)	309.6		0	0	0	0	0	0	0	310	0
27-Feb	2020	Water (SW)	50.9		0	0	0	0	0	0	0	51	0
27-Feb	2020	Water (SW)	199.9		0	0	0	0	0	0	0	200	0
27-Feb	2020	Water (SW)	487.7		0	0	0	0	0	0	0	488	0
3-Apr	2020	Water (SW)	85.2		0	0	0	0	0	0	0	85	0
3-Apr	2020	Water (SW)	255.0		0	0	0	0	0	0	0	255	0
3-Apr	2020	Water (SW)	531.9		0	0	0	0	0	0	0	532	0
19-Oct	2020	Water (SW)	37.7		0	0	0	0	0	0	0	38	0
19-Oct	2020	Water (SW)	106.9		0	0	0	0	0	0	0	107	0
19-Oct	2020	Water (SW)	535.9		0	0	0	0	0	0	0	536	0
30-Nov	2020	Water (SW)	1.0		0	0	0	0	0	0	0	1	0
30-Nov	2020	Water (SW)	2.1		0	0	0	0	0	0	0	2	0
30-Nov	2020	Water (SW)	55.2		0	0	0	0	0	0	0	55	0
30-Nov	2020	Water (SW)	55.2		0	0	0	0	0	0	0	55	0
30-Nov	2020	Water (SW)	250.3		0	0	0	0	0	0	0	250	0
28-Dec	2020	Water (SW)	59.8		0	0	0	0	0	0	0	60	0
28-Dec	2020	Water (SW)	312.4		0	0	0	0	0	0	0	312	0
28-Dec	2020	Water (SW)	636.6		0	0	0	0	0	0	0	637	0
18-Dec	2020	DEP	650.9		0	0	0	0	0	0	0	0	651
					16,016	766	9,046	19	471	16,588	4,309	4,997	651
			52,862.3										

For propane, it was (usage in gallons) x (emission factor). This is a small number.

For waste oil, it was (usage in gallons) x (emission factor). This is also a small number.

Some emissions factors are detailed below:

https://www.epa.gov/sites/production/files/2015-07/documents/emission-factors_2014.pdf									Conversion to CO2e		Converstion to metric tons	
Fossil Fuels												
Fuel Type	Heating Value	CO2 Factor	CH4 Factor	N2O Factor	CO2 Factor	CH4 Factor	N2O Factor	Unit	CO2e	CO2e	CO2e	CO2e
	mmBtu per scf	kg CO2 per mmBtu	g CH4 per mmBtu	g N2O per mmBtu	kg CO2 per scf	g CH4 per scf	g N2O per scf		kg CO2e per mmBtu	kg CO2e per scf	Metric Tons / mmBtu	Metric Tons / scf
Natural Gas (per scf)	0.001026	53.06	1	0.1	0.05444	0.00103	0.0001	scf	53.11	0.05449555	0.0531148	5.44956E-05
Propane Gas	0.002516	61.46	0.022	0.1	0.15463	0.000055	0.000252	scf	61.49	0.154706471	0.06149035	0.000154706
	mmBtu per gallon	kg CO2 per mmBtu	g CH4 per mmBtu	g N2O per mmBtu	kg CO2 per gallon	g CH4 per gallon	g N2O per gallon		kg CO2e per mmBtu	g CO2e per gallon	Metric Tons / mmBtu	Metric Tons / gal
Distillate Fuel Oil #2	0.138	73.96	3	0.6	10.21	0.41	0.08	gallon	74.21	10.24409	0.0742138	0.01024409
Motor Gasoline	0.125	70.22	3	0.6	8.78	0.38	0.08	gallon	70.47	8.81334	0.0704738	0.00881334
Propane	0.091	62.87	3	0.6	5.72	0.27	0.05	gallon	63.12	5.74165	0.0631238	0.00574165
Used Oil	0.138	74	3	0.6	10.21	0.41	0.08	gallon	74.25	10.24409	0.0742538	0.01024409
Gas	100 year GWP											
CH4	25											
N2O	298											
Electricity												
From same EPA website above:												
	Total output emission factors			Non-baseload emission factors								
eGRID Subregion	CO2 Factor	CH4 Factor	N2O Factor	CO2 Factor	CH4 Factor	N2O Factor			CO2e		CO2e	
	(lb CO2 /MWh)	(lb CH4 /MWh)	(lb N2O /MWh)	(lb CO2/MWh)	(lb CH4/MWh)	(lb N2O/MWh)			Metictons / kw hr		Metictons / kw hr	
NYCW (NPCC NYC/Westchester)	**622.42**	**0.02381**	**0.0028**	1,131.63	0.02358	0.00244			**0.000283053**		0.000514041	
Source: EPA Year 2010 eGRID 9th edition Version 1.0 February 2014.												
Note: Total output emission factors are used for quantifying emissions from purchased electricity.												
Note: Non-baseload emission factors are used for quantifying the emission reductions from purchased green power								My note:	You get almost 2x the impact by purchasing green power. (1.			
From EPA power profiler												
https://www.epa.gov/egrid/power-profiler#/NYCW												
	CO2	NOx		NOx as CO2e	NOx as CO2e				CO2e			
	lbs / Mwhr	lbs / Mwhr		lbs / Mwhr	lbs / Kwhr				Metictons / kw hr			
Con Ed	596.4	0.3	298	89.4	0.0894				**0.000311162**			
NYSEG	253.1	0.1	298	29.8					**0.000128358**			
NYPA									**0.000378303**			
NYCW (NPCC NYC/Westchester)									**0.000283053**			
Based on telecon with Steve Campbell on Feb 9, 2010, use 80% gas												
	GWHrs	Percent	lbs/kwhr	lbs/kwhr								
Gas	36,620	0.55	1.0094	0.56								
Oil	8,710	0.13	2.11	0.28								
Nuclear	16,635	0.25	0	-								
Hydro	2,850	0.04	0	-								
Renewables	1,500	0.02	0	-								
	66,375	1.00	Total	0.83					0.000378309			

Now, let's look at Scope 2 and the emissions associated with electricity generation. For this example, I will feature the information from NYSEG. They supplied for each of the 48 meters, a history of billing. This included usage in kw-hrs and costs. The usage was analyzed. Bills were received for some meters monthly and others every two months. The final data (which was close to a year but typically off by a few days) was factored to represent a full 365 days. This yielded usage data in kw-hrs for each meter for a full year.

Each electricity supplier was asked for the makeup of how the power was generated. Data from NYSEG is shown below. Note that I was informed that it was applicable for the time period analyzed (post 2018).

Fuel Sources and Air Emission to Generate Your Electricity for
New York State Electric & Gas Corp.—NYSEG - 2018
January 1, 2018–December 31, 2018

Fuel Sources

Biomass	< 1 %
Coal	4 %
Hydroelectric	15 %
Natural Gas	41 %
Nuclear	35 %
Oil	< 1 %
Renewable Biogas	< 1 %
Solar	< 1 %
Solid Waste	2 %
Wind	3 %
Total	100 %

(Total may vary slightly from 100% due to rounding)

Thus, I calculated an estimate for the emissions of CO2 per kw-hr for the blend. This was then applied to the consumption data to yield the equivalent CO2 associated with our electric usage. I believe this is more accurate than using average e-grid data:

	Percent	Actual	lbsCO2 /1000000 BTU	Plus leakage	# CO2/# Methane Factor		BTU/kwhour	# CO2/Kw hour
Biomass	0.05	0.0005	0			1,000,000	0	0
Coal	4	0.04	228			1,000,000	10,551	0.10
Hydro	15	0.15	0			1,000,000		-
Natural Gas	40.9	0.409	117	0.02	84	1,000,000	7,732	0.44
Nuclear	34.9	0.349	0			1,000,000	10,442	-
Oil	0.05	0.0005	0			1,000,000	0	-
Renewable Biogas	0.05	0.0005	0			1,000,000	0	-
Solar	0.05	0.0005	0			1,000,000	0	-
Solid Waste	2	0.02	91			1,000,000	8,000	0.01
Wind	3	0.03	0			1,000,000		-
	100	1						0.55

The below table summarizes the NYSEG data for consumption by user:

Type	Type	SL	TL	Unidentified	FD #1	PS	NA	Highway	Track	Parks Dept	Police	Sparkle Lk	Rail Station	Town Hall	YCCC	WWTP	Museum
Street Lights	SL	14,537	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pump Station	PS	0	0	0	0	32,347	0	0	0	0	0	0	0	0	0	0	0
Downing Park	SL	2,911	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Street Lights	PS	0	0	0	0	3,148	0	0	0	0	0	0	0	0	0	0	0
Unidentified	Unknown	0	0	4,160	0	0	0	0	0	0	0	0	0	0	0	0	0
Fire Dept #1	FD #1	0	0	0	9,270	0	0	0	0	0	0	0	0	0	0	0	0
YCCC	YCCC	0	0	0	0	0	0	0	0	0	0	0	0	0	16,482	0	0
Traffic Lights	TL	0	1,353	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Traffic Lights	TL	0	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Street Lights	SL	1,102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pump Station	PS	0	0	0	0	3,982	0	0	0	0	0	0	0	0	0	0	0
Pump Station	PS	0	0	0	0	260	0	0	0	0	0	0	0	0	0	0	0
Pump Station	PS	0	0	0	0	24,209	0	0	0	0	0	0	0	0	0	0	0
Street Lights	SL	1,117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parks/Rec	Parks Dept	0	0	0	0	0	0	0	0	62,920	0	0	0	0	0	0	0
Junior Lake Pool	NA	0	0	0	0	0	no data	0	0	0	0	0	0	0	0	0	0
Pump	PS	0	0	0	0	7,624	0	0	0	0	0	0	0	0	0	0	0
Pump	PS	0	0	0	0	80,550	0	0	0	0	0	0	0	0	0	0	0
Street Lights	SL	no data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Street Lights	SL	13,271	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HWY Dept	Highway	0	0	0	0	0	0	101,157	0	0	0	0	0	0	0	0	0
HWY Dept	Highway	0	0	0	0	0	0	6,639	0	0	0	0	0	0	0	0	0
Sewer Pump	PS	0	0	0	0	108,032	0	0	0	0	0	0	0	0	0	0	0
Parks	Parks Dept	0	0	0	0	0	0	0	0	37,474	0	0	0	0	0	0	0
Pump	PS	0	0	0	0	17,642	0	0	0	0	0	0	0	0	0	0	0
Street Lights	PS	0	0	0	0	2,995	0	0	0	0	0	0	0	0	0	0	0
Unidentified	Unknown	0	0	37,459	0	0	0	0	0	0	0	0	0	0	0	0	0
Pump	PS	0	0	0	0	761	0	0	0	0	0	0	0	0	0	0	0
Devito Track	Track	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Street Lights	SL	15,748	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Police Dept	Police	0	0	0	0	0	0	0	0	0	328,500	0	0	0	0	0	0
Street Lights	SL	1,425	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water	SL	117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water	PS	0	0	0	0	81,812	0	0	0	0	0	0	0	0	0	0	0
Street Lights	SL	257	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Office trailers	Sparkle Lk	0	0	0	0	0	0	0	0	0	0	43,907	0	0	0	0	0
No data	NA	0	0	0	0	0	no data	0	0	0	0	0	0	0	0	0	0
Railway Park	SL	15,896	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Old Rail Station	Rail Station	0	0	0	0	0	0	0	0	0	0	0	204	0	0	0	0
Wastewater Treat	WWTP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,925	0
WWTP	WWTP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	807,376	0
Parks/Rec	Sparkle Lk	0	0	0	0	0	0	0	0	0	0	25,768	0	0	0	0	0
Street Lights	SL	268,075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Street Lights	SL	43,988	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Town Hall	**Town Hall**	0	0	0	0	0	0	0	0	0	0	0	0	101,640	0	0	0
Traffic Lights	TL	0	2,229	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YCCC	YCCC	0	0	0	0	0	0	0	0	0	0	0	0	0	370,973	0	0
WWTP	WWTP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	575,899	0
Totals		**3,282,363**	**378,443**	**3,807**	**41,619**	**9,270**	**363,360**	**0**	**107,796**	**0**	**100,394**	**328,500**	**69,675**	**204**	**101,640**	**387,455**	**1,390,200**	**0**

Calculations also had to be made for NYPA and Constellation, since the Town purchases power from all of them. This data varied in granularity. In each case, a blended emission factor was calculated based on power production information, and usage data was then multiplied by that factor.

Wastewater treatment facilities: The Town central sewer plant and district is named the "Hallock's Mill" district and the plant is located on Greenwood Street. I originally noted that calculation of GHG emissions was not complete. Since then, I have reviewed the methodology used by prior consultants for the State, and updated this with current data. I calculated it two ways. Both are high level estimates based on default values as allowable: First, I used the EPA tool:

https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool

And I chose default values for all variables. I also inserted the average protein consumption per person of 42.6 kg/person/year, and no use of solids as fertilizer. This yielded 4,000 Mtons/year.

Second, I used the prior consultant report cited below (which estimated 3,510 Metric Tons / year in 2010). I used the same methodology in the report Mid-Hudson Regional Greenhouse Gas Emissions Inventory Final Report for Mid-Hudson Tier II Regional Greenhouse Gas Emissions (GHG) Inventory Prepared for New York State Energy Research and Development Authority (NYSERDA) 17 Columbia Circle Albany, New York 12203-6399 Prepared by ICF International, Sub-consultant to VHB, Inc. December 13, 2012 which is reprinted below:

Wastewater emissions are calculated based on the population served by wastewater treatment processes. Population data in the Mid-Hudson Region were obtained from the NYS Data Center.[33]

Wastewater emissions were calculated using EPA's State Inventory Tool (SIT). Methane emissions from municipal wastewater treatment were calculated by multiplying the population served by municipal WWTPs, from the Census 2010 population data for the region, by the annual per-capita 5-day biological oxygen demand (BOD_5) rate times the emission factor of CH_4 emitted per quantity of BOD_5. Default values for New York State in the SIT were used.

$$CH_4\ Emissions\ (MT) = Population\ x\ Per\ capita\ BOD_5 \left(\frac{kg}{day}\right) x \frac{Days}{year} x \frac{MT}{kg} x\ EF \left(\frac{GgCH_4}{GgBOD_5}\right) x\ \%\ of\ WW\ anaerobically\ digested$$

Where:

Population	=	Population served by municipal WWTPs.
Per capita BOD_5	=	5-day biochemical oxygen demand per capita. Default value is 0.09 kg BOD5/day.
EF	=	Emission factor of CH_4 emitted per quantity of BOD_5. Default value is 0.6 Gg CH_4/Gg BOD_5.
% of WW anaerobically digested	=	Fraction of wastewater BOD_5 that is anaerobically digested. Default value is 16.25%.

Nitrous oxide emissions form municipal wastewater treatment were calculated by multiplying the population served by the percent of the population using centralized wastewater treatment (not septic systems), times the amount of direct N_2O emissions from wastewater treatment per person per year.

$$N_2O\ Emissions\ (MT) = Population\ x\ Fraction\ of\ population\ not\ on\ septic\ x\ Direct\ N_2O\ emissions\ from\ WWT \left(\frac{gN_2O}{\frac{person}{year}}\right) x \frac{MT}{g}$$

Where:

Population	=	Population served by municipal WWTPs.
Fraction of population not on septic	=	Percent of population that is served by centralized WWTPs as opposed to septic systems. The default value for New York State is 79%.
Direct N_2O emissions from WWT	=	The amount of N_2O emitted from WWTPs. Default value is 4.0 grams N_2O per person per year.

Nitrous oxide emissions from wastewater biosolids were calculated using the following equation:

$$N\ in\ Domestic\ Wastewater = Population\ x\ Protein \left(\frac{kg}{\frac{person}{year}}\right) x\ Frac(npr) \left(\frac{kg\ N}{kg\ protein}\right)\ x\ Fraction\ nonconsumption\ N\ x \left(\frac{MT}{kg}\right)$$

$$N_2O\ Emissions\ (MT) = N\ in\ Domestic\ WW\ (MT) - Direct\ N\ Emissions\ from\ Domestic\ WW\ (MT)\ x\ (1 - \%\ of\ Biosolids\ used\ as\ fertilizer)\ x\ EF \left(\frac{kgN_2O - N}{kgsewageN_{produced}}\right) x \left(\frac{N_2O}{N_2}\right)$$

Where:

Population	=	Population served by municipal WWTPs.
Protein	=	Available protein per person per year (kg/person/year). Default value is 42.6 kg/person/year.[34]
Fraction of population not on septic	=	Percent of population that is served by centralized WWTPs as opposed to septic systems. The default value for New York State is 79%.
Direct N_2O emissions from WWT	=	The amount of N_2O emitted from WWTPs. Default value is 4.0 grams N_2O per person per year.

[34] *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2010.* Tables 8 to 14.

This yielded 3,980 MTons CO2e per year.

Town of Yorktown Greenhouse Gas Emissions Report for 2020

Based on discussion with the managers responsible for building and fleet maintenance, there were no fugitive emissions from refrigerant leaks during this period. I had forgotten to include this in the prior submission.

In total, the municipal emissions are therefore approximately 3,000Metric tons/year from vehicles and buildings plus 4,000 Metric tons/year from the fugitive emissions at the WWTP. This is a total of 7,000 Metric tons/year.

About the author:

This report was prepared entirely as a volunteer effort by R. DeAngelis. I am a retired IBM senior engineering manager with extensive experience in energy management. I have degrees in Chemical Engineering and an MBA. I mention this only to hope it provides some confidence in the assessment. I appreciate the opportunity to serve on the Yorktown Climate Smart Communities Task Force.