Part 2: Croton's governmental greenhouse gas emissions

This entire emissions report can be summed up in one (long!) sentence:

In calendar 2007, the Village government spent over a half million dollars buying almost 17.8 billion British thermal units (Btu) of energy to conduct Village business and provide Village services that caused over 1,774 metric tonnes of greenhouse gas emissions.

The CACP software converts all the different energy sources from gallons of diesel or gasoline to kilowatt-hours of electricity or therms or cubic feet of propane or natural gas into a single standard unit, British thermal units, a.k.a. Btus. Keep in mind that one metric tonne is 2,204 pounds, a long ton, and is larger than a short ton, which is 2,000 pounds. As this Part 2 of the report is all about the numbers, let's turn that the sentence above into a simple equation:

17.8 billion Btus = 5.2 million kiloWatt-hours (kWh) for one year
= enough to run an average house for 50 years
= $532,000 in energy expense
= 1,774 metric tonnes of emissions.

2.1 Our governmental greenhouse gas emissions: an overview

The ICLEI CACP protocol designates the typical purpose of energy use as "sectors," such as buildings (heating, cooling, ventilation), fleet (diesel, gasoline, compressed natural gas), water delivery (electrical), streetlights (electrical), and wastewater (electrical). Solutions to reducing emissions within a given sector, such as buildings, are typical related and similar, no matter what actual municipal department or function that building happens to serve.

In Table 1, Summary by Sector (shown in redacted form in the Executive Summary table), we see the results of the 2007 greenhouse gas emission inventory for the weight of emissions for the three key gases produced, the amount of energy consumed, and the cost of that energy, sorted by the key sectors within the village operations (buildings, vehicles, water delivery, streetlights, and wastewater).

The village's buildings and facilities produce the single largest set of emissions (~30%%) and with the next largest coming from the Village's fleet (~24%), and water delivery services (~21%) surprisingly close behind. (The data for Table 1 comes from the sector totals in the complete detailed report in Table 2, in descending tCO_2e order.)

Table 1: Executive Summary by Sector: 2007 Village government emissions, energy, and cost.

Summary by Sector	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	CO_2e (tonnes)	(%)	Energy (MMBtu)	(%)	Cost ($)	(%)
1. Buildings and Facilities	528	3	43	**528**	29.8%	**6,525**	36.7%	**$149,262**	28.0%
2. Vehicle Fleet	412	12	10	**415**	23.4%	**5,701**	32.1%	**$126,894**	23.8%
3. Water Delivery Facilities	368	3	20	**369**	20.8%	**3,583**	20.2%	**$149,560**	28.1%
6. Other Indirect Emissions (commutation, solvents, etc.)	-	-	-	**254**	14.3%	**0**	0.0%	**$8,430**	1.6%
4. Streetlights & Traffic Signals	184	1	8	**184**	10.4%	**1,699**	9.6%	**$88,791**	16.7%
5. Wastewater Facilities	23	0	2	**24**	1.4%	**252**	1.4%	**$9,269**	1.7%
Totals	1515	19	83	**1,774**	100%	**17,760**	100%	**$532,206**	**100.0%**

As mentioned, the CACP protocol estimates emissions by weight for prominent three greenhouse gases, carbon dioxide, nitrous oxide, and methane. The latter two are less comon than carbon dioxide, hence they are measured in kilograms (kg), not tonnes (t). While emitted in much smaller amounts than carbon dioxide, both nitrous oxide and methane have very powerful greenhouse gas effects, even in low doses. Due to the methane's chemical properties, one molecule of methane is 22 times more powerful in forcing atmospheric warming within one hundred years than one molecule of carbon dioxide. Likewise, one molecule of nitrogen dioxide in 298 times more powerful in forcing

warming within one hundred years than one molecule of carbon dioxide. Time does remove some of the global warming potential (GWP) of both nitrogen oxide and methane. But time has much less effect in reducing the carbon dioxide, a stable compound whose long-lasting molecules have an atmospheric lifetime of 1,000 years or more. The CACP protocol takes all this into account by converting the impacts of all the other gases plus carbon dioxide into a lump sum of "carbon dioxide equivalents" or "CO_2e" as we will label it here and throughout this report.

For comparison's sake, according to the research of the Global Footprint Network, the average North American citizen generates about 20 tonnes of CO_2e per year (tCO_2e/y)–five times more than the average global citizen (www.footprintstandards.org). By that estimation, Croton's 8,000 residents might generate collectively about 160,000 tCO_2e per year, with about half due to their home and half due to transportation. In other words, Croton's residential sector generates 100 times more greenhouse gas emissions than the village's government operations. We are placing our village government under a microscope in order to save taxpayers money, and to highlight one area where government can lead by example.

Before we get to the detailed findings in Table 2, it may help to look at the big results in visual, pie chart form. In Figure 1, the left hand pie chart shows the emission of CO_2e tonnes as a percent by sector from Table 1. The right hand pie chart shows the costs for each sector in dollars from Table 1. (See Figure 5.)

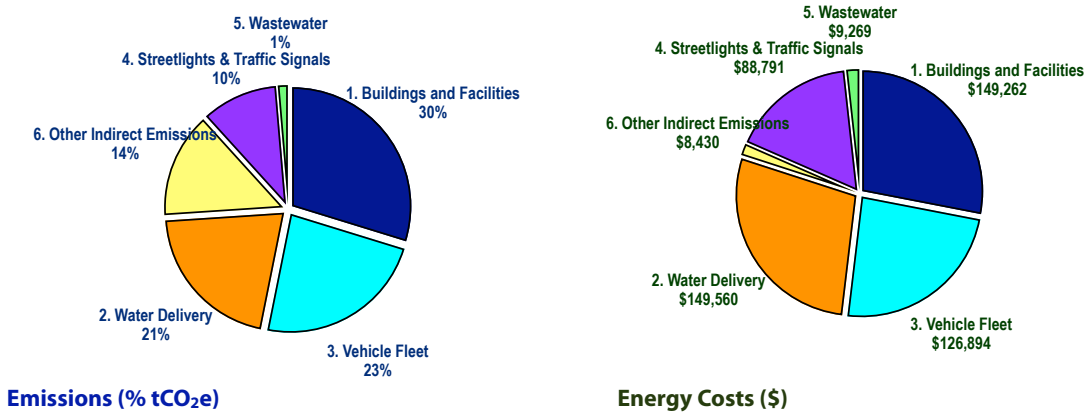

Figure 5: 2007 Village government inventory by sector in % emissions and $ cost.

The left pie chart in Figure 5 shows the emissions of tonnes of carbon dioxide equivalents (tCO_2e) in the blue column in Table 1 for each sector. The total cost of the energy consumed by each sector is in the right pie chart. We sorted these by largest to smallest emission source, with building and facilities as the #1 emitting sector. Notice that if we sort by largest to smallest cost, water delivery would be the most expensive sector, followed by buildings and facilities.

2.2. Croton's Greenhouse Gas Emissions: the Detailed Inventory

After this bird's eye view above, let's get to the heart of this baseline inventory! Table 2, "2007 Government greenhouse gas emissions: Details by facility and activity," displays all the details of each village service or facility that we could document caused a greenhouse gas emission in calendar 2007. To help readers visualize the location of these emission sources, we included as many street addresses or locations as possible. (A geographic display of Croton's "Top 20" emitters appears as the map in the Executive Summary at the front of this report.)

In 2007, a single building, the Village's Municipal Building, led all other facilities by a wide margin in producing greenhouse gas emissions : 198 tCO_2e (tonnes of carbon dioxide equivalent) in Line 1.1 of Table 2. The largest Village building, it operates around the clock housing Croton's Police Department. Myriad departments, volunteer committees, community organizations and nonprofits use the building on evenings and weekends for meetings. As the building in Croton that "never sleeps," the Municipal Building houses good opportunity for energy savings.

The combined emissions of Village's three firehouses, 187 tCO_2e, almost matches that of the Municipal Building, as seen in Lines 1.3, 1.4, 1.5 in Table 2. Providing clean, safe potable water from the Village's wellfields at 340 Grand Street also is a major contributor to emissions. The pumping required to lift 400 million gallons a year through the system to hilltop storage tanks relies on electricity and is responsible for 369 (Line 2.T of Table 2) of the total 383 tonnes of emission generated by the water department. (Due to rounding, in Table 2 some "0" values understate actuals.)

Table 2: 2007 Government greenhouse gas emissions: Details by facility and activity

Sector details by facility/activity	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	CO_2e (tonnes)	(%)	Energy (MMBtu)	(%)	Cost ($)	(%)
1. Buildings and Facilities									
1.1 Municipal Building (1 Van Wyck St.)									
Electricity	113	1	5	113	6.4%	1,038	5.8%	$ 36,227	6.8%
Fuel Oil (#2)	61	0	9	61	3.4%	832	4.7%	$ 18,000	3.4%
R22 (Freon replacement)	24	0	0	24	1.4%	-	0.0%	$ 533	0.1%
Subtotal	**198**	**1**	**14**	**198**	**11.2%**	**1,870**	**10.5%**	**$ 54,760**	**10.3%**
1.2 DPW Garage (Gateway Plaza Garage)									
Electricity	33	0	1	33	1.9%	306	1.7%	$ 11,129	2.1%
Fuel Oil (#2)	3	0	1	3	0.2%	46	0.3%	$ 648	0.1%
Natural Gas	69	0	6	69	3.9%	1,295	7.3%	$ 19,334	3.6%
Subtotal	**105**	**0**	**8**	**105**	**5.9%**	**1,647**	**9.3%**	**$ 31,111**	**5.8%**
1.3 Harmon Firehouse (30 Wayne St.)									
Electricity	41	0	2	41	2.3%	375	2.1%	$ 13,819	2.6%
Fuel Oil (#2)	-	0	0	0	0.0%	6	0.0%	$ 90	0.0%
Natural Gas	33	0	3	33	1.9%	618	3.5%	$ 8,547	1.6%
R22 (Freon replacement)	8	0	0	8	0.5%	-	0.0%	$ 177	0.0%
Subtotal	**82**	**0**	**5**	**82**	**4.6%**	**999**	**5.6%**	**$ 22,633**	**4.3%**
1.4 Washington Engine Firehouse (81 N. Riverside Ave.)									
Electricity	16	0	1	16	0.9%	149	0.8%	$ 5,871	1.1%
Fuel Oil (#2)	31	0	5	31	1.7%	427	2.4%	$ 7,477	1.4%
Natural Gas	1	0	0	1	0.1%	13	0.1%	$ 357	0.1%
Subtotal	**48**	**0**	**6**	**48**	**2.7%**	**589**	**3.3%**	**$ 13,705**	**2.6%**
1.5 Grand Street Firehouse (154 Grand St.)									
Electricity	19	0	1	19	1.1%	179	1.0%	$ 5,988	1.1%
Fuel Oil (#2)	-	0	0	0	0.0%	6	0.0%	$ 90	0.0%
Natural Gas	38	0	4	38	2.1%	712	4.0%	$ 3,178	0.6%
Subtotal	**57**	**0**	**5**	**57**	**3.2%**	**897**	5.1%	**$ 9,256**	**1.7%**
1.6 Water Dept Office (340 Grand Street)							0.0%		
Electricity	2	0	0	2	0.1%	16	0.1%	$ 895	0.2%
Propane	14	0	2	14	0.8%	222	1.3%	$ 6,131	1.2%
Subtotal	**16**	**0**	**2**	**16**	**0.9%**	**238**	1.3%	**$ 7,026**	**1.3%**
1.7 Municipal Place Shop							0.0%		
Electricity	5	0	0	5	0.3%	46	0.3%	$ 2,461	0.5%
Propane	9	0	2	9	0.5%	138	0.8%	$ 3,800	0.7%
Subtotal	**14**	**0**	**2**	**14**	**0.8%**	**184**	1.0%	**$ 6,261**	**1.2%**
1.8 Recreation Building (at Water Dept)							0.0%		
Electricity	2	0	0	2	0.1%	19	0.1%	$ 1,654	0.3%
Propane	4	0	1	4	0.2%	61	0.3%	$ 1,654	0.3%
Subtotal	**6**	**0**	**1**	**6**	**0.3%**	**80**	0.5%	**$ 3,308**	**0.6%**
1.9 Municipal Place Trailer							0.0%		
Electricity	2	0	0	2	0.1%	18	0.1%	$ 1,012	0.2%
Subtotal	**2**	**0**	**0**	**2**	**0.1%**	**18**	**0.1%**	**$ 1,012**	**0.2%**
1.10 Silver Lake Park (Truesdale Drive)									
Electricity	-	0	0	0	0.0%	3	0.0%	$ 190	0.0%
Subtotal	**-**	**0**	**0**	**0**	**0.0%**	**3**	0.0%	**$ 190**	**0.0%**
Total Buildings and Facilities	**528**	**3**	**43**	**528**	**29.8%**	**6,525**	**36.7%**	**$ 149,262**	**28.0%**

Sector details by facility/activity	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	CO_2e (tonnes)	(%)	Energy (MMBtu)	(%)	Cost ($)	(%)
2. Water Delivery									
2.1 Meter pit heat & pump (119 Old Post Rd)									
Electricity	55	0	2	55	3.1%	509	2.9%	$44,483	8.4%
Fuel Oil (#2)	3	0	1	3	0.2%	46	0.3%	$648	0.1%
Subtotal	**58**	**0**	**3**	**59**	**3.3%**	**555**	**3.1%**	**$45,131**	**8.5%**
2.2 Pumphouse #4 (340 Grand Street)									
Electricity	113	1	5	113	6.4%	1,041	5.9%	$37,255	7.0%
Propane	5	0	1	5	0.3%	83	0.5%	$2,230	0.4%
Subtotal	**118**	**1**	**6**	**118**	**6.7%**	**1,124**	**6.3%**	**$39,485**	**7.4%**
2.3 Pumphouse #1 (340 Grand Street)									
Electricity	94	1	4	95	5.4%	870	4.9%	$30,232	5.7%
Propane	9	0	2	9	0.5%	149	0.8%	$4,016	0.8%
Subtotal	**104**	**1**	**6**	**104**	**5.9%**	**1,019**	**5.7%**	**$34,248**	**6.4%**
2.4 Pumphouse #3 (340 Grand Street)									
Electricity	68	0	3	69	3.9%	630	3.5%	$23,630	4.4%
Propane	4	0	1	4	0.2%	65	0.4%	$1,766	0.3%
Subtotal	**72**	**0**	**4**	**73**	**4.1%**	**695**	**3.9%**	**$25,396**	**4.8%**
2.5 Mt. Airy Pump (Hessian Hills tank)									
Electricity	6	0	0	6	0.3%	53	0.3%	$1,108	0.2%
Propane	3	0	0	3	0.2%	42	0.2%	$1,108	0.2%
Subtotal	**8**	**0**	**1**	**8**	**0.5%**	**95**	**0.5%**	**$2,216**	**0.4%**
2.6 Pump #2									
Propane	5	0	1	5	0.3%	76	0.4%	$2,015	0.4%
Subtotal	**5**	**0**	**1**	**5**	**0.3%**	**76**	**0.4%**	**$2,015**	**0.4%**
2.7 Bungalow Road Duck Pond									
Electricity	2	0	0	2	0.1%	19	0.1%	$1,068	0.2%
Subtotal	**2**	**0**	**0**	**2**	**0.1%**	**19**	**0.1%**	**$1,068**	**0.2%**
2.8 Prickley Pear Golf Course Heat tape									
Electricity	-	0	0	0	0.0%	-	0.0%	$1	0.0%
Subtotal	**-**	**0**	**0**	**0**	**0.0%**	**-**	**0.0%**	**$1**	**0.0%**
2.T **Total Water Delivery Facilities**	**367**	**3**	**20**	**369**	**20.8%**	**3,583**	**20.2%**	**$149,560**	**28.1%**
3. Vehicle Fleet									
3.1 Police Passenger									
Gasoline	109	6	6	111	6.3%	1,535	8.6%	$36,326	6.8%
Subtotal	**109**	**6**	**6**	**111**	**6.3%**	**1,535**	**8.6%**	**$36,326**	**6.8%**
3.2 Public Works-Heavy Duty Trucks									
Diesel	126	0	0	127	7.2%	1,729	9.7%	$36,902	6.9%
Subtotal	**126**	**0**	**0**	**127**	**7.2%**	**1,729**	**9.7%**	**$36,902**	**6.9%**
3.3 Public Works Pickup Trucks									
Gasoline	57	4	3	59	3.3%	809	4.6%	$17,649	3.3%
Subtotal	**57**	**4**	**3**	**59**	**3.3%**	**809**	**4.6%**	**$17,649**	**3.3%**
3.4 Public Works--Equipment									
Diesel	14	0	0	14	0.8%	192	1.1%	$4,106	0.8%
Off road Diesel	23	0	0	23	1.3%	313	1.8%	$6,691	1.3%
Off road Gasoline	2	0	0	2	0.1%	25	0.1%	$594	0.1%
Subtotal	**39**	**0**	**0**	**39**	**2.2%**	**531**	**3.0%**	**$11,391**	**2.1%**
3.5 Fire Department Light Truck									

Sector details by facility/activity	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	CO_2e (tonnes)	(%)	Energy (MMBtu)	(%)	Cost ($)	(%)
Gasoline	21	0	0	21	1.2%	296	1.7%	$6,994	1.3%
Subtotal	**21**	**0**	**0**	**21**	**1.2%**	**296**	**1.7%**	**$6,994**	**1.3%**
3.6 Fire Department Heavy Duty Equipment									
Diesel	23	0	0	23	1.3%	311	1.8%	$6,642	1.2%
Subtotal	**23**	**0**	**0**	**23**	**1.3%**	**311**	**1.8%**	**$6,642**	**1.2%**
3.7 Administration Passenger									
Gasoline	17	1	0	17	1.0%	241	1.4%	$5,705	1.1%
Subtotal	**17**	**1**	**0**	**17**	**1.0%**	**241**	**1.4%**	**$5,705**	**1.1%**
3.8 Public Works- Gasoline Light trucks									
Diesel	9	0	0	9	0.5%	126	0.7%	$2,666	0.5%
Subtotal	**9**	**0**	**0**	**9**	**0.5%**	**126**	**0.7%**	**$2,666**	**0.5%**
3.9 Fire Department Diesel Light Truck									
Diesel	9	0	0	9	0.5%	123	0.7%	$2,619	0.5%
Subtotal	**9**	**0**	**0**	**9**	**0.5%**	**123**	**0.7%**	**$2,619**	**0.5%**
Subtotal Vehicle Fleet	**410**	**12**	**10**	**415**	**23.4%**	**5,701**	**32.1%**	**$126,894**	**23.8%**
4. Streetlights & Traffic Signals									
4.1 Streetlights (659 fixtures @ average 125 W)									
Electricity	124	1	5	124	7.0%	1,142	6.4%	$57,447	10.8%
Subtotal	**124**	**1**	**5**	**124**	**7.0%**	**1,142**	**6.4%**	**$57,447**	**10.8%**
4.2 Outdoor Lighting (Gateway Plaza Parking Lot/Office)									
Electricity	22	0	1	22	1.2%	207	1.2%	$8,203	1.5%
Subtotal	**22**	**0**	**1**	**22**	**1.2%**	**207**	**1.2%**	**$8,203**	**1.5%**
4.3 Alexander Lane Ballfields									
Electricity	2	0	0	2	0.1%	22	0.1%	$7,956	1.5%
Subtotal	**2**	**0**	**0**	**2**	**0.1%**	**22**	**0.1%**	**$7,956**	**1.5%**
4.4 Outdoor Lighting (Salt Shed/Rear Parking Lot)									
Electricity	8	0	0	8	0.5%	73	0.4%	$3,743	0.7%
Subtotal	**8**	**0**	**0**	**8**	**0.5%**	**73**	**0.4%**	**$3,743**	**0.7%**
4.5 Senasqua Park (Elliott Way)									
Electricity	12	0	1	12	0.7%	111	0.6%	$3,501	0.7%
Subtotal	**12**	**0**	**1**	**12**	**0.7%**	**111**	**0.6%**	**$3,501**	**0.7%**
4.6 Outdoor Lighting (N. Riverside Footbridge)									
Electricity	6	0	0	6	0.3%	52	0.3%	$2,790	0.5%
Subtotal	**6**	**0**	**0**	**6**	**0.3%**	**52**	**0.3%**	**$2,790**	**0.5%**
4.7 Outdoor Lighting (Section A Parking Lot)									
Electricity	3	0	0	3	0.2%	24	0.1%	$1,362	0.3%
Subtotal	**3**	**0**	**0**	**3**	**0.2%**	**24**	**0.1%**	**$1,362**	**0.3%**
4.8 Park Lighting (Black Rock)									
Electricity	2	0	0	2	0.1%	19	0.1%	$1,116	0.2%
Subtotal	**2**	**0**	**0**	**2**	**0.1%**	**19**	**0.1%**	**$1,116**	**0.2%**
4.9 Outdoor Lighting (Croton Dam Road)									
Electricity	2	0	0	2	0.1%	19	0.1%	$1,102	0.2%
Subtotal	**2**	**0**	**0**	**2**	**0.1%**	**19**	**0.1%**	**$1,102**	**0.2%**
4.10 Traffic Signals									
Electricity	2	0	0	2	0.1%	18	0.1%	$832	0.2%
Subtotal	**2**	**0**	**0**	**2**	**0.1%**	**18**	**0.1%**	**$832**	**0.2%**
4.11 Outdoor Lighting (Holiday Lights Benedict Blvd)									
Electricity	1	0	0	1	0.1%	9	0.1%	$491	0.1%
Subtotal	**1**	**0**	**0**	**1**	**0.1%**	**9**	**0.1%**	**$491**	**0.1%**
4.12 Outdoor Lighting (Veterans Corner)									

Sector details by facility/activity	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	CO_2e (tonnes)	(%)	Energy (MMBtu)	(%)	Cost ($)	(%)
Electricity	-	0	0	0	0.0%	3	0.0%	$248	0.0%
Subtotal	**-**	**0**	**0**	**0**	**0.0%**	**3**	**0.0%**	**$248**	**0.0%**
4.T **Total Streetlights**	**184**	**1**	**8**	**184**	**10.4%**	**1,699**	**9.6%**	**$88,791**	**16.7%**
5. Wastewater									
5.1 Skyview pump									
Electricity	7	0	0	7	0.4%	63	0.4%	$2,678	0.5%
Subtotal	**7**	**0**	**0**	**7**	**0.4%**	**63**	**0.4%**	**$2,678**	**0.5%**
5.2 Nordica Drive Pump									
Electricity	7	0	0	7	0.4%	60	0.3%	$2,586	0.5%
Subtotal	**7**	**0**	**0**	**7**	**0.4%**	**60**	**0.3%**	**$2,586**	**0.5%**
5.3 1 Arrowcrest Drive									
Electricity	3	0	0	3	0.2%	28	0.2%	$1,953	0.4%
Natural Gas	4	0	0	4	0.2%	74	0.4%	$537	0.1%
Subtotal	**7**	**0**	**1**	**7**	**0.4%**	**102**	**0.6%**	**$2,490**	**0.5%**
5.4 Half Moon Bay River Club pump									
Electricity	3	0	0	3	0.2%	27	0.2%	$1,515	0.3%
Subtotal	**3**	**0**	**0**	**3**	**0.2%**	**27**	**0.2%**	**$1,515**	**0.3%**
5.T **Total Wastewater Facilities**	**24**	**0**	**2**	**24**	**1.4%**	**252**	**1.4%**	**$9,269**	**1.7%**
1-5T **Subtotal (sectors 1-5)**	**1,513**	**19**	**83**	**1,520**	**85.67%**	**17,760**	**100.0%**	**$523,776**	**98.4%**
6. Other Indirect Emissions									
6.1 **Employee Commute and Business Travel**									
a. Passenger car (412,966 miles)				181.84	10.2%	-		-	
b. Passenger rail (1,150 miles)				0.09	0.0%	-		-	
c. Air travel (850 miles)				0.83	0.0%	-		-	
Subtotal				**182.62**	**10.3%**	-		-	
6.2 **Groundskeeping**									
Fertilizer use (2,350 pounds)				9.79	0.6%	-		-	
Subtotal				**9.79**	**0.6%**	-		-	
6.3 **Maintenance Solvents**									
a. Lubricants (600 gallons)				48.59	2.7%	-		-	
b. Asphalt (300 short tons)				13.88	0.8%	-		-	
c. Aerosols (5,000 fluid ounces)				0.90	0.1%	-		-	
d. Paints (105 gallons)				0.39	0.0%	-		-	
Subtotal				**63.76**	**3.6%**	-		-	
6.4 **Solid Waste**									
Employee (17.21 short tons)				-1.89	-0.1%	-		$ 430	0.1%
Subtotal				**-1.89**	**-0.1%**	-		**$ 430**	1.5%
6.5 **Wind Power**									
Renewable energy credits (not included in CACP 2.0)				na		na		**$ 8,000**	**1.5%**
6.T **Total Other indirect emissions**	na	na	na	**254**	**14.3%**	na		**$ 8,430**	**1.6%**
Grand totals (sectors 1-6)	**1,513**	**19**	**83**	**1,774**	**100%**	**17,760**	**100%**	**$532,206**	**100%**
na= not available	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	CO_2e (tonnes)	(%)	Energy (MMBtu)	(%)	Cost ($)	(%)

The data in Table 1 and Figure 1 may be interesting. But it does not help us figure out what each department might do, until we resort all the energy and costs inputs by the Village department that incurred them. Figure 6 shows what each department (or budget category) contributes to the overall emission output. (See Figure 6; For a more detailed look at the composition of emission sources within each department, see Appendix A, Figure A1.)

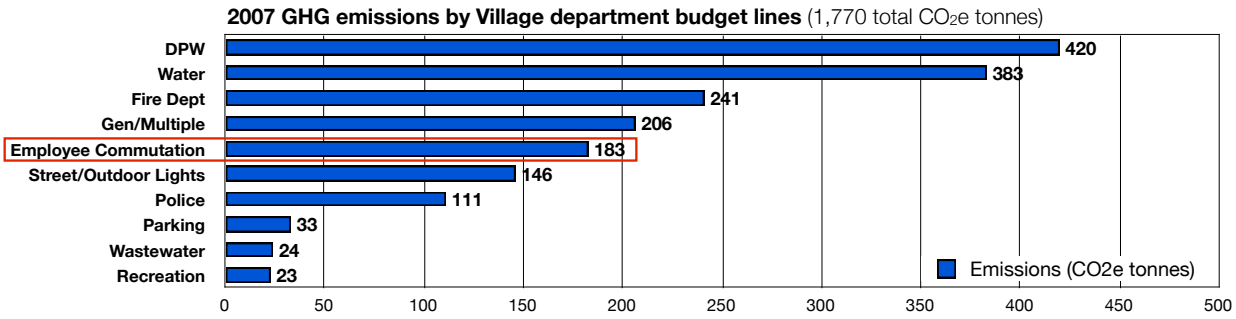

Figure 6: 2007 Greenhouse gas emissions by village department (CO_2e tonnes)

The DPW and Water service areas as the most emission intensive, when we arrange the 2007 greenhouse gas emissions as a bar chart for distinct budget areas within the Village's annual appropriations plans. If impact of employee commuting (in the red box) were a budgeted department, it would rank as the fifth largest emission source. (See Figure C1 in the Appendix C for a breakdown for each department.)

It can be helpful to examine this same data by type of energy or emission source across all sectors or departments. In Table 3, the cumulative contributions of each energy is listed by the same categories as in Table 2: emission volume, energy value, and cost. The energy emission types are arranged here in descending order of cost.

Table 3: Source report by fuel: costs, emissions, and energy consumed 2007

Emission Sources by energy type purchased	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	CO_2e (tonnes)	CO_2e (%)	Energy (MMBtu)	Cost* ($)
Electricity	775	4	31	777	*43.80%*	7,148	$314,546
Gasoline	204	11	9	208	*11.72%*	2,881	$66,674
Diesel	181	0	0	182	*10.26%*	2,481	$52,935
Natural Gas	145	0	13	145	*8.17%*	2,712	$31,953
Fuel Oil (#2)	98	0	16	98	*5.52%*	1,363	$26,953
Propane	53	0	10	53	*2.99%*	836	$22,720
Offroad Diesel	23	0	0	23	*1.30%*	313	$6,691
R22/Freon replacement	32	0	0	32	*1.80%*	0	$710
Offroad Gasoline	2	0	0	2	*0.11%*	25	$594
Total purchased energy	**1,513**	**15**	**79**	**1,520**	***85.67%***	**17,759**	**$523,776**
Indirect emissions: commuting, solvents, etc				254	*14.3%*	na	$8,430
Grand total	**1,513**	**15**	**79**	**1,774**	***100%***	**17,759**	**$532,206**

Notes on compiling emissions by sector and department data *(Tables 2 & 3, Figures 5 & 6)*

In 2007, the Village's ten buildings and numerous other structured facilities–from the Municipal Building to the DPW garage–accounted for 35% of our emissions. The building represent about 60,000 square feet of conditioned space, that is, interior space heated in winter and cooled in summer. The village's fleet of cars, trucks, backhoes, tractors, and lawnmowers are the second largest source at 27%. Our municipally-owned and operated water delivery system is just behind that at 24%. The Village pumps about 400 million gallons of water a year from its wells in the Croton River Gorge up to storage and distribution tanks that then use gravity to send water to your faucet. Water is heavy; 1 US Gallon of water = approximately 8.35 pounds (3.78 kilograms). Electric pumps at the several pump houses between the well field and the hilltop tank do all that work. Streetlights are the most significant portion of the 12% of emissions that come from lighting and traffic signals. The wastewater facilities contribute 2% of the Village's overall emissions and reflect the pumping of wastewater from the Village up to the County's main lines that lead to treatment facilities. This 2% does not include the Village's pro-rated share of the energy used to run the County's water treatment plant as that data was not readily accessible. It is interesting to compare this pie chart (where the emissions come from) to the village budget pie chart on the preceding pages (where the money goes).

As Croton does not operate a bus fleet, this pie chart combines all vehicle data in the ICLEI CACP worksheets (Transit Fleet and Vehicle Fleet) into one data set (Vehicle Fleet) for the purposes of these snapshots. The data for each major sector are derived from the "Subtotals" for each sector (See Table 2).

CACP sums the emissions of CO_2, N_2O, and CH_4 in metric tonnes as "Equivalent CO_2"for the report. Note that we label these values more specifically in metric tonnes (t) as in "tCO_2e." rather than the the ICLEI label for the purposes of this report. One metric tonne = 2,204 US pounds. ICLEI uses international metric untis (metric tonnes, kilograms) rather than "British" units (pounds, tons). All of the scientific research in the US and rest of the world that forms the methodological basis for ICLEI"s Clean Air Climate Protection model uses the metric units. The equivalent carbon dioxide values for each village facility or activity come from the line item subtotals in Table 2. The equivalent carbon dioxide values for each village facility or activity used throughout this report derive from the line item subtotals in Table 2.

Sector 1, Lines 1.1 and 1.3 (R22): Regarding R22 (freon replacement) for numerous air conditioners in 2007, the Municipal Building Trane unit had 14 pounds replaced, jury room unit 6 pounds, and Historical Society unit 1.25 pounds, and the Harmon Firehouse had 10 pounds. replaced, each at a price of $25.00 per pound. A unit of R22 has a global warming potential (GWP) 1,780 times greater than the same unit of CO2. So for Mun Bldg the CO_2e in metric tonnes is: (14 + 6 + 1.25) lbs x 1,780 GWP= 37,825 lbs. Divide by 37,825 lbs by 2,204lb/t =17.2 tCO_2e. The 10 lbs of R22 for the Harmon Firehouse yields: 10 lbs x 1780 GWP= 17,800 lbs. Therefore, 17,800/2,204lb/t =8 tCO_2e.

Sector 6, Other Indirect Emissions: Had the Village stopped short of examining emission impacts of indirect activities (such as employee commutation, use of solvents, waste stream volume and management enumerated in sector 6 of Table 2), this report would have missed almost 1 in 6 of the tonnes of actual emissions (14.3%) that operating our village services and facilities produce.

Table 3 gathers all the purchased fuel data from Table 2 and aggregates them by type of fuel, arranged here in descending order of cost, which happens to coincide with emissions order.