



TOWN OF CARRBORO
NORTH CAROLINA

TRANSMITTAL

PLANNING DEPARTMENT

DELIVERED VIA: ☐ *HAND* ☐ *MAIL* ☐ *FAX* ☒ *EMAIL*

To: **Board of Aldermen**
 David Andrews, Town Manager
 Department Directors

From: **Chris Lazinski, Consultant**
 Randy Dodd, Environmental Planner

Date: **June 13, 2014**

Subject: **Town of Carrboro 2013 Greenhouse Gas Inventory**

Background and Summary

Pursuant to the Town of Carrboro's membership in ICLEI – Local Governments for Sustainability, the Cities for Climate Protection (CCP) initiative, the passage of a resolution in 2009 committing the Town to reduce its greenhouse gas (GHG) emissions, and the completion of previous GHG emissions inventories, an updated inventory has been completed to track the Town's progress in reducing GHG emissions in municipal operations. In accordance with the Town's membership in the CCP initiative, this updated inventory is provided to fulfill CCP Milestone 5 for monitoring and verifying results of actions pursued (see Table 1).

Information

Data Collection

In putting together previous GHG emissions reports, an emphasis was placed on clarity of scope, accessibility and transparency of both energy consumption and GHG emissions data, and repeatability of the methodology. That emphasis has allowed this update to be completed with the exact same methodology as the original baseline, which allows for the most accurate comparison of data and tracking of emissions over time.

Table 1. Cities for Climate Protection Five Milestone Process

Milestone	Description	Notes
1	Conduct a baseline emissions inventory and forecast.	A summary of the inventory completed last year can be found at https://carrboro.legistar.com/Calendar.aspx (see June 18th, 2013 agenda). The information contained in this memo serves as an update to that report.
2	Adopt an emissions reduction target.	Carrboro adopted a climate protection resolution in 2009; this and previous annual reports suggest an approach for further articulation as a measurable emissions reduction target for Carrboro municipal emissions.
3	Develop a Local Action Plan	A countywide inventory that included elements of a plan was previously developed. Carrboro has just drafted an Energy and Climate Protection Plan and will be pursuing additional community planning in 2014/15.
4	Implement policies and measures	Carrboro has adopted the climate protection resolution, and has pursued various measures, such as establishment of the WISE program, policies and initiatives that encourage alternative transportation, support of alternative fuels, and energy assessments of Town buildings
5	Monitor and verify results	This memo is the Town's third annual effort to monitor and verify the results of policies and procedures implemented to reduce GHG emissions from municipal operations.

Scope

For consistency with previous inventories and per standard GHG inventory reporting protocols, this inventory focuses only on the Scope 1 and Scope 2 GHG emissions attributable to Town operations. Scope 1 emissions are direct emissions resulting from the combustion of fuel on-site. Examples of Scope 1 emissions include vehicular tailpipe emissions from Town vehicles and emissions from burning natural gas to heat Town facilities. Scope 2 emissions are indirect emissions associated with the consumption of purchased or acquired energy. Scope 2 emissions primarily result from the Town's electricity consumption. As a general rule, emissions are attributable to the Town if they are emitted by an entity that the Town has full operational control over. By this definition, the scope of this inventory includes all electricity use billed to the Town for its facilities, street lighting, and other outdoor lighting, as well as the fuel usage of the Town's vehicle fleet and natural gas use in its facilities. This scope excludes any emissions from operations of the Orange Water and Sewer Authority (OWASA), Orange County Solid Waste (OCSW), and Chapel Hill Transit (CHT), electricity usage attributable to traffic signals within Town limits, and other non-municipal activities. While the services of water treatment and delivery, waste processing, public transit, and traffic management are in the public sector and occur within Town limits, the emissions attributable to these services cannot be directly controlled by only the Town and are therefore outside the scope of this inventory. It is worth noting that the total community emissions for Carrboro was estimated in 2011 at 115,000 metric tonnes of carbon dioxide equivalent (MTCDE) (2009 values), while emissions related to municipal operations are currently less than 2,000 MTCDE. This means that municipal emissions make up less than 2% of the total emissions coming from Carrboro. Therefore, the Town's effort in cooperating with other private and public entities is paramount to appreciable local reductions.

In order to obtain a more complete understanding of the comprehensive local carbon footprint, it is recommended that the Town continue to work with other public service providers and the private sector in coordinating future GHG inventories.

GHG Accounting Methodology

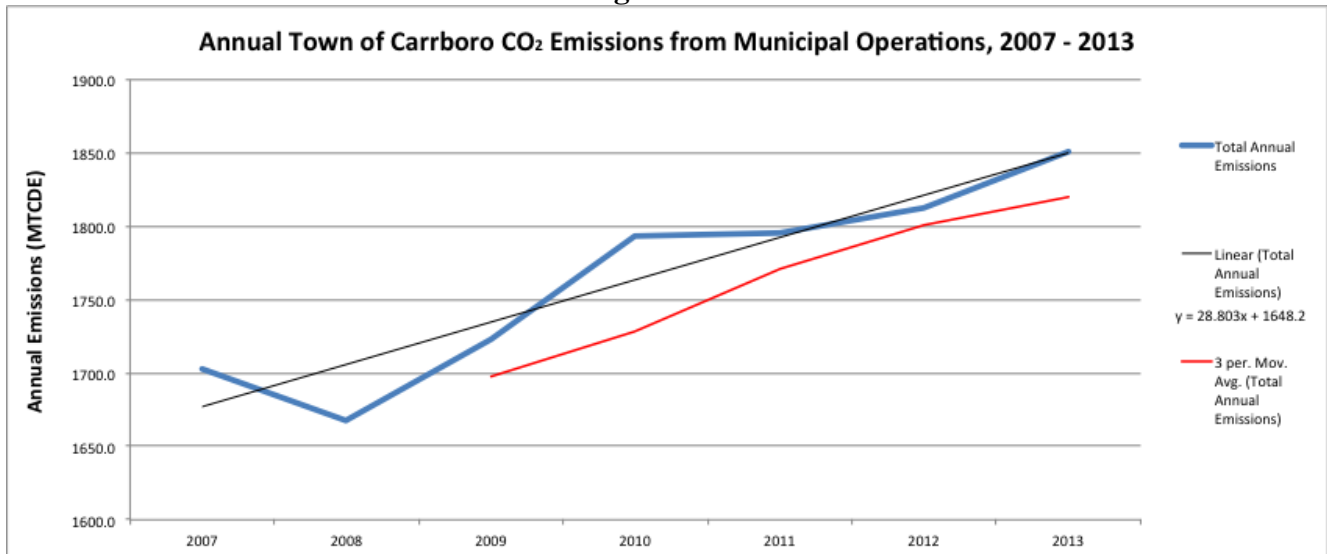
While electricity, natural gas, and vehicle fuel are all different forms of energy, they all produce GHG emissions at some point in the consumption process. In order to combine different sources of energy into one emissions profile, all usage figures must be converted into one “common denominator” unit, which in this case is metric tons of carbon dioxide equivalent, or MTCDE. Conversion factors used in converting kilowatt-hours (kWh) to GHGs were obtained from the EPA. The EPA released new conversion factors for converting kWh to GHG emissions in February 2014, which lowered the amount of CO₂ emitted per kWh for North Carolina. This new conversion factor was applied to all kWh consumption data from 2003 to present for consistency, which slightly lowered emission levels from previous inventories due to the decrease in lbs. CO₂ emitted per kWh. Many of the conversion factors convert the base unit of energy into pounds of CO₂, so to get the units into MTCDE, a factor of 2204.62 lbs. per metric ton was applied. A table of obtained and derived conversion factors is presented below in Table 2.

Table 2. Conversion Factors for GHG Emissions Calculations

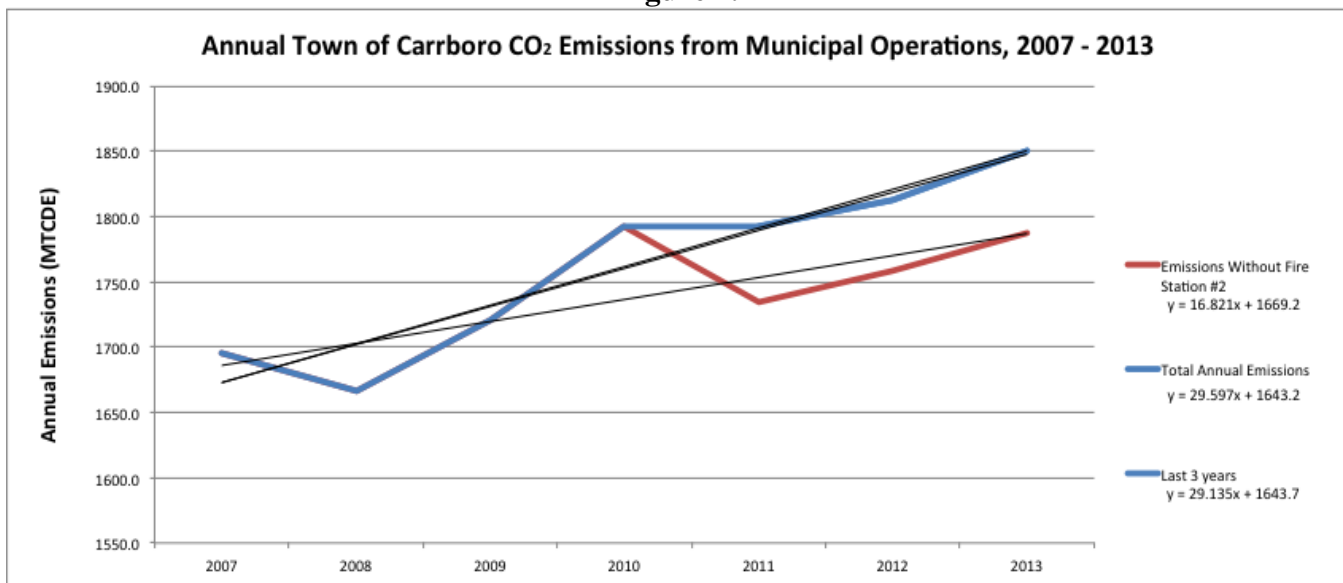
Energy Type	Unit	Lbs. CO₂	MTCDE
Electricity	1 Kilowatt-hour	1.07365	0.000487
Natural Gas	1 Therm	11.0231	0.00500
Gasoline	1 Gallon	19.54	0.00886
B20 Bio-diesel	1 Gallon	17.89	0.00811

Results

The conversion factors in the table above were applied to all Town electricity, natural gas, and vehicle fuel use as defined by the project scope from May 2013 to April 2014 and combined with data from previous inventories. Figure 1 shows the Town’s overall annual emissions from 2007 to 2013. A linear trend line applied to the “Total Annual Emissions” data set in Figure 1 reveals that the total emissions attributable to Town operations have been growing at an average rate of 29.6 MTCDE per year between 2007 and 2013, or at a rate of 1.7% of 2007 emissions per year. In an effort to reduce the impact of inter-annual climate variability on emissions, a three-year moving average of emissions was also constructed and is shown in red on Figure 1. Even with the three-year average, it is clear that there is an upward trend to the Town’s emissions.

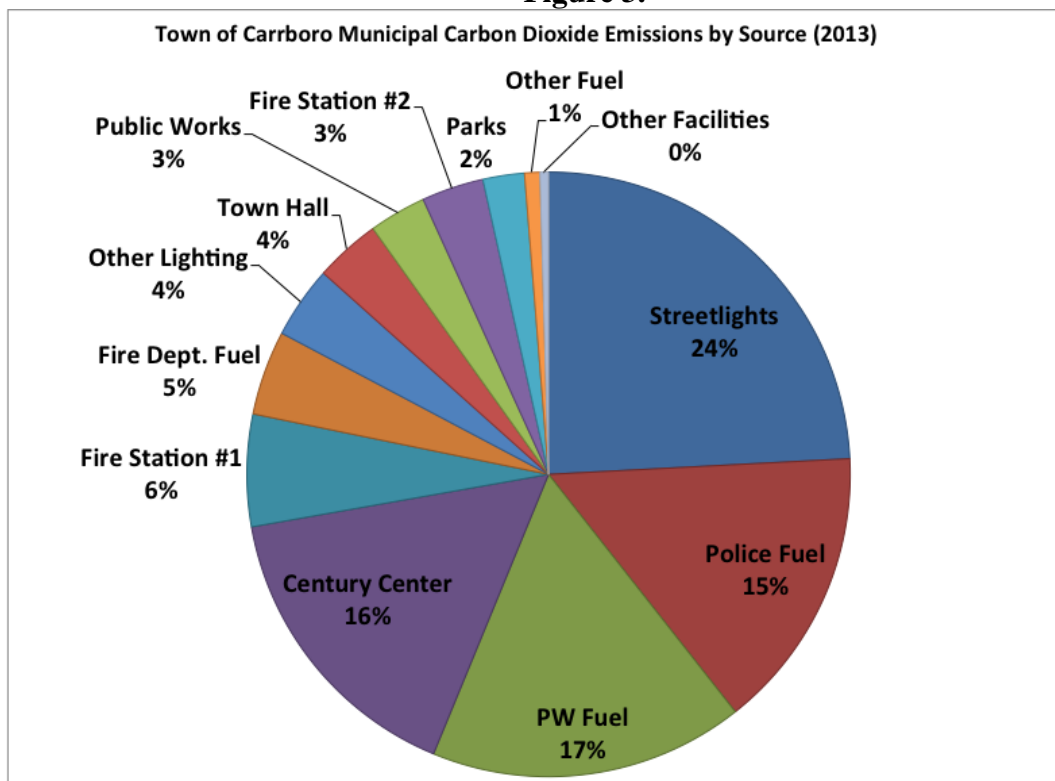
Figure 1

However, with the opening of Fire Station #2 in August 2010, a significant contributor to emissions was added to the Town's operations, thereby inflating the actual rate of emissions growth. Figure 2 was constructed in order to determine how the emissions from the Town's facilities other than Fire Station #2 were changing from 2007 to 2012. The trend line applied to this data set reveals that the Town's emissions excluding the new fire station were growing at a rate of 16.8 MTCDE per year between 2007 and 2013, or 1.0% of 2007 emissions per year. This means that even among existing facilities, emissions were growing. A third trend line was applied to the most recent 3 years of total emissions data and showed that despite the introduction of Fire Station #2, the rate of emissions growth has remained unchanged.

Figure 2.

In order to help focus the Town's efforts in emission reduction, Figure 3 was constructed to show the percentage contribution to the Town's emissions from all sources during the 2013 calendar year. All vehicle fuel usage combined accounted for 38% of emissions, while all facilities combined to contribute 34%, with the remaining 28% attributable to streetlights and other public outdoor lighting. The single largest source of emissions is street lighting at 24% of the total, but it is worth noting that the Town does not own its street lighting infrastructure and instead has a lease arrangement with electric utility providers. Emissions from streetlights were followed by Public Works fuel usage at 17% of the total, which is an increase from last year. The Century Center is the third-largest contributor to emissions at 16% of total emissions, but it is the largest single facility emitter under the Town's control. The fourth and fifth largest contributors to emissions were Police Department fuel usage at 15% of the total, and Fire Station #1 at 6% of the total.

Figure 3.



In order to track how these five largest contributors to Town emissions have performed since 2007, Figure 4 was constructed.

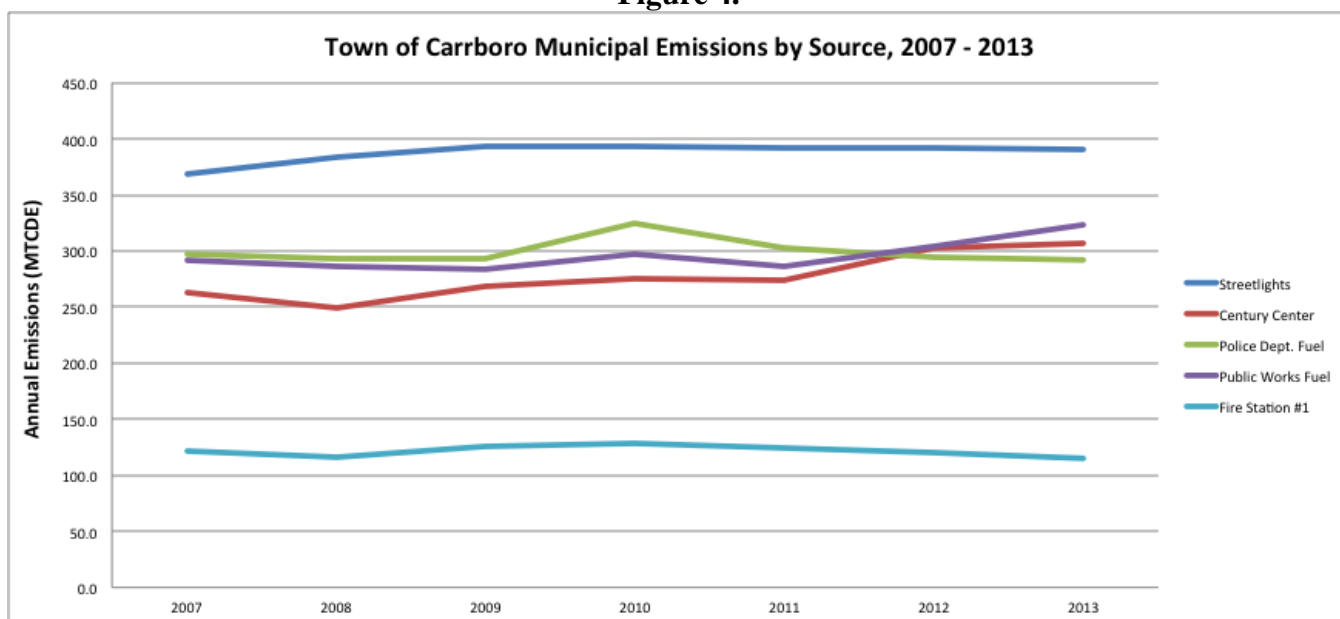
Figure 4.

Table 2 makes clear that there were notable reductions in emissions compared to 2011 levels at Fire Station #1 and through reduced Police Department fuel usage. These reductions were negated by significant increases in emissions over that same time period at the Century Center and from increased Public Works and Fire Department fuel usage.

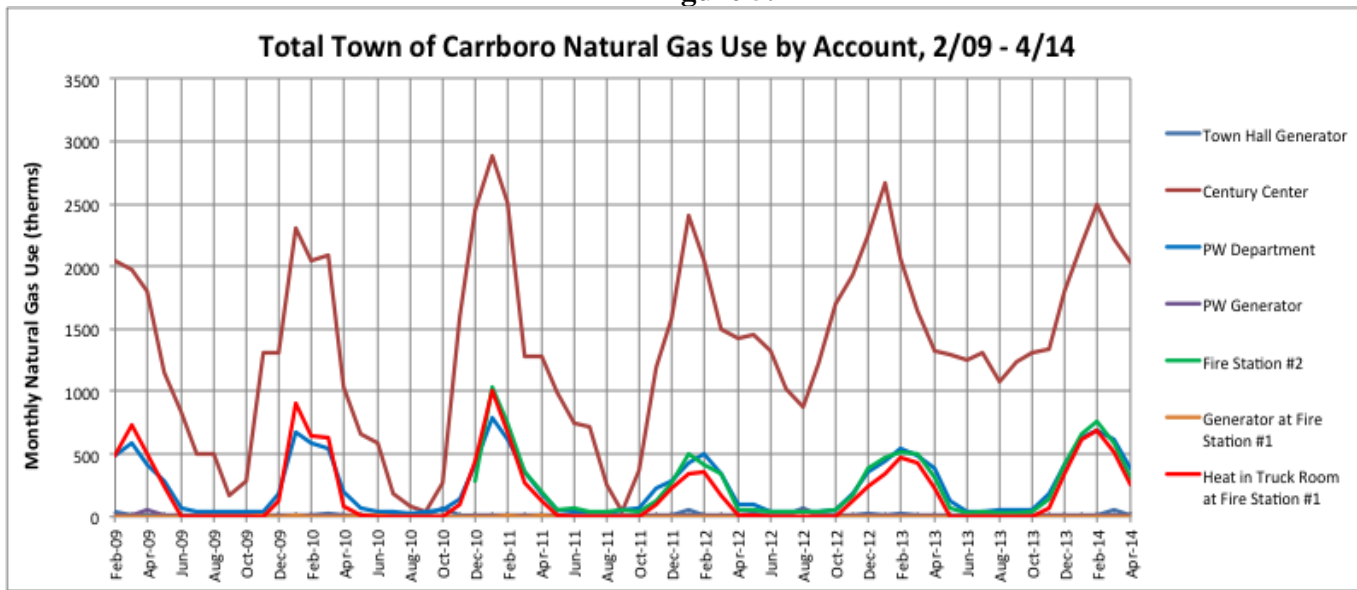
Table 2. Municipal Operations Emissions Sorted in Decreasing Order

Facility Name	2011 Emissions (MTCDE)	2012 Emissions (MTCDE)	2013 Emissions (MTCDE)	Change in MTCDE from 2011	% Change from 2011
Streetlights	392.3	391.3	390.2	-2.1	-0.5
Police Fuel	303.0	294.2	292.0	-11.0	-3.6
Public Works Fuel	286.8	304.0	323.8	37.0	12.9
Century Center	274.1	303.1	307.2	33.1	12.1
Fire Station #1	124.7	119.9	115.1	-9.6	-7.7
Fire Dept. Fuel	79.0	80.9	86.9	7.9	10.0
Other Lighting	73.1	74.2	74.2	1.1	1.5
Town Hall	71.6	68.6	71.4	-0.2	-0.3
Public Works	60.2	55.3	58.9	-1.3	-2.2
Fire Station #2	58.5	54.0	63.8	5.3	9.1
Parks	42.3	42.9	42.8	0.5	1.2
Other Fuel	16.9	15.6	15.7	-1.2	-7.1
Other Facilities	12.4	7.9	8.8	-3.6	-29.0
Annual Totals	1794.9	1811.9	1850.8	55.9	3.1

Overall, municipal emissions increased by 2.1% between 2012 and 2013. The largest single change in emissions between 2012 and 2013 was the increase in fuel use (19.8 MTCDE) from Public Works vehicles. Further analysis (not presented) indicates that this increase was primarily due to increased solid waste fuel use from hauling to the transfer station beginning in the summer of 2013. (Replacing one of the solid waste trucks with more efficient truck to be obtained in 2014-15 with grant support should mitigate this increase). The second largest change was an increase in emissions (9.8 MTCDE) from Fire Station #2. This increase can be attributed to an operational issue with the HVAC system during the summer, which hopefully represents an aberration and not an ongoing increase in emissions. The third largest change was an increase in emissions (6.0 MTCDE) from Fire Department fuel use that resulted from an increase of 200 service calls. These three changes make up a total of 35.6 MTCDE, and when subtracted from total 2013 emissions, the remainder of 1815.2 MTCDE is roughly the same as total 2012 emissions of 1811.9 MTCDE.

At the Century Center, the primary driver of the increase in emissions from 2011 to 2013 was an increase in natural gas usage, especially during the summer months. As is evident from Figure 5, natural gas usage at the Century Center would drop down to under 200 therms per month during the summers of 2010 and 2011, but in 2012 and 2013 natural gas usage at the facility never dropped below 1000 therms per month during the summer. This significant change in the usage pattern resulted in much higher emissions attributable to the facility. To address this issue, the Town has programmed a study of the Century Center system in the 2014-15 operating budget and funds for improvements in the Capital Improvements Program.

Figure 5.



Emissions Reduction

While Town emissions are not increasing at a particularly high rate, they did increase during this 7-year window, which is potentially contrary to the direction desired based on participation in Cities for Climate Protection and the Town's 2009 pledge to reduce its emissions. For future

updates, it is recommended that additional analyses be pursued to further study changes and include a component that “normalizes” emissions to factors such as population and service area growth/change, provision of services, and annual climate variability. Based on this 2013 update, should the Town’s commitment to emissions reductions continue, it is clear that action is needed to prevent future emissions growth and begin to reduce overall emissions. The completion of an Energy and Climate Protection Plan in May 2014 along with operating budget and CIP programming are positive recent steps towards pursuing reductions.

According to a 2009 resolution passed by the Board, the Town’s goal is to “cut CO₂ emissions by [the Town’s] proportion of the amount which is required to stabilize the climate back to less than 350ppm of CO₂ in the atmosphere in time for a 90% probability for success” in averting the worst impacts of climate change. While this resolution applies to the emissions of the whole community, the most easily quantifiable and manageable emissions of the community from a governmental perspective are those attributable the Town’s municipal operations, which make sense as the starting point for any emissions reduction initiative. In an effort to understand what the corresponding emissions reductions must be to bring the emissions from the Town’s municipal operations in line with the 350ppm goal, a “back-cast” was performed using current emissions trends in the GHG emissions inventory provided in June 2013. While there is considerable difficulty in quantifying an emissions reduction target in line with the Town’s 2009 resolution for reasons of atmospheric physics and scientific uncertainty, the current trends were projected linearly back to 1988, which is the year where global annual average atmospheric CO₂ crossed the 350ppm threshold.

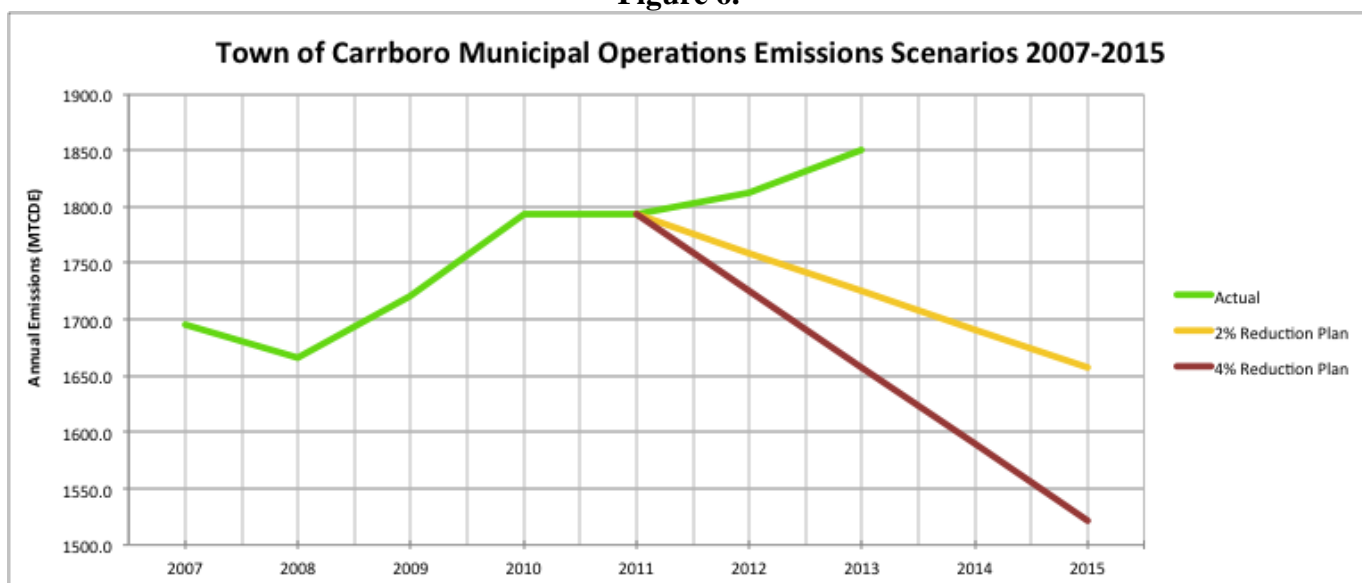
Policy Options

As was stated in the 2011 and 2012 baseline reports, two cities that have adopted policies that may be helpful for Carrboro are Asheville and Chapel Hill. In 2007, Asheville committed to reducing its municipal operations carbon footprint by an amount equal to 2% of its total emissions every year beginning in 2007 with the goal of reducing emissions 80% by the year 2050. In 2011, the City Council updated this policy to reductions of 4% of annual emissions levels with a goal of reducing emissions 80% by 2030. Since implementing this policy, the City has managed to outperform their goal with GHG emissions reductions totaling 17.59% over 5 years. The scale of their effort is much greater than Carrboro's, however, as their total reductions achieved during FY2012 alone are roughly equivalent to all of the emissions of the municipal operations of Carrboro combined. The Town of Chapel Hill adopted a goal of a 35% reduction by 2025 of emissions attributable to Town operations on their way to a goal of a 60% reduction by 2050. Their 2025 target works out to be reducing emissions by 1.8% of baseline emissions per year, assuming that 2006 is their baseline year. Given the policies in place in these two model cities, it is recommended that Carrboro explore the feasibility and fiscal impact of implementing a GHG reduction policy that sets an annual reduction goal of 2% of 2007 levels per year.

An annual percent reduction strategy is also recommended because it provides the most easily measurable goal for the Town to pursue. Implicit in future efforts would be exploration of the best financing mechanisms for pursuing efforts, whether it is through performance contracting, an internal revolving fund or "energy bank", community investing in renewable energy, or other ways to finance projects through energy savings, as well as possibly through debt servicing such as Qualified Energy Conservation Bonds.

Figure 6 shows the difference between actual emission levels and what emission levels would be had the Town followed either a 2% or 4% of 2007 levels annual emissions reduction plan starting in 2011. As is evident from the figure, the Town's emissions in 2013 went up slightly compared to those in 2012, which leaves Town emissions 126.1 MTCDE above the levels they would have to be at to meet a 2% reduction goal set in 2011 and 193.9 MTCDE above a 4% reduction goal set in 2011.

Figure 6.



To put a 2% of 2007 levels annual emissions reduction goal into more concrete terms, 2% of 2007 emissions levels is 33.9 MTCDE. In 2013, Town Hall contributed 71.4 MTCDE of emissions to the Town total through its electricity and natural gas use at the facility. If a 2% annual reduction target were implemented, the target would be met by reducing emissions equivalent to approximately half of Town Hall's 2013 emissions contribution every year until 2025.

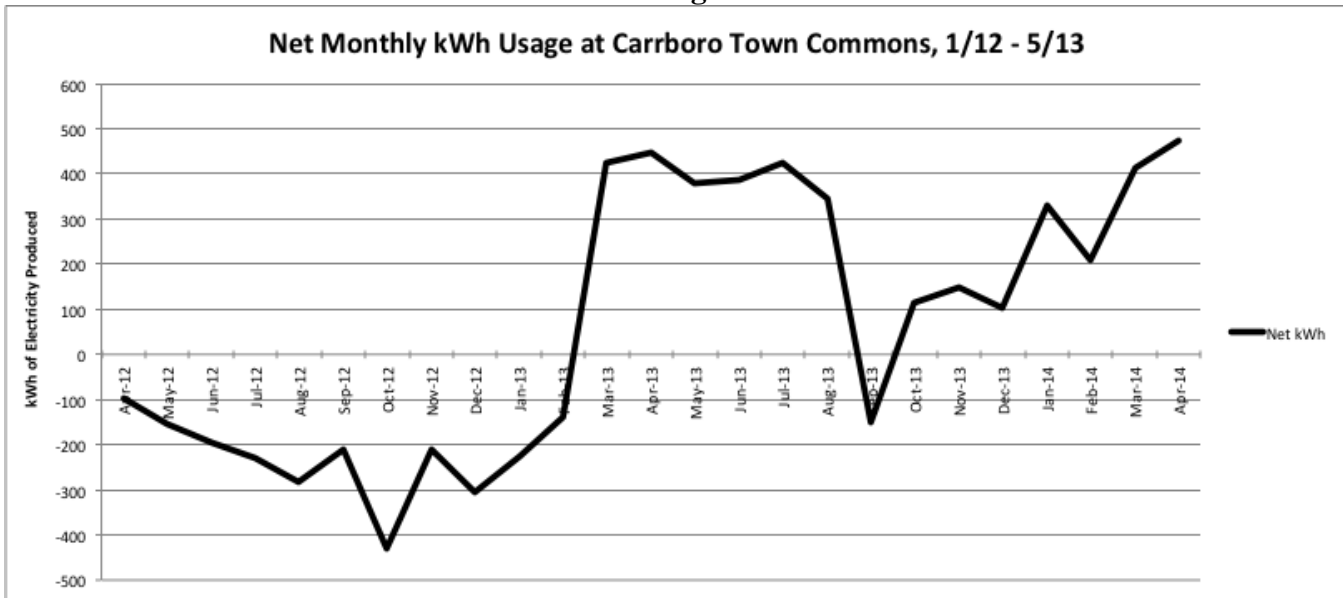
In order to help achieve any proposed emission reduction goal, energy efficiency projects in Town facilities have already been preliminarily investigated as part of a study by Waste Reduction Partners in 2008 and the Town's applications to obtain Energy Efficiency Conservation Block Grant (EECBG) money in 2010. Furthermore, the Town's draft Energy and Climate Protection Plan, as supported by the FY 14/15 operating budget and 2014 Capital Improvement Program update, outlines strategies the Town is planning to pursue involving Town facilities, lighting, and the fleet with a goal of reducing municipal energy use by 5-10% by FY 15/16. Achieving this level of reduction is heavily dependent on successful cooperation with electric utility providers and NCDOT to replace streetlights and other outdoor lights.

Carrboro Town Commons Solar PV

The 5kW solar photovoltaic (PV) system that was installed on the south-facing roof of the market stalls at the Carrboro Town Commons has now been producing electricity for over a year. As of the end of April 2014, the system had cumulatively produced 7,506 kWh, which means that 3.7 MTCDE of emissions or 0.2% of the Town's 2013 total has been offset by the project. The system has been successful in making the Town Commons a net producer of electricity for each month since beginning its operation except for September 2013, when the system produced

only 213kWh. Figure 7 shows net usage of electricity at the Town Commons site between April 2012 and April 2014.

Figure 7.



Given the trends in Figure 7, it is clear that once the system came online in February 2013, it produced at or near maximum capacity during the spring and summer, with fall and winter weather patterns limiting the production of the system.

If the goal of Solarize Carrboro to install 200kW of residential solar PV capacity in 2014 is met, and assuming that those systems produce electricity at the same rate that the Town Commons system does, their efforts will produce approximately 300,000 kWh annually, or offset approximately 146 MTCDE, which is 7.9% of municipal 2013 emissions, but only 0.3% of total residential buildings emissions and 0.1% of estimated 2009 total community emissions.

Conclusion and Recommendation

Based on the information contained in this and previous inventories, it is clear that strong and coordinated action is needed to reduce emissions from Town operations. The Town has developed a plan and committed resources to reduce emissions in the first half of 2014. It is recommended that the Town use the information provided in this report and supporting data and analysis to continue to identify emissions reductions opportunities, and to update the inventory in the spring of 2015. As with previous reports, it is again recommended that the Town investigate the fiscal implications and alternative strategies for implementing a GHG reduction policy across all Town operations with a goal of reducing emissions by at least 2% of 2007 levels annually through at least 2025. This approach will allow the Town to determine the best fit for Carrboro to implement the policy in order to further the Town's goals of environmental stewardship, economic sustainability, and "leading by example".