



TOWN OF CARRBORO  
NORTH CAROLINA

**TRANSMITTAL**

**PLANNING DEPARTMENT**

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

**To:** **Board of Aldermen**  
**David Andrews, Town Manager**  
**Patricia McGuire, Planning Director**  
**Christina Moon, Planning Administrator**  
**Randy Dodd, Environmental Planner**

**From:** **Chris Lazinski, DELTA Fellow**

**Date:** **June 12, 2013**

**Subject:** **Town of Carrboro 2012 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 an initial fulfillment of CCP Milestone 5 (Table 1).

**Table 1. Cities for Climate Protection Five Milestone Process**

<b>Milestone</b>	<b>Description</b>	<b>Notes</b>
1	Conduct a baseline emissions inventory and forecast.	A summary of the inventory completed last year can be found at <a href="http://www.townofcarrboro.org/BoA/Agendas/2012/04_03_2012_D2A.pdf">http://www.townofcarrboro.org/BoA/Agendas/2012/04_03_2012_D2A.pdf</a> . 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 memo suggests an approach for further articulation as a measurable emissions reduction target for Carrboro municipal emissions.

3	Develop a Local Action Plan	Carrboro has not adopted a Local Action Plan. Carrboro has pursued components of a plan, for example, through the WISE program, and through various local planning efforts.
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 first annual effort to monitor and verify the results of policies and procedures implemented to reduce overall GHG emissions.

**Information**  
**Data Collection**

In putting together the 2011 GHG emissions baseline report, 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.

*Scope*

For consistency with the 2011 baseline report and as 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 footprint for Carrboro was estimated at 115,000 metric tonnes of carbon dioxide equivalent (MTCDE) (2009 values), while municipal operations were estimated at less than 2,000 MTCDE (<2%). 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. Many of the conversion factors convert the base unit of energy into lbs. CO<sub>2</sub>, 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**

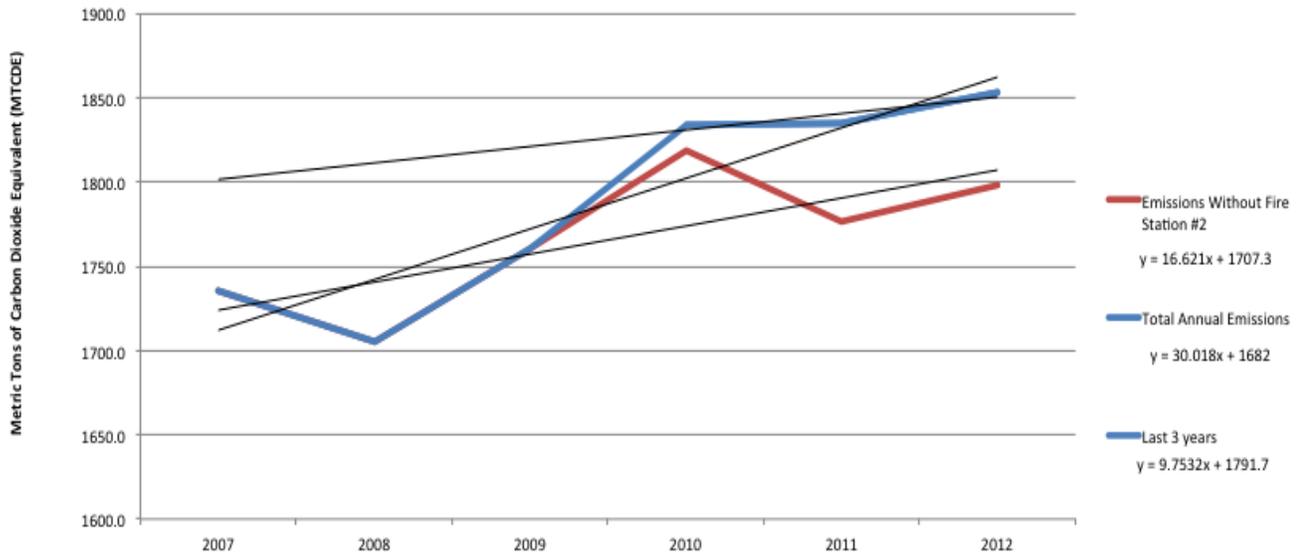
<b>Energy Type</b>	<b>Unit</b>	<b>Lbs. CO<sub>2</sub></b>	<b>MTCDE</b>
<b>Electricity</b>	1 Kilowatt-hour	1.11841	0.0005073
<b>Natural Gas</b>	1 Therm	11.0231	0.00500
<b>Gasoline</b>	1 Gallon	19.54	0.00886
<b>B20 Bio-diesel</b>	1 Gallon	17.89	0.00811

## **Results**

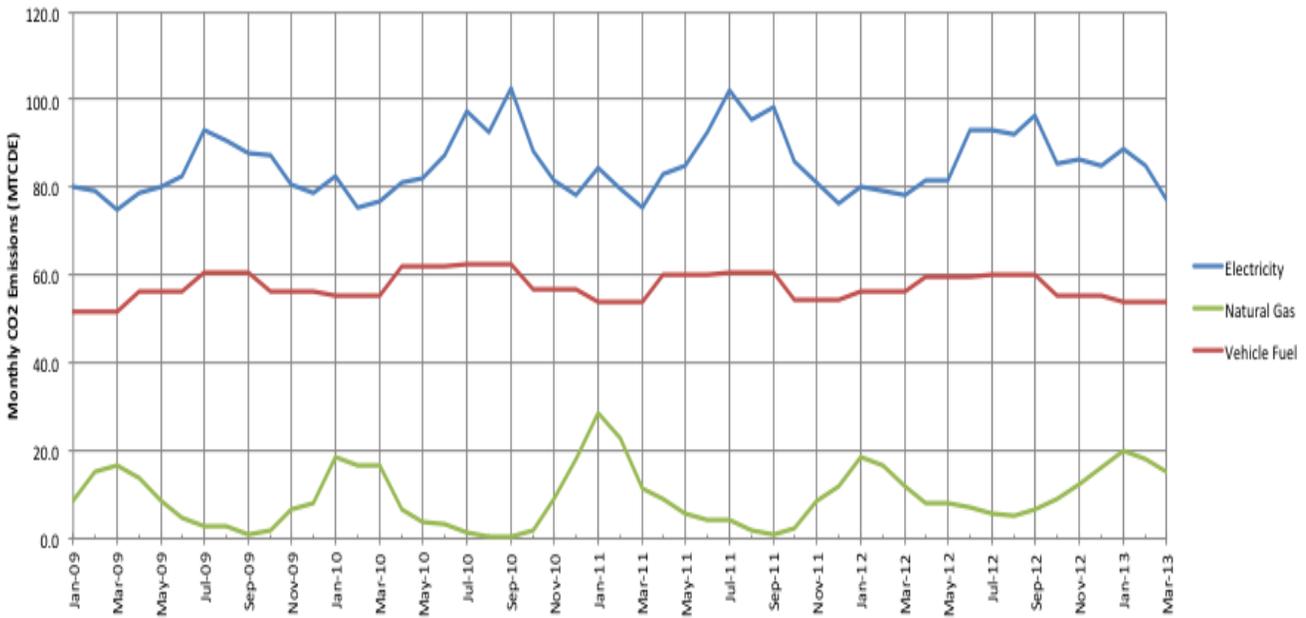
The conversion factors in the table above were applied to all Town electricity, natural gas, and vehicle fuel use as defined by the project scope from January 2012 to May 2013 and combined with data from the original baseline inventory. Figure 1 shows the Town’s overall annual emissions from 2007 to 2012. Figure 2 shows the monthly breakdown of emissions from 2009 to 2012 by sector. Because vehicle fuel use is reported quarterly, those figures were averaged over the quarter to obtain the monthly usage approximations in Figure 2.

A 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 30.0 MTCDE per year between 2007 and 2012, or at a rate of 1.7% of 2007 emissions per year. 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. The “Emissions Without Fire Station #2” data set 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 16.6 MTCDE per year between 2007 and 2012, 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 to show that growth in overall emissions has slowed to 9.8 MTCDE per year since the introduction of Fire Station #2 in 2010, or 0.6% of 2007 emissions per year.

**Figure 1. Annual Town of Carrboro CO<sub>2</sub> Emissions from Municipal Operations, 2007 - 2012**

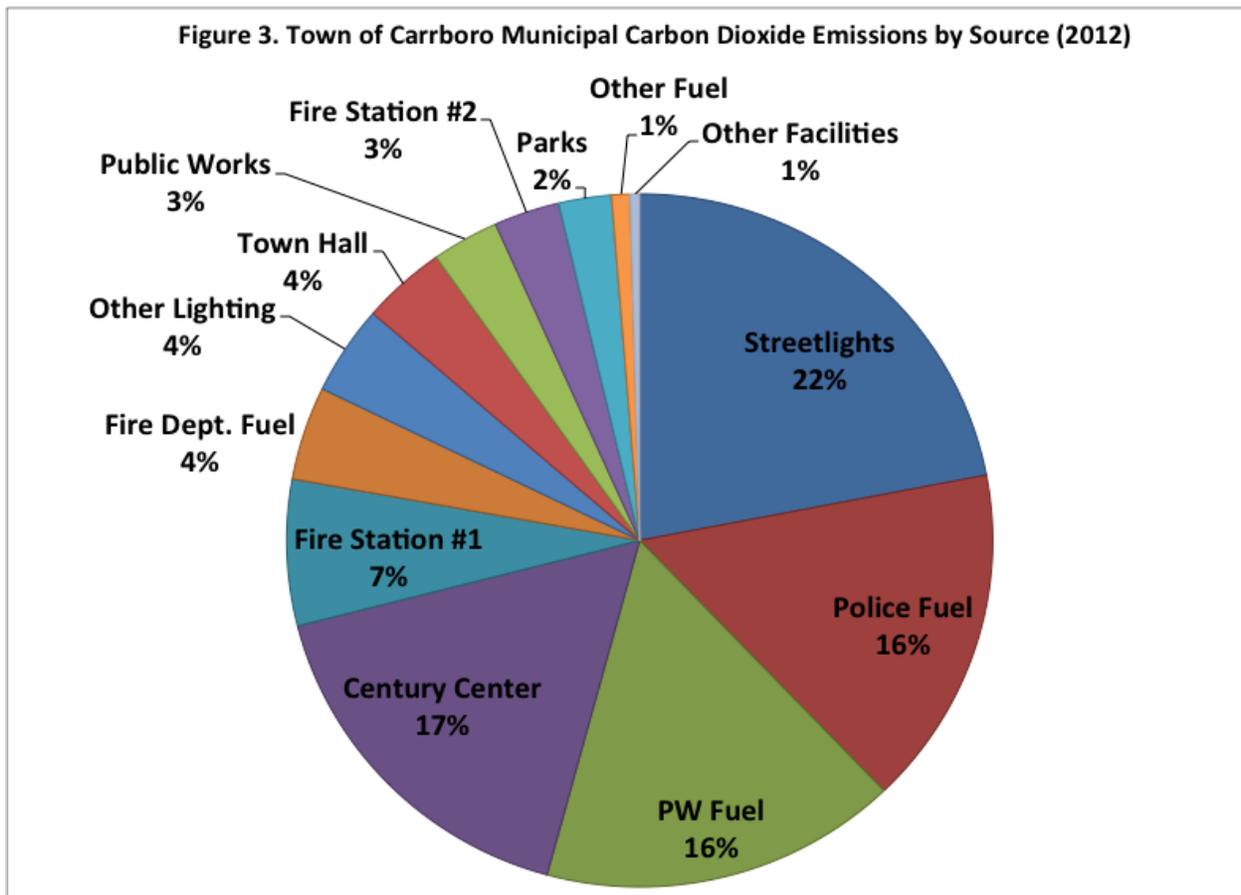


**Figure 2. Monthly Town of Carrboro Municipal Operations CO<sub>2</sub> Emissions by Sector, 1/09 - 3/13**



While Town emissions are not increasing at a particularly high rate, they did increase during this 6-year window, which is contrary to the direction desired based on participation in Cities for Climate Protection and the Town’s 2009 pledge to reduce its emissions. Based on this updated data, 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.

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 2012 calendar year. All vehicle fuel usage combined accounted for 37% of emissions, while all facilities combined to contribute another 37%, with the remaining 26% attributable to streetlights and public lighting. The single largest source of emissions is street lighting at 22% 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 the Century Center at 17% of the total, making it the largest single facility emitter. Tied for third place were Carrboro Police Department and Public Works fuel usage, both at 16% of the total. Given that these are the top four emission sectors, a change in any of these areas would have a big impact on the overall Town emissions footprint.



In order to track how the 11 largest emission sectors in the Town were performing since the 2011 baseline report, Figure 4 was constructed.

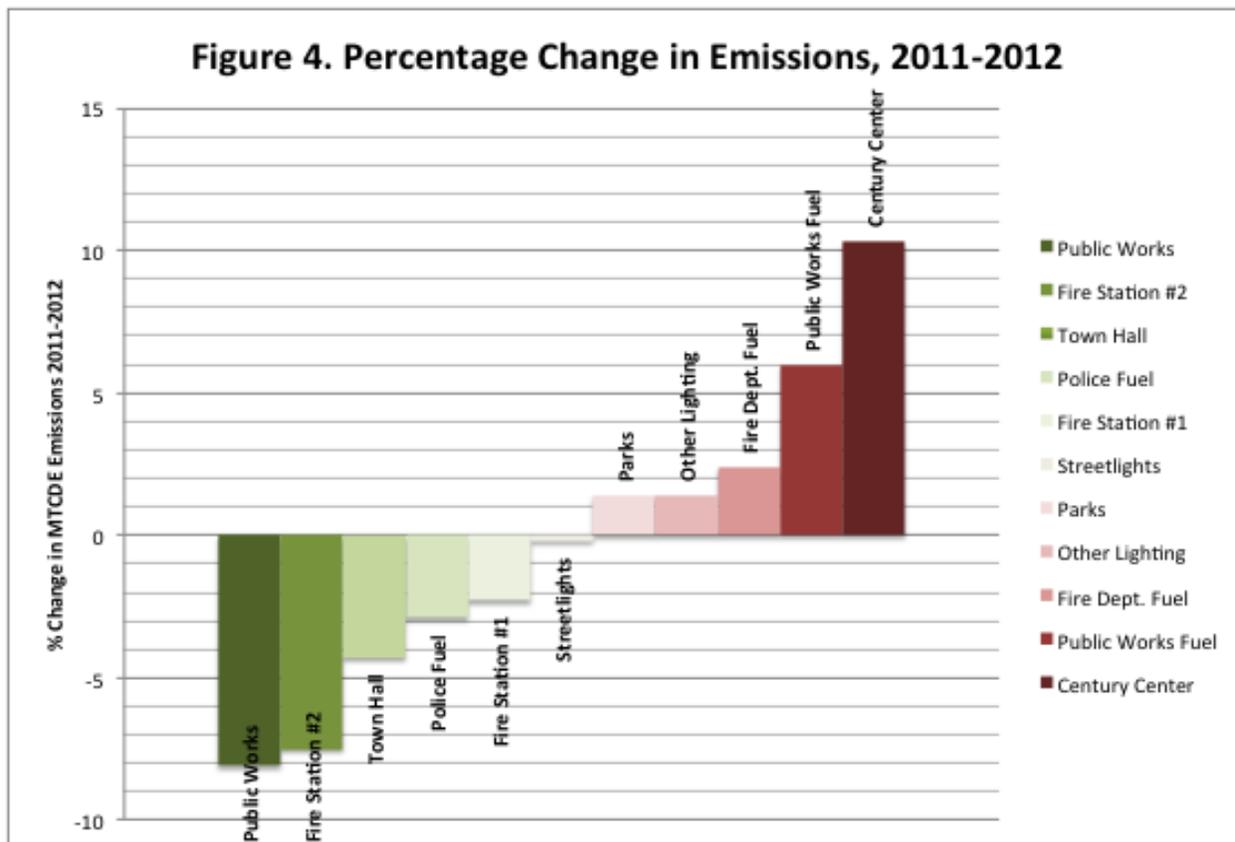
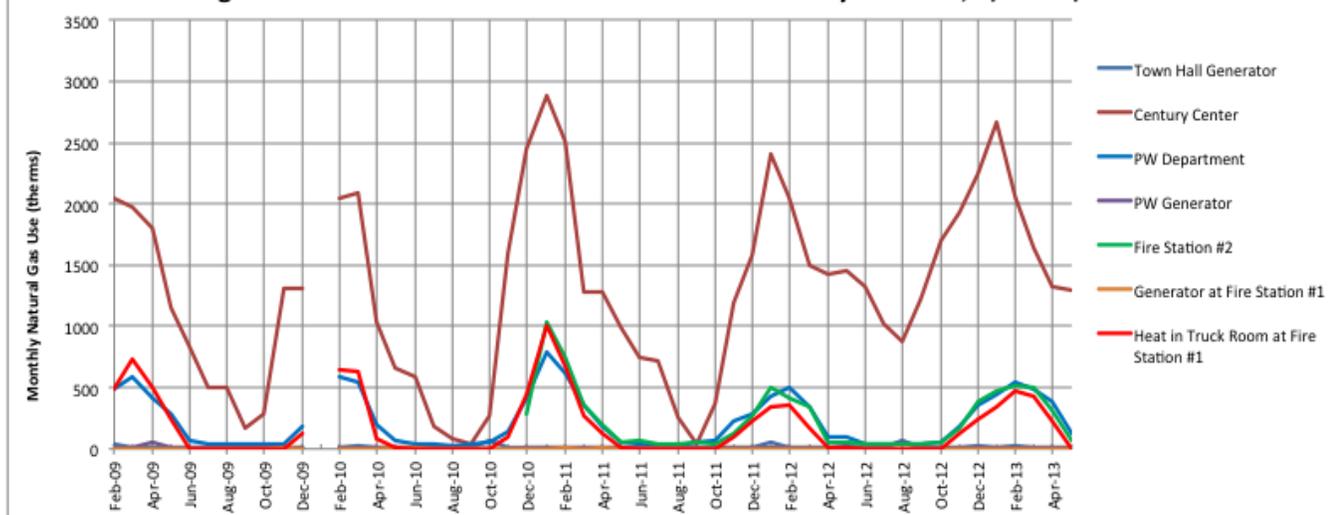


Figure 4 makes clear that there were notable reductions in emissions at the Public Works facility, as well as at Fire Station #2 and at Town Hall. Unfortunately, these emission reductions were negated by increases in emissions from Public Works fuel usage and a greater than 10% increase in emissions from the Century Center. As the facility with the greatest emissions under the Town’s control, a deeper look into the emissions in 2012 from the Century Center is warranted.

The largest single change in the Century Center’s emissions profile over the past year was a sharp increase in natural gas usage, especially during the summer months. Figure 5 is a graph showing natural gas usage in all Town accounts from 2009 to present. Note the large peak in the Century Center consumption data that occurs every January, followed by a pronounced trough typically in August and September. In 2012, the trough in the summer never occurred to the level that it had in previous years, with natural gas consumption only dropping down below 1000 therms for the month of August 2012. This trend resulted in a 38% increase over 2011 levels in natural gas consumption at the facility in 2012. If the Century Center had the same emissions level in 2012 as in 2011, total Town emissions would have been 1828.3 MTCDE, marking a 0.3% drop of 6.1 MTCDE in total Town emissions over 2011 levels as opposed to the 1% overall increase of 19.0 MTCDE that was observed.

**Figure 5. Total Town of Carrboro Natural Gas Use by Account, 2/09 - 5/13**



### Emissions Reduction

According to a 2009 resolution passed by the Board, the Town’s goal is to “cut CO<sub>2</sub> emissions by [the Town’s] proportion of the amount which is required to stabilize the climate back to less than 350ppm of CO<sub>2</sub> 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 government 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. 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 CO<sub>2</sub> crossed the 350ppm threshold.

Due to the short nature of the time series over which data is available, it is difficult to determine the true rate at which the Town’s emissions attributable to municipal operations have grown between 1988 and present. The assumption implicit in this analysis is that the data gathered from 2007 to 2012 can be used to accurately represent trends prior to 2007. It should be noted that certain events, such as the incorporation of the Century Center into Town facilities in 2001, likely mean that a linear representation of the growth in emissions based on current trends overestimates Town emissions in 1988, and should be the subject of further study. For the purposes of this analysis, in order to approximate the Town’s possible historical and future emissions from 1988 to 2035, the two trend lines from Figure 1 were extended to determine upper and lower bounds for emissions growth. The trend line incorporating the contribution of Fire Station #2 represents a “high emissions growth” scenario, and the trend line modeling growth over the last 3 years represents a “low growth” scenario. In Figure 6, these two trends are projected back to 1988 and forward to 2035 to determine possible GHG emission rates over that time series. The 1988 baseline is selected from the “high emissions growth” scenario because

that scenario results in the lowest baseline, giving the Town a lower emissions level to work toward.

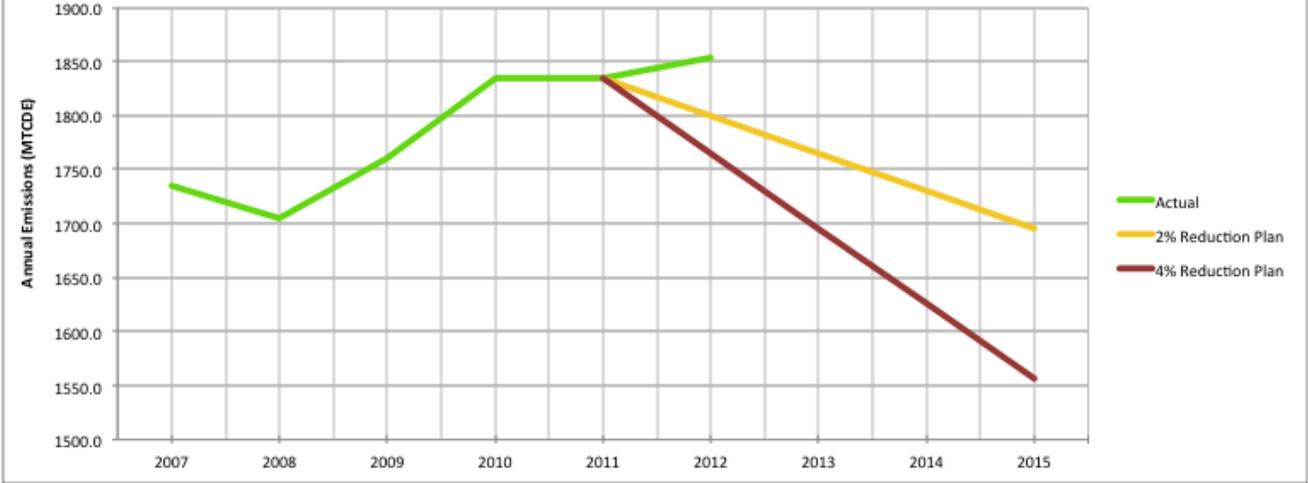
### Policy Options

As was stated in the 2011 baseline report, two cities that are recommended as exemplars for Carrboro in designing a potential policy 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 depicts past and present emissions according to current trends as well as future emissions forecasts under different policy scenarios for Carrboro. If implemented in 2012, a 2% of 2007 emissions levels annual reduction policy would result in emission levels that are 42% lower than the 2007 baseline by 2035 and a return to possible 1988 levels by 2031. A 4% annual reduction policy would reduce emissions to 90% lower than the baseline by 2035 and a return to possible 1988 levels by 2021. Figure 7 is an excerpt from Figure 6, which 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 2012 went up slightly compared to those in 2011, which leaves Town emissions 53.7 MTCDE above the levels they would have to be at to meet a 2% reduction goal and 88.4 MTCDE above a 4% reduction goal.

**Figure 7. Town of Carrboro Municipal Operations Emissions Scenarios 2007-2015**

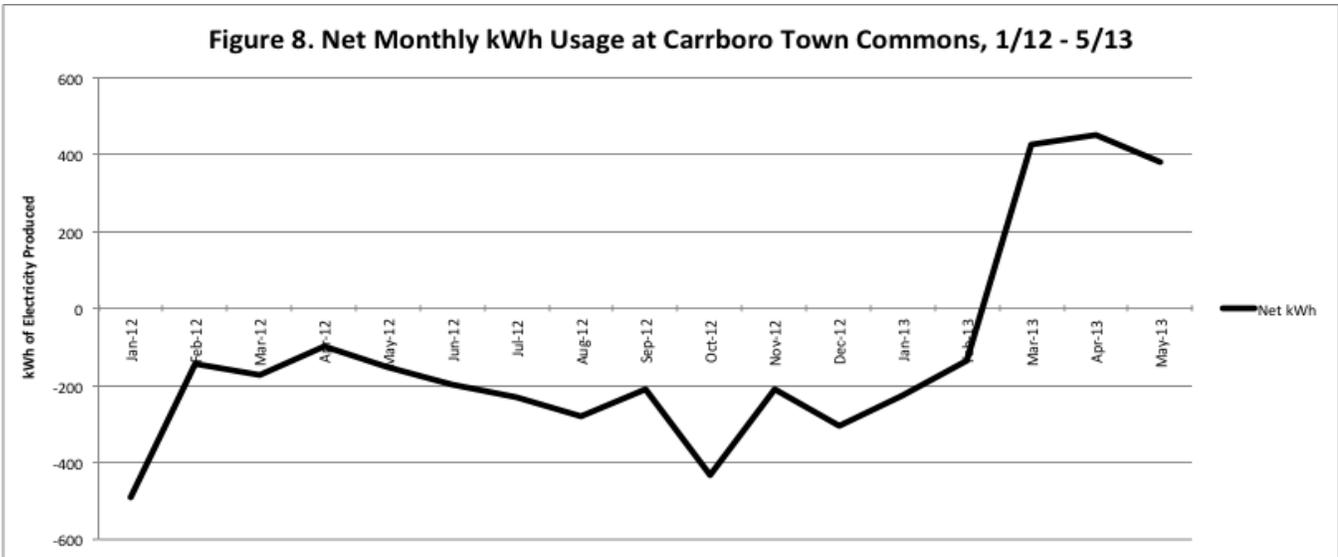


To put a 2% of 2007 levels annual emissions reduction goal into more concrete terms, 2% of 2007 emissions levels is 34.7 MTCDE. In 2012, Town Hall contributed 71.4 MTCDE of emissions to the Town total through its electricity and natural gas use at the facility. If a 2% annual reduction target were implemented, the target would be met by reducing emissions equivalent to just under half of Town Hall’s 2012 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.

Carrboro Town Commons Solar PV

The Town recently installed a 5kW solar photovoltaic (PV) system on the south-facing roof of the market stalls at the Carrboro Town Commons. The project began producing electricity in late February 2013, marking an important first step in generating clean electricity for use by the Town. Because the system began operation in 2013, its impact is not recorded in the annual inventory for 2012. Since the system came online, it has averaged production of 630kWh per month, meaning that it is currently on pace to produce 7,560kWh over a 12-month period. While that projected amount is 0.37% of total Town electricity use in 2012, the energy consumed on site at the Town Commons is small enough that the PV array has actually made the Town Commons a net producer of electricity between March and May 2013. At no point since 2009 has the Town Commons used more than 630kWh of electricity in one month, meaning that if current energy production and consumption trends continue, all emissions from electricity consumed at the Town Commons will be offset by clean electricity generated by the solar PV array. Figure 8 shows net usage of electricity at the Town Commons site between January 2012 and May 2013.



To put the production of the solar PV project in another context, the system is on track to produce 7,560kWh annually, which would offset the emission of 3.8 MTCDE. If the Town chose to, the Town could meet an annual 2% reduction goal by installing 10 systems that are identical to the one currently installed at the Town Commons and using all of that electricity in Town facilities. Of course, such a strategy would be much less cost-effective than pursuing energy efficiency and other means. The community investment approach for the Town Commons project is an innovative approach in allowing community investors to benefit from available tax credits that are not available to the Town. However, increasing the scope of PV installation to the necessary scale in order to achieve desired emissions reductions is a non-trivial undertaking.

**Recommendation**

Based on the information contained in this inventory update, it is clear that strong and coordinated action is needed to negate the growth in emissions from Town operations. As with the report to the Town in the spring of 2012, 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”.