TOWN OF CARRBORO

NORTH CAROLINA

DELIVERED VIA: ☐ *HAND*

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To: **David Andrews, Town Manager**
Mayor and Board of Aldermen

From: **Randy Dodd, Environmental Planner**

Cc: **Management Team**
Energy Plan Workgroup Members

Date: **Wednesday, October 2nd, 2013**

Subject: **Strategic Energy and Climate Action Planning Update**

Background and Summary

This memo provides an update to the Town's energy and climate action planning efforts. Potential "next steps" are identified, along with a summary of current initiatives. After receiving Board feedback, staff will prepare a draft Strategic Energy and Climate Action Plan for Board review, and will also consider items presented in this memo in the upcoming updates to the Capital Improvements Program (CIP) and annual budget cycle.

Information

Town staff have been collaborating in 2013 to recommend new energy and climate action initiatives, with a goal of providing input into annual capital improvement and budget processes. After Board review of this update, staff intend to focus on the best opportunities for inclusion in a draft and final Strategic Energy and Climate Action Plan, and the annual CIP and budget updates. Multiple workgroups have been temporarily established to help develop the plan, with about 15 staff members participating in one or more groups. The workgroup structure is presented in Table 1. This structure recognizes and aligns with elements of the plan, as envisioned.

The Town has been involved in activities associated with inventorying greenhouse gas emissions and planning for and pursuing emissions reductions since 2001, when the Board of Aldermen adopted a resolution pledging the Town's commitment to reduce greenhouse gas emissions, improve air quality and save energy through joining the Cities for Climate Protection (CCP) program. In 2009, the Board of Aldermen passed a resolution resolving that the Board "will seek, and will facilitate the community at large, to cut CO2 emissions by its proportion of the amount which is required to stabilize the climate back to <350 ppm of CO_2 …", and asks staff to evaluate how to achieve this target for municipal operations and the community. In April 2012, a detailed municipal emissions inventory using local data was completed, with a recommendation that the Town "investigate the financial costs of implementing a GHG reduction policy across all Town operations with a goal of reducing emissions 2% of 2007 levels annually through at least 2025. If the costs are found to be acceptable, then it is recommended that the Town implement the policy in order to further the Town's stated goals of environmental stewardship and "leading by example"". This inventory was updated in the spring of 2013, with the Board requesting at its June 18th, 2013 meeting that staff also look into the implications of a 7% annual reduction in emissions.

Table 1: Workgroups Structure

Municipal Fleet *Matt Efird (TMO)* *Chris Sherman (PW)* *Lynwood Daniel (PW)* *Jeff Brubaker (PL)* *Walter Horton (PD)* *Ryan Downs (FRD)*	Outdoor Lighting (including street lights) *Matt Efird (TMO)* *Tina Moon(PL)* *David Poythress (PW)* *Robert Douglas (RPD)* *Walter Horton (PD)* *Cathy Wilson (TCO)*	Community Transportation *Jeff Brubaker (PL)* *Tina Moon (PL)* *David Poythress (PW)*	Land Use/Urban Forest *Randy Dodd (PL)* *Tina Moon (PL)* *David Jantzen (PW)*
Municipal Buildings *Chris Sherman (PW)* *Robert Douglas (RPD)* *Cathy Wilson (TCO)* *Tina Moon (PL)*	Community Commercial Sector *Randy Dodd (PL)* *Annette Stone (ECD)*	Community Residential Sector *Randy Dodd (PL)* *Tina Moon (PL)*	Management/Finance *Matt Efird (TMO)* *Sandy Svoboda (MS)*

Examples of actions the Town has taken historically that address energy and climate action include (more details in Attachment 1):

- participating in the State's most ambitious and successful (and fare free since 2001) transit program (Chapel Hill Transit) for several decades;
- assertively supporting bicyclists and pedestrian for many years via Safe Routes to Schools, bicycle facilities, sidewalks and greenways;
- other transportation efforts to provide alternative modes and reduce vehicle use (transportation demand management, transit-oriented/mixed use land use planning, participation in regional transit efforts, road connectivity, alternative fuels, expansion of affordable housing options)
- the "Worthwhile Investments Save Energy" (WISE) program for community buildings;
- partnering with OWASA and Orange County on water/sewer and solid waste management initiatives;
- municipal fleet emissions reductions;
- building Fire Station #2 to LEED silver standards;
- energy audits of Town buildings and follow up;
- pursuing a community solar project and providing ongoing contributions to NC Green Power.

Potential Next Steps

The proposals presented below expand on past municipal and community sector efforts to reduce energy consumption and emissions and increase the effectiveness of the urban forest in climate protection and providing other ecological and community services. The intent is to present tractable "next steps". Table 2 summarizes each step for further review and consideration for programming in the CIP and the 2014-15 operating budget update. A more comprehensive and longer term perspective will be included in the draft plan.

Municipal Sector

Streetlights

Assuming a new rate structure is available[1], a primary recommendation is that the Town plan for and implement a streetlight replacement program over the next several years. Prioritizing this action is warranted because of the large contribution of street lighting to all municipal emissions (22%), the significant efficiency improvement offered by LED lighting (at least 50% improvement), the relatively short payback anticipated, and the potential to capitalize future energy savings with the cost savings for LED lighting.[2] Key decisions will be: developing an agreement with Duke Energy that lays out ownership, replacement, and maintenance of fixtures; capitalization of the initiative (very preliminary estimate of $200k for lights on Town streets); deciding what fixtures to replace and when; and outreach to the community. This approach is modeled on Asheville's approach to LED streetlight replacement program that is paying for itself and for other energy improvements with the savings realized. A factsheet on Asheville's initiative is included as Attachment 2. In the immediate future, staff will continue to collaborate with Piedmont Electric (PEMC) on the pilot LED lighting project at Anderson Park.

Buildings

For municipal buildings, it is recommended that the Town: continue in the near future to replace lights and lighting controls; replace older/less efficient water fixtures and small HVAC units with more efficient fixtures and units; and seek outside assistance for more detailed studies of energy use and efficiency opportunities[3]. The results of more detailed studies of Town buildings should provide important information on costs and energy savings to guide decisions and priorities for building retrofits and system maintenance/replacement. It is specifically recommended as a near term step that a study of the HVAC system at the Century Center be completed, and that improvements identified in the study be pursued. Over the longer term, it is recommended that the Town plan for and program additional energy improvements in Town buildings, with priorities and timing considering cost-effectiveness.

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[1] The NC League of Municipalities (NCLM) intervention in the Duke Energy rate case includes a request for a new rate option which is tentatively included in the settlement. The NC Attorney General's office has challenged the NC Utilities Commission final order (Sept., 2013), seeking less financial impact on customers.

[2] See Table 2. Note that LED technology is very rapidly advancing, and costs/efficiencies/payback are expected to only become more attractive for the Town. For example, CREE has just announced a new product line: "the XSPR™ LED Residential Street Light delivers payback in less than a year while consuming over 65% less energy." See more at: http://www.cree.com/Lighting/Products/Outdoor/Streetlights/XSP-Series-Streetlight

[3] Plans should at a minimum take advantage of available utility incentives.

Table 2: Recommended Energy and Climate Action Items

Component	Action Item
MUNICIPAL OPERATIONS ***Streetlights***	• Development and implement comprehensive streetlight replacement plan upon adoption of rate structure by Duke Energy o Negotiate agreement with Duke Energy ▪ Ownership of fixtures; responsibility for installation o Develop and implement plan ▪ Identify fixtures to include; estimate upfront costs, savings, payback, energy/ emissions reductions; develop financing plan; develop implementation schedule ▪ Seek contract support
Municipal Buildings	• Continue to implement lighting retrofits • Install more efficient water fixtures and small HVAC units • Upgrade HVAC and building envelopes o Complete study and implement for Century Center HVAC o Study other buildings and systems and pursue improvements ▪ Install insulation in 2nd floor/replace roof at Town Hall
Municipal Fleet	• Seek grant funding from CFAT for solid waste truck • Continue to prioritize fuel-efficient vehicle replacement in CIP; repurpose/ reduce fleet as needed • Study dual-battery setup for Police vehicles that allow essential systems to run without fuel use • Research training, certification and equipment requirements for fleet mechanics to service a growing hybrid/electric fleet • Evaluate use of Fire-Rescue vehicles for fire inspections
Land use/ urban forest	**Municipal** • Study opportunities for increased tree canopy on Town land • Implement opportunities for increased tree canopy on Town land **Community** • Investigate and recommend ordinance updates and improvements in development review/permit compliance process • Estimate current and historical tree canopy o Seek data collection contract support • Study opportunities for increased tree canopy in the community • Support opportunities for increased tree canopy in the community
COMMUNITY ***Community Transportation***	• Commit local matching funds for Bolin Phase 2 and Morgan greenways • Support Safe Routes to Schools Implementation Committee • Additional action items that may be considered: * Consider GHG emissions during development of Town parking management plan. * Work with transit agencies to plan for increased transit service/new transit connections. * Work with the MPO to ensure that future plans (i.e. long-range transportation plans) include goals related to GHG reduction and methods of modeling GHG emissions. * Encourage car sharing and explore the feasibility of bike sharing systems. * Encourage walking by increasing pedestrian safety at key intersections and in key corridors. * Work with partners to encourage carpooling and other TDM strategies.
Community Buildings	• Support Elite Pete volunteers (small supply budget; explore intern opportunities) • Update website
PLANNING	• Present draft of energy and climate plan to BoA • Continue annual contract for municipal inventory ; update community inventory every 3-5 years • Engage community in long term plan development

Fleet

For the municipal fleet, an immediate recommendation is to seek grant funding (upon release of an RFP anticipated for the fall of 2013) from the North Carolina Solar Center's Clean Fuel Advanced Technology Project to replace a solid waste truck.[4] Staff will also consider and pursue steps shown in Table 4 for vehicle replacement, new technology, training and certification, and equipment requirements.

Community Sector

For community transportation, a step that is currently included in Town planning documents but is worth emphasizing for its climate protection/energy benefits is for the Town to identify local matching funds to allow greenways design work for Bolin Phase 2 and Morgan future phases to proceed. These greenway segments are anticipated to provide significant reduction in motor vehicle trips. Timely identification of a local match will also leverage 80% federal funds, and will avoid the loss of priority of these projects from the MPO's project list. With the expiration of grant funds, it is also recommended that the Town offer support for Safe Routes to Schools implementation and Elite Pete volunteers (trained by Clean Energy Durham) to help maintain momentum created by grants that recently ended.

Consideration of climate protection in Carrboro should also consider the role that the urban forest provides for energy efficiency in buildings and carbon storage and sequestration, and steps the Town can take to encourage additional climate protection through urban forestry. A recent study by the Ecological Society of America [5] provides a helpful perspective into further exploration of this opportunity:

- On a global scale, urban forestry has a small role in sequestering carbon, but significantly contributes to the energy efficiency of buildings and reduction of the heat island effect.
- In the U.S. in 2003, carbon removed from the atmosphere by forest growth or stored in harvested wood products offset 12-19% of U.S. fossil fuel emissions
- Forest carbon storage differs from many other mechanisms that control atmospheric CO2 because forests have a life cycle during which carbon stocks, gains, and losses vary with forest age. Younger forests such as disturbed urban forests can sequester carbon at greater rates.
- The net climate impact of urban trees varies as a function of: 1) the net effect of trees on building energy use; 2) the carbon storage rate of the specific trees; 3) fossil fuel emissions from energy associated with planting, maintenance, irrigation, fertilizer use.

Of particular interest in including urban forestry as a climate protection tool are the many co-benefits of forest protection and restoration (Attachment 4), which are important to community interests in Carrboro.

Immediate steps for supporting renewable energy are not included in this update; however, renewable energy warrants inclusion for longer term energy and climate action planning. It is encouraging that the upfront costs of renewable energy are very rapidly declining and shifting the market. At the same time, local governments are financially constrained in their role to promote and utilize renewable energy by the nature of currently available financial incentives (e.g., tax credits), which are available to the private sector but not the public sector. The

[4] Solid waste vehicle replacement is already programmed without the assistance of the grant. However, the grant would allow for the purchase of a truck that has fuel savings estimated at ~40%, with an equivalent of 38 tons of CO2 reduction, or the removal of 6-7 cars from the road .

[5] Ryan, M.G. et al. A Synthesis of the Science on Forests and Carbon for U.S. Forests. Issues in Ecology, Spring 2010. Report Number 13.

Town does have land and facilities with solar access that some homeowners and businesses do not have access to. The absence of recommending near future next steps with renewable energy also recognizes the potential for significant staff impact and possibly fiscal impact for pursuing renewable energy and acknowledges the impact that will be involved with other elements of the planning presented[6].

In general, these recommendations present a near term course of action to continue to pursue both community and municipal measures. Town assistance in community energy use improvements may result in relatively small improvements on a relative basis but important on an absolute scale because of the overwhelming (98%) share for the community footprint. Therefore, efforts in the community sector can conceivably be significant in terms of effectiveness for staff hours and municipal budget invested.

The Board specifically asked staff in June, 2013 to consider implications for a 2% versus 7% annual reduction goal in municipal emissions. Some information has been gathered for this update, with a preliminary sense of the scale of fiscal impacts summarized below. However, additional and ongoing study will be needed to more fully document the impact, implications and tradeoffs for this range of annual reduction goals. In addition to the information provided in Table 3 and as a first step towards quantifying the impact, the following points are offered:

- Assuming that a rate structure is available to the Town, implementing LED streetlights is anticipated to be a major step with a relatively rapid payback that could result in a roughly 10% municipal footprint reduction for the year(s) in which fixture replacement occurs. The Town may wish to initiate plans with Duke Energy and pursue other steps to move forward with streetlight upgrades on Town roads to more energy efficient LED lighting, assuming that a rate structure incentivizing the upgrade is available.
- Further study of the fiscal and staff impact of both the measures proposed in this memo and any new measures identified will be included in the upcoming draft plan, CIP update, and annual operating budget.
- The municipal inventory update presented in June, 2013 suggests that significant energy savings opportunities could exist for the Century Center, but the specific steps, costs for pursuing the improvements and payback are uncertain without further study, which will require outside assistance. Securing this assistance is recommended for FY 2014-15.
- Community outreach and participation and maintaining a community inventory are both steps that will require further study, staff effort, and funding support. Of note for outreach efforts is the recent loss of outside support due to the expiration of grants for Safe Routes to Schools and the grant administered by the Southeast Energy Efficiency Alliance.
- Support of urban forestry data gathering will enable staff to quantify the value of the urban forest and recommend specific future steps to enhance the urban forest.

[6] In considering future community solar projects, it is worth noting that: 1) the Town Commons project involved about ¼ FTE; 2) Appalachian Institute for Renewable Energy (partner on the Town Commons project) is currently focused on ~50-100kW installations for future projects (10-20 times larger than the Town Commons project).

Table 3: Scale of Fiscal Impact for Next Steps[7]

	Recommended Step	Notes
> $100k	1. Develop and implement comprehensive streetlight replacement plan	1. ~$200k upfront costs; annual cost savings >$50k for ~700 Duke fixtures on Town roads. Energy savings 50% (or more) per fixture and ~10% of municipal energy use (*see footnote #1 on p. 2; preliminary estimate based on Asheville experience*).
$10k-$100k (for each item)	1. Century Center HVAC 2. Building lighting retrofits/controls 3. Replace water fixtures and small HVAC units 4. Additional building studies/ improvements 5. Collect data to support urban forest inventory	1. Cost for Century Center HVAC study to be determined; cost estimate of improvements awaiting results of study (could exceed $100k) 2,3. Cost estimates available from previous studies (see Attachment 3) 4. Additional improvements (e.g., building envelope improvements) would likely require outside support with assessments. Improvements would exceed $100k[8] 5. Data collection for forest inventory to support valuation study using i-Tree Eco requires 2 person crew for 12 weeks, est. $20k.[9] Could cost less, e.g. via internship.
<$10k (for each item)	1. Pursue grant for solid waste truck 2. Support Safe Routes to Schools Implementation 3. Support Elite Pete Volunteers 4. Annual update of municipal inventory	1. Additional information presented at near future BoA meeting. 2-4. <$5k per item

Recommendation

Staff recommends that the Board of Aldermen receive this update, identify any additional initiatives for staff to pursue, and authorize staff to continue work on the plan and include relevant items for the CIP and budget cycle.

[7] For items for which preliminary cost estimates are currently available. Generally, the higher cost items are also anticipated to result in greater staff impact.

[8] Building maintenance offers significant opportunities for reducing operating expenses. For example, as the roof on Town Hall approaches the end of its life cycle the Town has an opportunity to replace it with a more reflective surface which may reduce HVAC loads, particularly if combined with additional attic insulation. Initial estimates indicate that this would be a CIP expense (upwards of $125k for the roof alone), and would likely require a consultant to assist with project management. However, roof replacement, increased attic insulation and HVAC system analysis and upgrades at Town Hall and the Century Center would likely result in a noticeable reduction in energy use and increased comfort for occupants.

[9] Per information provided at i-Tree workshop in Wilmington, NC June 2013.

Attachment 1

Background on Energy and Climate Planning

A baseline greenhouse gas emissions inventory provides a starting point for planning for emissions reductions, and is considered to be one of the 5 milestones of the CCP 5 Milestone process (Table 1).

Table 1. Cities for Climate Protection Five Milestone Process

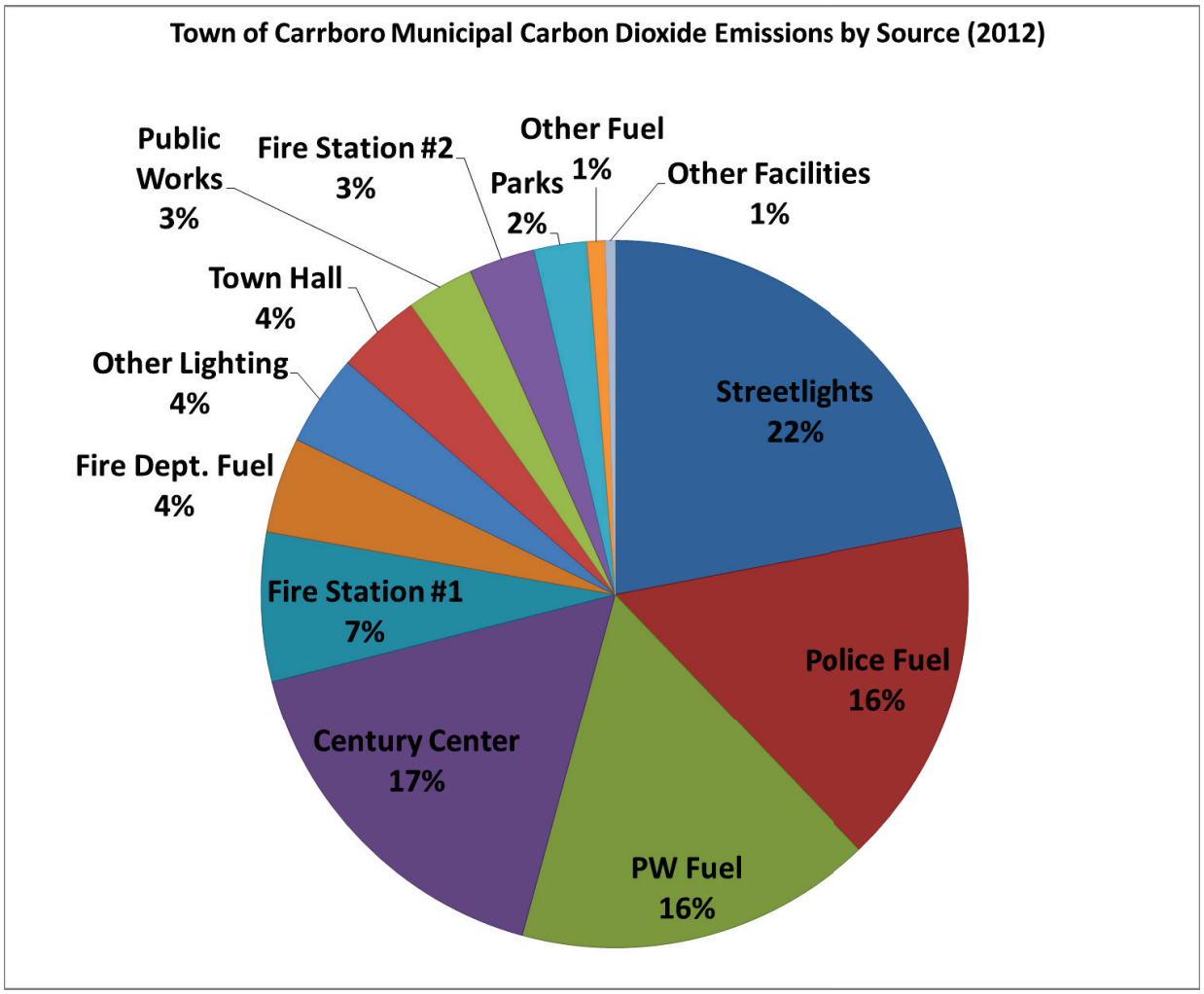
Milestone	Description	Notes
1	Conduct a baseline emissions inventory and forecast.	A summary of the most recent municipal inventory is available from the June 18, 2013 Board of Aldermen agenda item at http://carrboro.legistar.com/Calendar.aspx. Several previous municipal and community inventories have also been completed
2	Adopt an emissions reduction target.	The Orange County Greenhouse Emissions Inventory presented several scenarios for reduction targets. The Board of Aldermen adopted a climate protection resolution in 2009. Further articulation of the resolution using a 2%-7% annual reduction goal is currently being reviewed.
3	Develop a Local Action Plan	The Orange County Greenhouse Emissions Inventory presented preliminary concepts for inclusion in a Local Action Plan. While the Town has not formally adopted a Local Action Plan, the Town has pursued components of a plan, for example, through the WISE program, and through various local planning efforts. Staff intend to present a draft plan after receiving Board feedback for this update.
4	Implement policies and measures	Carrboro has adopted the climate protection resolution, and has pursued various measures, such as: the WISE program; policies and initiatives that encourage alternative transportation; support of alternative fuels; and energy assessments and follow up for Town buildings
5	Monitor and verify results	The Town has been involved in annual monitoring of municipal emissions for the past two years, and worked with a UNC Capstone team on emissions estimates in 2011. This memo recommends that staff continue annual monitoring and also develop an approach for periodically updating community emissions estimates.

Standard greenhouse gas (GHG) reporting classifies emission types into three types or "scopes". Scope 1 emissions are direct emissions resulting from the combustion of fuel on-site. Examples of Scope 1 emissions include vehicular tailpipe emissions from vehicles and emissions from burning natural gas to heat buildings. Scope 2 emissions are indirect emissions associated with the consumption of purchased or acquired energy. Scope 2 emissions primarily result from electricity consumption. Scope 3 emissions are other indirect emissions not covered in Scope 2, such as the extraction and production of purchased materials and fuels, electricity-related activities such as transmission and distribution losses, outsourced activities, and waste disposal. In 2011, a UNC Capstone team provided an inventory for Carrboro (Table 2). The most salient point for the remainder of this memo is that the Town's municipal inventory was calculated as roughly 2k metric tons of carbon dioxide equivalents (MTCDE), or a little less than 2% of the 115k total community inventory, including all community and public sources. This inventory has been subsequently updated twice for municipal sources only (Figure 1).

TABLE 2: UNC Capstone Inventory	Scope 1 GHGs (MTCDE)	Scope 2 GHGs (MTCDE)	Scope 3 GHGs (MTCDE)	Row Total (MTCDE)
Town of Carrboro Municipal Sources (excludes school and OWASA sources)				
Buildings and Facilities	100	484	-	584
Streetlights, Floodlights and Traffic Signals	-	467	-	467
Vehicle Fleet	676	-	-	676
OCSW	-	-	55	55
Public Transit* (Chapel Hill Transit)	-	-	960	960
Municipal Subtotals *(excluding Scope 3)*	***776***	***951***	-	***1,727***
Municipal Subtotals *(including Scope 3)*	***776***	***951***	***1015***	***2,742***
Town of Carrboro Public Sources (includes municipal, school, OCSW and OWASA sources)				
Schools (within municipal limits)	1,292	4,651	-	5,943
OWASA	-	-	2,030	2,030
Public Subtotals *(excluding Scope 3)*	***2,068***	***5,602***	-	***7,670***
Public Subtotals *(including Scope 3)*	***2,068***	***5,602***	***3,045***	***10,715***
Town of Carrboro Community Sources (excludes public sources)				
Residential	8,430	44,691	-	53,121
Commercial	1,782	16,687	-	18,469
Industrial	15	39	-	55 (due to rounding)
Transportation (within municipal limits)	31,576	-	-	31,576
OCSW	-	-	1,678	1,678
Community Subtotals *(excluding Scope 3)*	***41,803***	***61,417***	-	***103,220***
Community Subtotals *(including Scope 3)*	***41,803***	***61,417***	***1,678***	***104,899*** (due to rounding)
Town of Carrboro Sources (includes community and public sources)				
Town total *(excluding schools, excluding Scope 3)*	42,579	62,368	-	***104,946***
Town total *(including schools, excluding Scope 3)*	43,871	67,019	-	***110,889***
Town total *(including schools, including Scope 3)*	43,871	67,019	4,723	***115,614*** (due to rounding)

* For this table, Chapel Hill Transit buses GHG emissions are considered as Scope 3 relative to Carrboro because the Town of Chapel Hill administers the service.

Figure 1[10]



[10] Inventory update completed by Chris Lazinski, first as a UNC DELTA Fellow and then under contract. Emissions are shown for 2012. For future calculations, staff intend to use a 3-year average as a baseline.

Existing Initiatives

Carrboro has historically pursued initiatives that are primarily or secondarily motivated by reductions in energy use and emissions (especially for the community sector) which are briefly discussed in this section.[11] The community transportation sector is perhaps the sector that the Town has been most active in. To provide alternatives to vehicle use in general, the Town has been a partner in the State's most ambitious and successful (and fare free since 2001) transit program (Chapel Hill Transit) for several decades. The system provides over 7 million rides per year. The Town contributes about $1M annually to the operation of the system, or about 5% of the Town's annual budget. In addition to the high ridership, higher efficiency busses are being employed in the fleet, with 15 new hybrid busses acquired in 2013 (one third of the fleet is now employing hybrid technology), and solarizing lighting at bus stops has also been pursued. The Town has also been assertively supporting bicyclists and pedestrian for many years, with the Town being recognized as a "Silver" level bicycle friendly community by the League of American Bicyclists. (Carrboro is one of a handful of communities, and the smallest, east of the Mississippi River to receive this designation.) The Town has promoted walkability and bikability through the Safe Routes to Schools Action Plan, bicycle facilities[12], and sidewalks and greenways with support from a bond passed in 2003. The Town continues to pursue other measures (e.g., transportation demand management, transit-oriented/mixed use land use planning, participation in regional transit efforts, road connectivity, alternative fuels) to reduce community vehicle miles traveled and emissions and encourage alternative transportation modes. A relatively recent area of focus relevant to community transportation has been working to expand affordable housing options for workers employed in and near Carrboro that currently commute long distances, in part because of high local housing costs.

With support from federal stimulus funds, Carrboro pursued efforts in the past several years to reduce energy use in buildings in the community through establishment of the "Worthwhile Investments Save Energy" (WISE) program. During the recently ended grant period, the Carrboro WISE program: provided commercial loans to local businesses through the Energy Efficiency Revolving Loan Fund (EERLF); provided incentives for 18 single-family home and two multifamily complexes energy efficiency retrofits; reached over 200 additional citizens in Chapel Hill and Carrboro through a grass roots energy efficiency outreach and education campaign; and trained home performance contractors to be Home Performance with Energy Star certified contractors.

[11] Carrboro is one of 34 communities that has achieved the NC League of Municipalities Green Challenge "Advanced" level (2009).
[12] e.g., bike lanes, sharrows, multi-use paths, paved shoulders

While not being formally part of Carrboro municipal operations, entities that the Town cooperates with are important partners for energy and climate action efforts. Perhaps the two most important of these are OWASA and Orange County. OWASA's water conservation efforts are important for energy conservation, as every gallon conserved is a gallon that is not pumped and treated. OWASA staff estimate that, for every 1000 gallons of treated water and sewage conserved, 7.5 kilowatt hours (kWh) of energy/electricity are also saved, which is equivalent to the energy generated by the solar array at Town Commons for 1.5 hours. In addition, OWASA is pursuing opportunities to reduce energy use and costs e.g., by replacing older mechanical equipment with more efficient units, installing more efficient lighting and temperature controls, and using renewable energy sources instead of conventional fuels. Promising energy conservation projects that OWASA has identified include the replacement of the methane gas engine and boilers and the installation of a new aeration system at the Mason Farm Wastewater Treatment Plant. For solid waste, Orange County is recognized as being number one in the state for waste reduction, reaching 59% of its 61% reduction goal. The County is disposing 0.56 tons/person compared to the base year of 1991-92, when the disposal rate measured 1.36 tons. Waste reduction benefits emissions reductions both through reductions in methane (a potent greenhouse gas which is being captured at the landfill) and reduced emissions associated with hauling. The Town is faced with an emission reductions challenge with the closure of the landfill on Eubanks Road given the longer transport to the transfer station and out-of-county landfill. Another partner worth mentioning is Piedmont Biofuels (PBF) Cooperative; the Public Works facility has been hosting a community biodiesel pump run by PBF since 2004, with this pump being one of the earliest on the "B100" trail, and the supply chain for the fuel produced being provided from carbon neutral local sources.

For Town operations, the Town has taken the following steps in the past to address emissions. In 2008 and 2009, the Town partnered with Waste Reduction Partners, a program sponsored by the State and Triangle J COG, to perform an energy audit of Town buildings (Century Center, Town Hall, Fire Station #1, Public Works). The Town also worked with Big Woods Engineering in 2009-2010 to identify lighting and HVAC retrofits that could be pursued through the Energy Efficiency Conservation Block Grant program administered by the State Energy Office for these four buildings. (The grant application was not funded because criteria favored economically disadvantaged communities; more information on measures recommended is available in Attachment 2.) The Town also designed the new fire substation on Homestead Road to LEED silver standards. In the past several years, Public Works staff has been replacing older (T-12 fluorescent) lighting ballasts and bulbs with higher efficiency (T-8) ballasts and bulbs. Public Works staff estimate that 40% of these fixtures have been upgraded to date. Other incremental steps have also been pursued, such as installation of programmable thermostats, a community solar project at the Town Commons, and contributions ($80/month) for renewable energy to NC Green Power. The Town has also taken steps for the municipal fleet to reduce emissions, use alternative fuels, and save on operational expenses. Examples include: purchasing hybrid vehicles; implementation of 2007 emissions standards phased in over several years; downsizing/rightsizing of vehicle purchases; adoption of idling policy; and a fuel conservation initiative.

Attachment 2

LED Streetlights: Summary of Asheville Experience

Asheville is in the third and final phase of the streetlight upgrade program in which traditional bulbs will be upgraded to LED fixtures. When complete in 2013 all roads in city limits except NC Department of Transportation roads will be upgraded to LED streetlights. Over the last two years the City has upgraded 3,400 street lights to energy efficiency LED technology and expects to complete the city wide program in 2013, bringing the total to 7,400 fixtures. Once completed, all three phases are expected to save $450,000 annually and 1,294 tons of avoided carbon, which is equal to the emissions from burning 7 rail cars of coal. This lighting upgrade will result in reducing City of Asheville overall municipal carbon footprint by roughly 8%, a tremendous impact for one capital improvement project. The energy savings from the street lights are reinvested into additional efficiency improvements and sustainability programs through the Green Capital Improvement Program. The City of Asheville is the first in the nation to implement this innovative financial model that ensures the city has adequate resources to continue carbon reduction efforts in lean fiscal years. The lights typically last over 100,000 hours, or 20+ years, and feature a "plug and play" electrical system, which lowers maintenance costs. The LED lamp is also now owned by the City, rather than leased from the utility company, which also saves money. These lighting upgrades build further upon the successful lighting ordinance passed in 2008 which ensures all municipal streetlights adhere to "Dark Sky" standards. The lights have a 0 Backlight, Uplight and Glare "BUG" rating, meaning there is no light trespass or sky glow. Asheville has installed lights manufactured by CREE, with Durham/RTP based headquarters and technology development offices.

More information is available at:
http://coablog.ashevillenc.gov/2012/11/led-streetlights-coming-to-a-street-near-you/
http://coablog.ashevillenc.gov/2011/05/city-of-asheville-streetlight-led-upgrades-begin-this-week/
http://www.ashevillenc.gov/Portals/0/city-documents/Finance/Budget/CIPandDebtFY1112.pdf
http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/msslc-case-studies_webcast_05-08-2013.pdf
http://www.cree.com/Lighting/Products/Outdoor/Streetlights/XSP-Series-Streetlight

Attachment 3

Summary of Recommended Energy Improvements for Municipal Buildings, 2010 Study
(Big Woods Engineering)[13]

Building/Improvement	**Upfront Cost**	**Annual Energy Savings**	**Annual Cost Savings**
Town Hall: 1) Lighting retrofit: T12 to T8 fixtures/lamps (50% delamping); Incandescent to CFL; Exit signs to LED 2) Heat pump replacement : 4 units (2,3,4,5 ton), 6 SEER to 16 SEER	$30k	44,865 kWh	$4030
Fire Station #1: 1)Lighting retrofit: T12 to T8 fixtures/lamps (50% delamping); 2) Heat pump replacement : 4 units (3 ton), 8 SEER to 16 SEER	$23k	19,700 kWh	$1170
Public Works:1) Lighting retrofit: T12 to T8 fixtures/lamps (50% delamping)	$8k	10,270 kWh	$822
Century Center: Lighting Controls: new switches and sensors for corridors, meeting rooms, and offices- substantial wiring work required and engineer stamp. 60 fixtures are currently uncontrolled and on 24/7. Remaining fixtures to be controlled would benefit from sensors in meeting rooms, offices, and other rooms. (*Note that heating/cooling system beyond scope of Big Woods study*)	$15k	38,000 kWh	$2300

[13] Public Works staff estimate that T12 to T8 replacements are 40% complete.
The costs and energy savings have not been adjusted for inflation or other factors from 2010. More efficient (19 to 20 SEER rated), and more expensive, heat pumps are now available. The cost of a four ton 20 SEER unit currently averages about $6,500 to $7500.

Attachment 4

Urban Forestry, Climate Protection, and Ecological and Community Benefits

The following discussion demonstrates why Carrboro's urban forest has a wide variety of benefits that include but are not just limited to climate protection and energy management.[14] Therefore, there is significant merit and synergy in managing the forest to reduce energy consumption and store carbon, while simultaneously forwarding many community goals.

Nationally, urban forests in the United States are estimated to contain about 3.8 billion trees, with an estimated structural asset value of $2.4 trillion. This dollar value reflects only a portion of the total worth of an urban forest. Urban trees also provide innumerable ecosystem services that affect both the local physical environment (such as air and water quality) and the social environment (such as individual and community well-being) that contribute to urban quality of life.

Urban forest services and benefits include:

Local climate and energy use—Trees influence thermal comfort and energy use by providing shade and reducing wind speeds. The establishment of 100 million mature trees around residences in the United States has been estimated to save about $2 billion annually in reduced energy costs. For example, three or more large trees strategically placed on sunny sides of a house shade it from the hot summer sun, thus reducing the air-conditioning cost as much as 30 percent.

Carbon storage—urban trees mitigate climate change by directly storing carbon within their tissues and by reducing carbon emissions from power plants through lowered building energy use. Urban trees in the conterminous United States have been estimated to store 770 million tons of carbon, valued at $14.3 billion. One acre of forest absorbs six tons of carbon dioxide and puts out four tons of oxygen. This is enough to meet the annual needs of 18 people.

Air quality—Trees improve air quality by lowering air temperatures and removing air pollutants and in doing so, reducing the impacts of emissions from both stationary and mobile sources. Urban trees in the conterminous United States have been estimated to remove some 784,000 tons of air pollution annually, with a value of $3.8 billion.

Water flow and quality—Trees improve water quality, reduce runoff and erosion, and mitigate the need for costly stormwater treatment by intercepting and retaining or slowing the flow of precipitation reaching the ground. This allows more recharging of the ground water supply. During an intense storm in Dayton, OH, for example, the tree canopy was estimated to reduce potential runoff by 7 percent. In Carrboro, increased tree canopy could have a specific regulatory benefit of helping the Town comply with rules to protect Jordan Lake by reducing nitrogen and phosphorus in runoff.

Wildlife and biodiversity—Urban forests help create and enhance animal and plant habitats.

Soil quality—Trees and other plants help improve soil quality by breaking up heavy soils, mining nutrients, and remediating soils at contaminated sites by absorbing, transforming, and containing a number of contaminants.

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[14] Most of information in this section extracted from Nowak, D. et al., "Sustaining America's Urban Trees and Forests". USDA Forest Service, Northern Research Station. State and Private Forestry General Technical Report NRS-62. June 2010.

Community well-being—Urban forests make important contributions to the economic vitality and character of a city, neighborhood, or subdivision. Community involvement in urban forestry efforts has been demonstrated to contribute to a stronger sense of community and neighborhood empowerment.

Individual well-being and public health—The presence of urban trees and forests creates a more aesthetic, pleasant, and emotionally satisfying place in which to live, work, and spend leisure time. Urban trees also provide numerous health benefits. For example, tree shade reduces ultraviolet radiation and its associated health problems. Hospital patients with window views of trees have been shown to recover faster and with fewer complications than patients without such views. The reduction in airborne pollutants results in significant human health benefit such as reduced rates of respiratory disease and illness. In laboratory research, visual exposure to settings with trees has produced significant recovery from stress within five minutes, as indicated by changes in blood pressure and muscle tension.[15]

Aesthetics- trees are not only beautiful in themselves but add beauty to their surroundings. Trees add color to the urban scene, soften the harsh lines of buildings, screen unsightly views, and provide privacy and a sense of solitude and security, while contributing to the general character and sense of place in communities. The specimen trees in downtown Carrboro are a great example of this benefit.

Noise abatement—properly designed plantings of trees and shrubs can significantly reduce noise. Wide plantings (around 100 ft.) of tall dense trees combined with soft ground surfaces can reduce apparent loudness by 50 percent or more (6 to 10 decibels).

Real estate and business—landscaping with trees can increase property values and commercial benefits. One study found that on average, prices for goods purchased in Seattle were 11% higher in landscaped areas than in areas with no trees. A mature tree can often have an appraised value of between $1,000 and $10,000[16]. Landscaping, especially with trees, can increase property values as much as 20 percent.[17]

A well-recognized national nonprofit, American Forests, recommends that communities set and maintain tree canopy goals. A community can design tree cover targets that fit the policy and environmental quality needs of the community. Chapel Hill updated its tree protection ordinance, and in doing so, established minimum tree canopy standards:[18] As another local example, Raleigh recognizes the community benefits of the urban forest by treating it as a local government capital responsibility. The City not only maintains an active urban forestry program[19], but also includes significant funds for tree replacement in their capital budget.

Town staff are considering using i-Tree, a state-of-the-art, peer-reviewed software suite from the USDA Forest Service, as a tool to support urban forestry efforts. The i-Tree tools help communities strengthen their urban forest management and advocacy efforts by quantifying the environmental services that trees provide and the structure of the urban forest. More information is available at http://www.itreetools.org/index.php.

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[15] Dr. Roger S. Ulrich Texas A&M University, as reported by City of Raleigh
[16] Council of Tree and Landscape Appraisers, as reported by City of Raleigh
[17] ICMA, as reported by City of Raleigh
[18] http://www.townofchapelhill.org/index.aspx?page=879 (December, 2010)
[19] http://www.raleighnc.gov/neighbors/content/PRecParks/Articles/UFDivision.html