Sustainability Action Plan
Greensboro, North Carolina

Recommended by the Community Sustainability Council

Accepted by the Greensboro City Council 1/4/2011

November 2010

Dear Council Members,

On behalf of the entire Community Sustainability Council (CSC), we are pleased to present to you the City of Greensboro's first ever Sustainability Action Plan.

The practice of sustainability seeks to balance the environmental, economic and human needs of our current generation with the need to proactively safeguard our community's environmental and economic future. This Action Plan recommends a number of policies and strategies the City can adopt to do so.

The Action Plan is the culmination of a two-year process of collecting public input, working with City staff and developing CSC recommendations around a number of key topic areas. It includes several recommended policies and strategies the City and community can support to reduce greenhouse gas (GHG) emissions, improve energy efficiency, provide for economic development opportunities, promote an improved quality of life and save taxpayer money. Among the many anticipated co-benefits of these policies and strategies are reduced energy and fuel costs, more green jobs, improved air quality, improved public health and greater educational opportunities.

This Action Plan has been developed in the context of difficult economic times, significant City budgetary constraints and unpredictable future energy costs. This plan is only a beginning, starting with measures that have little or no cost to implement, yet provide significant benefits to the City and community in terms of increased energy and resource efficiency. In addition to the significant federal Energy Efficiency and Conservation Block Grant (EECBG) funds the City recently received, having a completed Action Plan also positions the City well to pursue similar future funding opportunities.

Essential to our overall recommended strategies is the establishment of a Cash Flow Sustainability Account, which would divert 50 percent of operating cost savings from City energy efficiency and conservation projects to fund additional such projects, with the remaining 50 percent allocated to the City's general budget. Such an account will provide funding for the next round of measures that may require more upfront money, but will be crucial to making meaningful reductions in GHG emissions and safeguarding our economy.

We believe the time to act is now. While the strategies in the Action Plan only begin to stabilize the City's GHG emissions, they provide critical momentum to move the City in the right direction and become more energy and resource efficient while saving money. And, with additional support for outreach and education efforts, it sets the stage for the City's long-term progress and benefits, both environmentally and economically.

We thank you for your consideration and look forward to discussing the Action Plan's many benefits with you in more detail.

Sincerely,

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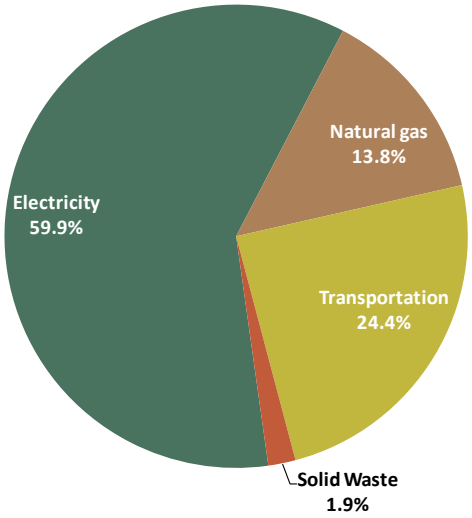
Executive Summary

A Sustainability Action Plan (Action Plan) has been developed to document Greensboro's progress toward sustainability and advise City Council on actions the City can take to effectively manage energy, resource use and waste production internally and promote these and other actions throughout the community. Its goals are to reduce greenhouse gas (GHG) emissions, improve energy efficiency, provide for economic development opportunities, promote an improved quality of life and save taxpayer money. Among the many anticipated co-benefits are reduced energy and fuel costs, more green jobs, improved air quality, improved public health and greater educational opportunities.

A GHG inventory has been compiled for the Greensboro community. In 2007, Greensboro's community GHG emissions totaled an estimated 5.5 million metric tons of carbon dioxide equivalent ($MTCO_2e$). Based on projected growth rates, total community emissions are estimated to be approximately 6.9 million $MTCO_2e$ in 2020. The primary sources of emissions include electricity use and natural gas consumption, transportation and solid waste.

City of Greensboro 2007 Emission Sources (community-wide) 5,517,198 Metric Tons CO2e



Based on discussions and review of the GHG inventories, the Community Sustainability Council (CSC) has recommended the City establish a preliminary goal of stabilizing GHG emissions at forecasted 2010 levels by the year 2020.

To make progress toward this goal as well as pursue community sustainability overall, the Action Plan includes 12 policies and supporting strategies organized around 8 topic areas identified by the CSC in dialogue with City staff and the community over the last two years. These policies are summarized below:

Topic Area	Proposed Policies
Transportation and Land Use	*Policy 1 - Transportation and Land Use*: Encourage increased density, a mix of land uses and more integrated links between transportation and land use through changes to Greensboro's Comprehensive Plan, Development Ordinance and other related plans. *Policy 2 - Transportation and Land Use:* Reduce vehicle miles traveled, including the use of single-occupant vehicles, by promoting alternative forms of transportation and providing greater infrastructure for mass transit, cycling and other non-vehicular travel options.
Green Jobs and Buildings	*Policy 3 – Green Jobs and Buildings*: Develop a coordinated City program to provide technical support, energy audits and education and outreach to increase energy efficiency and

Topic Area	Proposed Policies
	conservation in commercial and residential buildings. *Policy 4 – Green Jobs and Buildings:* Use a combination of code changes, incentives, partnerships and education to promote green building in Greensboro. *Policy 5 – Green Jobs and Buildings:* Work with community partners to encourage green job creation, training and placement. *Policy 6 – Green Jobs and Buildings:* Promote more efficient use of water through education, partnerships and pilot projects.
Waste Reduction and Recycling	*Policy 7- Waste Reduction and Recycling:* Employ a combination of expanded recycling infrastructure, regulations and incentives to reduce waste generation and increase Greensboro's solid waste diversion and recycling rates.
City Operations	*Policy 8 – City Operations:* Develop standards, infrastructure, practices and projects to make City operations more energy, resource and cost efficient.
Nature in the City	*Policy 9 - Nature in the City:* Establish and enhance green corridors, parks and other City spaces for community gardens, green technologies, recreation, habitat and other community benefits.
Education and Outreach	*Policy 10 – Education and Outreach*: Support development of community leadership and volunteer programs to further community energy and sustainability efforts. *Policy 11 – Education and Outreach:* Provide technical support, awards and recognition to individuals and organizations furthering Greensboro's energy and sustainability efforts.
Green Technologies	As the Action Plan is implemented and updated in the future, it is recommended that the City continue to explore local green technologies and resources such as biofuels/landfill gas, active solar hot water, solar photovoltaics (PV), industrial scale waste heat recovery and smart grid.
Adaptation	*Policy 12 – Adaptation:* The City should develop a framework for adapting to a changing climate and integrating adaptation into its plans, ordinances and programs.

Collectively, these policies, along with strategies already funded as part of the City's recently completed Energy Efficiency and Conservation Strategy (EECS), are anticipated to reduce GHG emissions by 276,000 $MTCO_2e$ annually in 2020 and result in a cumulative cost savings to the City and community of approximately $29 million between 2010 and 2020. The estimated cumulative minimum cost to implement all polices and strategies is approximately $9.3 million in addition to funding already secured under the Department of Energy's Energy Efficiency and Conservation Block Grant Program.

This Action Plan is considered the first version of what will be a "living document," subject to further review and revision as strategies are implemented, progress is monitored, new strategies developed and goals revisited.

1.0 Introduction

The City of Greensboro finds itself in a time of rapid change – and challenge – not only in the capacity of the City's own resources, but also in the changing world around it. Recent economic challenges have pushed the City and the community to seek ways to be more resourceful, while rising energy prices and a changing climate paint an uncertain future.

Yet in these challenges and uncertainties lie great opportunities for Greensboro. They can prompt the City and community to become more energy and resource efficient and cut operating costs while doing so. The City can seek new ways to partner and collaborate with the community to educate and engage residents in energy, water and resource saving opportunities. Greensboro can explore new ways to configure land uses and transportation systems that give its citizens more choices and opportunities, and make community buildings and transportation systems more efficient. Finally, the City and community can look for ways to train the next generation work force to benefit from the emerging new energy economy, providing jobs for Greensboro residents and new opportunities for local business. All of these strategies can not only help reduce the impact of a changing climate on Greensboro or the impact of possible changes in energy supply and costs, they provide many co-benefits to the community, from cost savings to creating healthier and more livable neighborhoods.

The purpose of this Sustainability Action Plan (Action Plan) is to advise City Council on actions the City can take to effectively manage energy, resource use and waste production internally and promote these and other actions throughout the community. Its goals are to reduce greenhouse gas (GHG) emissions, improve energy efficiency, provide for economic development opportunities, promote an improved quality of life and save taxpayer money.

The recommended policies and strategies in this Action Plan intersect with many other City planning efforts, such as the Comprehensive Plan, the Housing and Community Development Consolidated Plan, the Transportation Improvements Plan and the Land Development Ordinance. To the extent feasible, the City should seek out opportunities to coordinate and create synergies between implementation of this Action Plan and these other planning efforts.

The policies and strategies identified in Section 5.0 of this Action Plan have been developed around several topic areas identified by the Community Sustainability Council (CSC) in dialogue with City staff and the community over the last two years. The topic areas addressed by the Plan include the following:

- Land Use and Transportation
- Green Jobs and Buildings
- Recycling and Waste Reduction
- City Operations
- Nature in the City
- Education and Outreach
- Green Technologies
- Adaptation

1.1 The Case for Reducing GHG Emissions

Many local governments, institutions, regional organizations and companies have embarked on efforts to reduce their GHG emissions associated with energy use, transportation, solid waste and other topic areas. While a driving force for many of these efforts has been to reduce contributions of GHGs to the atmosphere, there are many other benefits to Greensboro from reducing its GHG emissions. Several studies demonstrate that the implementation of GHG reduction strategies, such as improving building energy efficiency and public transit, have a positive impact on local and regional economies. Many of the policies and strategies contained in this Action Plan focus on reducing Greensboro's dependence on non-renewable fossil fuels and the amount of waste produced by the community, as well as reaping the benefits of a rapidly growing clean energy and green technology economy that can bring more jobs to the community. If implemented, these strategies will not only reduce Greensboro's GHG emissions, but over time they will enhance its economic vitality, as well as its viability as a sustainable, livable city.

A recent study by Appalachian State University reinforces the benefits that GHG reductions can have for North Carolina's economy. On the whole, the study showed the implementation of bundles of GHG emission reduction strategies identified by the North Carolina Climate Action Plan Advisory Group (CAPAG) would result in a mildly positive economic impact on North Carolina's economy. By 2020, the options analyzed would result in the creation of more than 15,000 jobs, $565 million in employee and proprietor income and $302 million in gross state product. For the study period, 2007 to 2020, the options analyzed would generate more than $2.2 billion net present value (NPV) in net additional employee and proprietor income, and more than $1.2 million NPV in net gross state product. In short, the CAPAG's recommendations document the opportunities for the state to reduce its GHG emissions while continuing its strong economic growth by being more energy efficient; using more renewable energy sources; and increasing the use of cleaner transportation modes, technologies and fuels[i].

Clearing Greensboro's Air

Poor air quality has been and continues to be a significant public health problem for Greensboro and the Triad. Many actions Greensboro can take to reduce GHG emissions will also improve air quality, benefitting the entire community.

Across the country, more and more local governments are committing to reduce GHG emissions and developing plans to achieve their goals - as of March 2010, over 1,000 cities across the country had signed the U.S. Conference of Mayors Climate Protection Agreement, making a pledge to reduce their GHG emissions. Along with reducing emissions and costs in their own operations, these cities are leading by example, helping to engage businesses, residents and organizations in their communities to realize the benefits of reducing their own emissions.

Some GHG Reduction Co-Benefits

- Support local businesses and stimulate economic development
- Reduce government, home and business energy and operational costs
- Reduce dependence on foreign fuel sources
- Reduce vulnerability to energy price increases and supply volatility
- Diversify energy supply and reduce loads on transmission system
- Reduce air pollution emissions, including ozone precursors and fine particles
- Improve public health through increased exercise and nutritious foods
- Reduce waste and increase landfill diversion rates
- Reduce vehicle miles traveled and traffic congestion
- Reduce water consumption in the community and impacts on water bodies and riparian habitats
- Provide opportunities for regional, state and national leadership and recognition
- Improve quality of life through preservation of urban forest, reduced commuting times and increased access to nature and open space
- Improve educational opportunities

2.0 History of Resource Efficiency and Sustainability

2.1 Community Sustainability Council

Within the Greensboro community there have been many efforts and projects taking place over the years to address the City's progress on energy and resource efficiency, GHG emissions reductions and sustainability. However, prior to 2008 there had not been an organizing body to pull these sustainability efforts together and effectively guide public policy. Greensboro's CSC was created by the City Council in April 2008 to fill such a role. The CSC has provided a venue to comprehensively evaluate and discuss the City's progress toward sustainability and has played the primary role in developing the policies and strategies in this Action Plan.

2.2 U.S. Conference of Mayors Climate Protection Agreement

In August 2007 the Greensboro City Council pledged to reduce GHG emissions when it voted to support the U.S. Conference of Mayors Climate Protection Agreement through actions ranging from anti-sprawl land-use policies to urban forest restoration projects to public information campaigns[ii]. Specifically, the resolution passed by the City Council expressed:

"That the City of Greensboro will support the U.S. Mayors Climate Protection Agreement as endorsed by the 73rd Annual U.S. Conference of Mayors."

Mayor Holliday signed the U.S. Mayors Climate Protection Agreement as endorsed by the 73rd Annual U.S. Conference of Mayors.

2.3 Greensboro's Progress Prior to the 2007 Greenhouse Gas Inventory

Inventories of GHG emissions associated with both City operations and the community have been completed to establish a "baseline" year of 2007 from which to measure progress. The City and community, however, made progress on projects prior to 2007 that have already contributed to reducing GHG emissions associated with City operations and the community. For example, the City purchased its first hybrid vehicle for its fleet in 2003 and has adopted a policy to purchase the smallest, most fuel efficient vehicle practical for the job to be performed. A number of improvements have also been made to City

What are Greenhouse Gases?

A greenhouse gas (GHG) is any gas that absorbs radiation in the atmosphere, contributing to climate change. Greenhouse gases include carbon dioxide, methane, nitrous oxide, perfluorocarbons, hydrofluorocarbons and sulfur hexafluoride. Carbon dioxide equivalent (CO_2e) is a unit that represents the global warming impacts of all these gases. For example, 1 metric ton of methane (CH_4) has a global warming potential of 21 and is therefore equivalent to 21 metric tons CO_2e ($MTCO_2e$).

buildings to make them more energy and resource efficient. These and other actions cumulatively contributed to GHG emissions reductions that are already reflected in the 2007 inventories.

Progress was also made on a community level in Greensboro prior to 2007. For example, the University of North Carolina at Greensboro first completed its Strategic Energy Plan in 2003, identifying strategies and actions to make the campus more energy efficient. Guilford College has installed the largest array of solar thermal panels of its kind on any college campus in the nation to provide hot water to its residence halls, dining hall and other buildings. Greensboro is also home to the Proximity Hotel, the nation's first hotel certified as "Platinum," the highest level of certification under the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program, and Bull Ridge, the first commercial spec warehouse in the country to achieve LEED certification. The community's traffic lights have been converted to low-energy light-emitting diodes (LEDs) and a user-friendly recycling program is in place.

In December 2009, the City completed and submitted to the U.S. Department of Energy an Energy Efficiency and Conservation Strategy (EECS) to serve as a road map for spending approximately $2.55 million in federal Energy Efficiency and Conservation Block Grant (EECBG) funds allocated to the City. The EECS, developed with input from the CSC, the community and City staff, identifies nine distinct strategies for promoting energy efficiency and conservation in City operations and the community, including the following projects:

- Improving City Facility, Multi-family and Construction Waste Recycling
- Energy Efficiency Retrofits and Building Automation System Improvements for City Buildings
- A Hydroelectric Turbine at the City's Water Treatment Plant
- Solar LED Street Lights for Phase 1A of the Downtown Greenway
- Green Jobs Development Infrastructure
- An Energy Outreach and Education Program
- A Residential Energy Audit, Implementation Support and Retrofit Demonstration Program
- A Revolving Loan Fund Program
- Comprehensive Plan Sustainability Recommendations

Collectively, these 9 projects are estimated to reduce GHG emissions in Greensboro by over 5,000 metric tons of carbon dioxide equivalent ($MTCO_2e$) annually during the term of the grant.

The City and community partners have also applied for other grants that would support and complement the policies and strategies in this Action Plan. This past spring the City was awarded a $5 million BetterBuildings grant from the Department of Energy to be used for residential and non-residential energy retrofits on existing buildings.

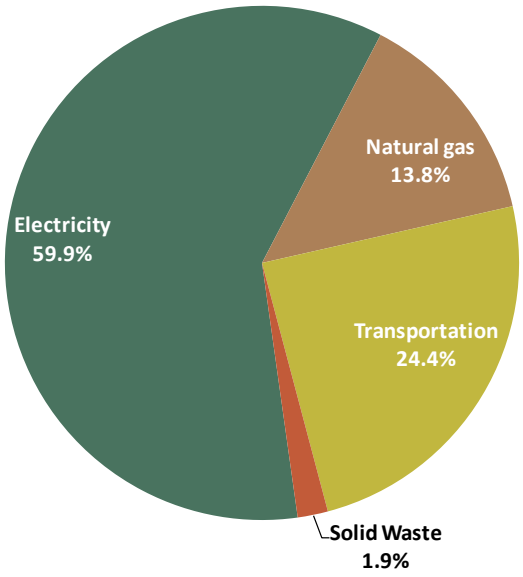
3.0 Greenhouse Gas Inventory and Projections

In 2009 the Center for Energy Research and Technology at North Carolina A&T State University produced a *Greenhouse Gas & Criteria Air Pollutant Emissions Inventory* for the Greensboro community. The data, methodologies and outcomes of the Inventory were reviewed, confirmed and expanded on for inclusion in this Action Plan. The inventory used accepted methodologies and emission factors from the organization Local Governments for Sustainability (ICLEI) and their associated Clean Air and Climate Protection (CACP) software.

In the baseline year for the inventory, calendar year 2007, community GHG emissions totaled an estimated 5.5 million $MTCO_2e$ (Figure 1). The GHG inventory includes emissions from most source activities in the community including energy consumption in buildings and processes (e.g. lighting, heating, cooling, fans, equipment, cooking), transportation (e.g. vehicle transportation on roads - cars, trucks and buses) and solid waste disposal. The emissions from these sources include residential, commercial, industrial, institutional and municipal activities. The data from which these emissions are calculated were provided by local utilities, planning organizations and the City of Greensboro. More details on the data sources and inventory methodology are provided in Appendix A.

Figure 1. Greensboro's 2007 Community-wide GHG Emission Sources

5,517,198 Metric Tons CO2e

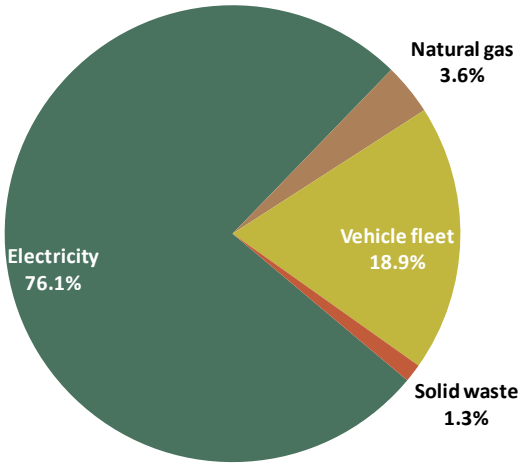


In addition to the community-wide inventory for Greensboro, an inventory of GHG emissions associated with City operations has also been completed. In 2007, GHG emissions from the City's operations,

primarily from building energy use, provision of services (including water treatment and distribution), and vehicle and equipment fleets, were estimated to be 122,458 MTCO2e, or about 2 percent of community-wide emissions.

Figure 2. Greensboro's 2007 City Operations GHG Emission Sources

122,458 Metric Tons CO2e



To enable planning toward a future GHG reduction goal, a forecast of Greensboro's community emissions has also been prepared. For the purpose of this forecast, it was assumed that emissions would grow at the rates presented in Table 1.

Based on these projected growth rates, total community emissions are estimated to be 6,889,423 $MTCO_2e$ in 2020.

Table 1. GHG Emission Growth Rate Factors

Emission Source	Growth Rate (year-over-year)	Source
Electricity and natural gas consumption	1.5 percent	North Carolina Climate Action Plan Advisory Group (CAPAG)
Transportation	2.4 percent	CAPAG
Solid Waste	1.2 percent	County of Guilford Solid Waste Management Plan Update, 2009

4.0 Sustainability Action Plan Development Process

This Action Plan is the outcome of efforts dating back to 2008 and reflects collaboration among the CSC, City staff and Greensboro community. This process included gathering input, taking stock of Greensboro's progress to date, researching opportunities and ideas from other communities and setting goals. This process is outlined in more detail below.

4.1 Collaboration Process

Collaboration for developing this Plan has included not only the extensive work of the CSC committee members in monthly meetings, but also input from City staff and the Greensboro community at large. The CSC took the first major step to engage the broader community in preparation for this effort in November 2008, when it held its first community-wide Environmental Gathering. Over 140 people attended the meeting, representing more than 60 community neighborhoods, organizations, faith communities and businesses. The purpose of the gathering was to brainstorm project ideas and to gauge the community's interest to engage in change and be proactive in various environmental sustainability areas.

In July 2009, the City invited residents to again provide input during two public meetings on ways to make Greensboro more 'green' by suggesting strategies for the EECS. Feedback from the meetings and a subsequent online survey were used to inform both the EECS and this Action Plan.

In fall 2009, the City, funded by federal EECBG funds, engaged a consultant team to develop the EECS, and to collect input on additional strategies for this Action Plan. In October 2009, the City hosted two more public open houses to invite the public's input for both the EECS and the Plan. Comments were collected to generate additional ideas, establish priorities and further refine ideas contributing to the policies and strategies in this Action Plan.

4.2 Mission and Goal Development

A foundation of this Action Plan is the following mission statement and a long-term GHG reduction goal to guide the development of policies and strategies, as well as future updates to the Action Plan. The mission statement is a reflection of the priorities and mission of the CSC, while the Action Plan's goal is the outcome of discussions among City staff and CSC members, with support from community input. This goal reflects not only Greensboro's unique conditions and priorities, it has also been developed in the context of creating a goal that is realistic and feasible for Greensboro to achieve. As progress is made on implementing this Action Plan, there will be opportunities to revisit interim and long-term goals and make adjustments as appropriate.

Mission Statement

The mission of this Action Plan is embodied in the overall mission established for the CSC. Specifically, the mission of the CSC is to research, advocate, coordinate and provide outreach for local measures to:

- Reduce energy use and CO_2 emissions
- Identify costs of implementation and possible funding strategies
- Monitor the progress and effectiveness of measures adopted by the Greensboro City Council

The completion of this Action Plan is another step in the CSC's efforts to serve City Council by formulating and suggesting strategies to reduce pollutants, reduce energy costs, conserve resources, protect and strengthen the local economy and save City and taxpayer money. It advises City Council on actions the City government can take to effectively manage energy use and waste production internally, and promote these actions throughout the community. The Action Plan's policies and strategies are quantified for their GHG reduction potential as well as the costs and benefits of implementation. The CSC will continue to support the development, implementation and monitoring of the policies and strategies adopted by City Council.

Goal Development

The CSC has proposed a GHG reduction goal and intends to monitor progress made in being more resource efficient, sustainable and better prepared for the future. . As a result, Greensboro will have an effective and comprehensive measure of its progress in working toward greater sustainability by measuring its progress towards a GHG reduction goal.

While the State of North Carolina does not have a stated GHG reduction goal, the North Carolina General Assembly created a Legislative Commission on Global Climate Change (LCGCC) in fall 2005 to address climate-related issues. These issues included whether North Carolina should set a goal for reduction of GHGs, and if so, what that goal should be. Subsequently, the NC Climate Action Plan Advisory Group CAPAG was established with the aim of developing proposals for dealing with global climate change in North Carolina. In its final report and recommendations released in October 2007, the CAPAG recommended that the state of North Carolina set an overall voluntary goal to bring statewide emissions back to a baseline, such as year 2000.

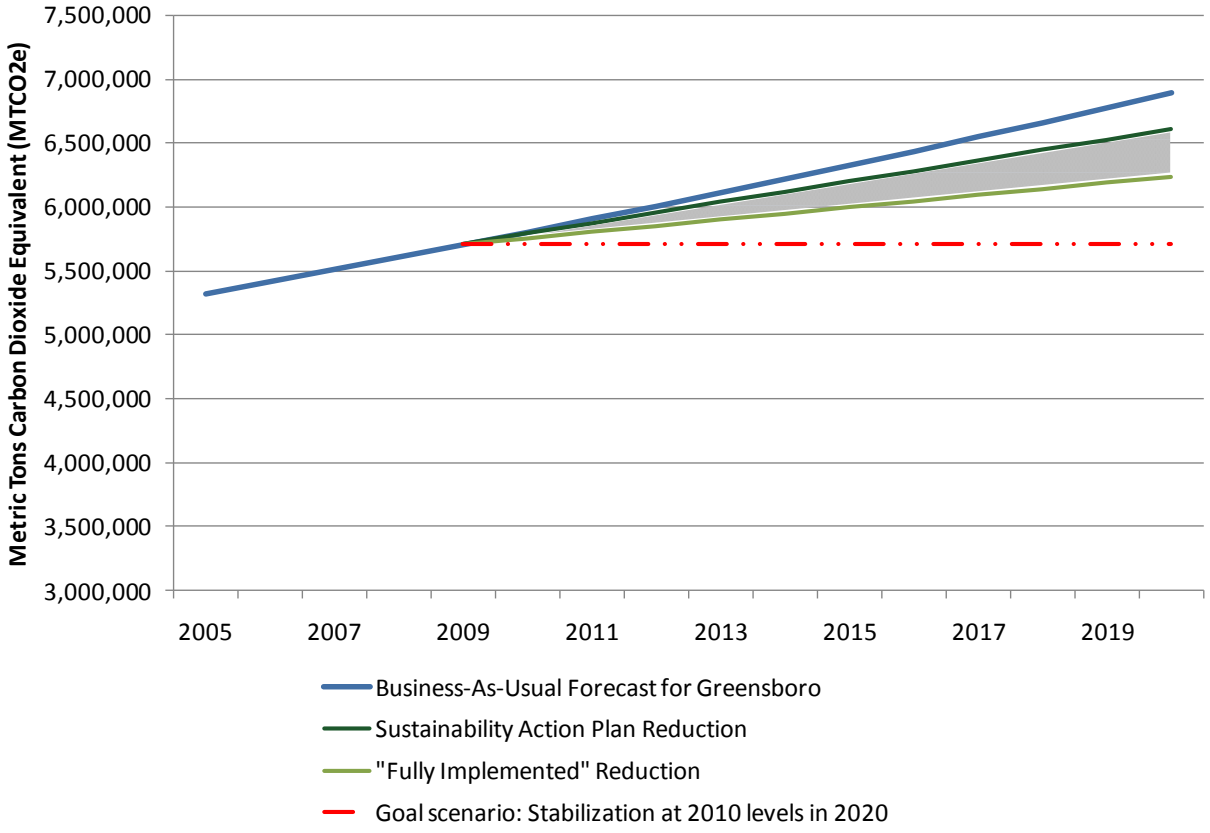
To set a goal that is appropriate for Greensboro, the CSC evaluated a number of other GHG reduction goals for local governments and discussed their applicability to Greensboro. The discussion of goal setting was built "bottom up"- that is, the CSC took stock of the City's current GHG emissions and forecasts for future emissions as discussed in Section 3, above, and evaluated what it would take to reach various future GHG reduction targets. This is in contrast to many other communities that have committed to goals before evaluating the level of effort needed to achieve them. As a result, Greensboro's goal has been grounded in what is feasible for the community, reflecting a balance between making significant progress and identifying a goal that is pragmatic and achievable.

Selected Goal

Based on discussions and review of the GHG inventories, the CSC has recommended the City establish a preliminary goal of stabilizing GHG emissions at forecasted 2010 levels by the year 2020. This goal

represents a 17 percent reduction of projected emissions in 2020 based on expected population growth and historic increases in per capita emissions. The policies and strategies in this Action Plan will not meet this goal but will establish a foundation for measuring achievement of this target and making initial progress. Additional measures -- either new policies and strategies or scaling up of strategies already contained in this Action Plan – would be necessary to meet the "Fully Implemented Reduction" level or the more ambitious "Goal Scenario: Stabilization at 2010 levels by 2020" level (Figure 3).

Figure 3. Business-As-Usual Forecast and Sustainability Action Plan GHG Reductions



4.3 Benefits from Planned and Ongoing Actions

This Action Plan has been developed in the context of an established 2007 baseline year; that is, success of this Action Plan's policies and strategies in reducing GHG emissions, reducing energy and resource use and making progress toward sustainability will be measured against this 2007 baseline year, which is the most recent year for which GHG inventories for City operations and the community have been completed.

It is important to note, however, that in addition to the new policies and strategies in this Action Plan, there are several ongoing actions in Greensboro that will contribute to GHG reductions in the future, as

well as other actions that have been initiated and/or completed since 2007 that will also reduce GHG emissions from this baseline. For example, discussed in Section 2.3, above, the City's recently completed EECS identified 9 distinct strategies that cumulatively are projected to reduce over 5,000 $MTCO_2e$ annually during the term of the grant. These reductions are in addition to the projected GHG reductions from policies and strategies in Section 5.0.

Because of the distributed nature of these actions across the community, it is difficult to quantify benefits from other community energy efficiency and GHG reduction efforts. As this Action Plan is implemented and the City collaborates with community partners, it would be beneficial to track these efforts to develop a more complete picture of the cumulative benefits of GHG community-wide reduction measures.

5.0 Sustainability Action Plan Policies and Strategies

The following sections identify a number of recommended policies and strategies for fulfilling the Action Plan's mission and making progress toward its stated goal of stabilizing community GHG emissions at 2010 levels by 2020. These policies and strategies are the reflection of significant work by the CSC over the past two years, as well as City staff and community input, to identify the priorities of Greensboro residents and the policies and strategies that can provide the most significant economic, social and environmental benefits to the community.

The CSC identified 12 policies during community wide meetings and in working subgroups, each with associated implementation strategies. These policies and strategies were organized under seven topic areas. An eighth topic area, "Adaptation" has been added during the creation of this plan to help the City plan for potential impacts from climate change.

These eight topic areas are:

- **Transportation and Land Use**
- **Nature in the City**
- **Green Jobs and Buildings**
- **Education and Outreach**
- **Recycling and Waste Reduction**
- **Green Technologies**
- **City Operations**
- **Adaptation**

Policies and strategies for each topic area have been developed based on reports from each of the working CSC sub-groups; these full reports are provided in Appendix B.

Each section below places the topic area in the context of GHG reductions and sustainability, provides recommended policies for the City to adopt and a number of recommended strategies to support each policy. Finally, for each topic area, projections of GHG emission reductions and costs are provided, both for policies and strategies as proposed, as well as hypothetical "full implementation" across the City[iii]. Table 2 provides a summary of estimated GHG reductions, cost and cost savings for each of the topic areas for which quantifications can be made. Emission reductions, costs and cost savings associated with individual policies under each topic area are presented in the following sections.

In Table 2, the "As Proposed" GHG emission reductions in 2020 represent a reasonable estimate of the performance of the strategies described under each of the following policies based on current technologies, performance of similar strategies in other communities and achievable rates of participation for the assumed level of funding. The "Fully Implemented" case assumes that these strategies are implemented with a level of effort and funding that will allow them to achieve higher rates of participation. Even the "Fully Implemented" case, however, does not represent an absolute upper bound; more aggressive implementation of these strategies could be envisioned, and there are certainly more strategies that could be considered under each of these policy areas. The assumptions behind the projected performance of these strategies are included in the following sections.

Costs and savings estimated in Table 2 include those incurred by both private and public entities in the community (e.g. individual citizens, local businesses and the City of Greensboro). As a result, the entity paying for the implementation costs may not be the same entity realizing the cost savings. Furthermore, the costs and cost savings could not be estimated for all the proposed strategies so there are some GHG reductions portrayed below for which cost savings and costs are not included.

Table 2. Summary of Policies and Strategies

Policy Topic	Minimum Cumulative Cost to Implement by 2020 (as proposed case only)	Minimum Cumulative Cost Savings by 2020 (as proposed case only)	GHG Reductions in 2020 [MTCO2e] (as proposed, fully implemented)	Percentage Reduction of Business-as-usual GHG Emissions in 2020 (as proposed, fully implemented)
Transportation and Land Use	$3,600,000	$17,600,000	181,000 - 403,000	2.6% - 5.9%
Green Jobs and Buildings	$2,900,000	$4,000,000	67,000 - 204,000	1.0% - 3.0%
Waste Reduction and Recycling	$2,300,000	$2,300,000	6,000 - 12,000	0.1% - 0.2%
City Operations	$500,000	$600,000	13,000 - 22,000	0.2% - 0.3%
SUBTOTAL	$9,300,000	$24,500,000	267,000 - 641,000	3.9% - 9.3%
Funded EECS Strategies	$3,100,000	$4,570,000	9,000 - 9,000	0.1% - 0.1%
TOTAL	**$12,400,000**	**$29,070,000**	**276,000 - 650,000**	**4.0% - 9.4%**

****Notes:** Numbers in the above table may not sum exactly due to rounding. No direct GHG reduction benefits from Nature and the City were quantified. The benefits of Education and Outreach are included under the Funded EECS Strategies. See Sections 5.5 and 5.6 of the Action Plan for further discussion. Only a portion of Funded EECS Strategies are assumed to still be in effect in 2020. Further documentation on how these costs and cost savings were arrived at are located in Appendix C..

5.1 Transportation and Land Use

Land use patterns and transportation choices are closely linked and interrelated. Providing a mix of land uses in Greensboro, planning for pedestrian-oriented activity centers, increasing development densities and linking development with transportation infrastructure can help promote greater walking and cycling and less reliance on the automobile. Increased land use densities and more frequent use of mixed-use development patterns also promote more efficient delivery of municipal services.

In addition to land use choices, transportation infrastructure and incentives can be provided throughout Greensboro that allow citizens to choose options that best meet their needs and provide alternatives to single-occupant automobiles. Enhancing the public transit network and optimizing routes can make bus travel more accessible for residents and more efficient for transit operations. Transportation choices can not only provide cost-effective options to the automobile, they can also promote community health by making cycling and walking more accessible and attractive. Transportation, particularly single-occupant vehicle use, is also a major use of energy; reducing vehicle use can help reduce energy consumption and costs. Reducing vehicle miles traveled (VMT), in turn, can help to reduce GHG emissions.

The following section identifies key policies the City of Greensboro can adopt to encourage greater density, provide an increased mix of land uses, provide greater linkages between transportation and land use and reduce dependence on the automobile. It also discusses policies the City can adopt to support infrastructure and programs for alternative transportation, such as public transit and bicycling. Each policy is supported by a number of recommended strategies.

Policy 1 - Transportation and Land Use:

Encourage increased density, a mix of land uses and more integrated links between transportation and land use through changes to Greensboro's Comprehensive Plan, Development Ordinance and other related plans.

Strategy 1A: Identify and Improve Mass Transit Corridors

- Identify near-term and long-term potential mass transit corridors and begin to increase densities along corridors
- Plan City infrastructure (storm water, utilities, etc.) to support density in corridors

- Progressively increase transit system usage, especially for discretionary ridership

Reducing Bus Idling Impacts

The environmental issues and problems associated with bus idling include diesel fuel use, air quality and climate impacts. Eliminating bus idling at the local level (schools, Greensboro Transit Authority, etc.) and determining barriers to large scale implementation can help reduce idling.

Strategy 1B: Increase Development Densities and Mix of Uses for Transit Corridors and Activity Centers

- Develop policies for minimum densities, minimum floor area ratios and density by right
- Revise site design requirements such as setbacks, parking standards, landscaping and buffers to allow for more site flexibility in achieving higher densities and mix of uses
- Provide incentives for shared parking to reduce parking requirements in areas of higher density development

Strategy 1C: Improve Housing Diversity and Property Utilization

- Promote intentional communities and mixed occupancies
- Explore alternatives to the limitation of occupancy of dwelling units
- Promote development of accessory dwelling units

Policy 2 - Transportation and Land Use:

Reduce vehicle miles traveled, including the use of single-occupant vehicles, by promoting alternative forms of transportation and providing greater infrastructure for transit, cycling and other non-vehicular travel options.

Strategy 2A: Increase Transit System Use

- Encourage higher discretionary use of the Greensboro Transit Authority system
- Investigate the feasibility of Park & Ride lots near route terminus points, preferably at commercial centers to support retail uses
- Accelerate plans for cross-town connectors, additional transfer points outside of downtown and other upgrades
- Explore options for increased express bus service to downtown and van services during shift changes
- Increase publicity, demonstration projects and employer participation to promote transit ridership
- Promote transit usage by displaying bus maps and adding bike racks at City libraries and other public facilities

Strategy 2B: Increase Bicycling Infrastructure

- Consider a “Complete Streets” policy that incorporates multi-modal capabilities where appropriate

- Provide more bicycle infrastructure, bike lanes and paths on all major thoroughfares
- Implement the City's Greenway Master Plan to increase off-road cycling opportunities and connections.
- Provide bike-sharing infrastructure along public greenways as they are completed and linked together
- Facilitate bike-sharing programs at local universities and colleges, other high employment locations, downtown and other larger business districts
- Formally include bicyclists in transportation planning processes
- Establish bike rental stations at strategic locations

Other Land Use Incentive Examples:
Water Resources

Alternative storm water retention models can remove barriers to higher density development. These can include best management practices (BMPs) that maximize infiltration on site, particularly in higher density areas and neighborhoods. The City could also offer incentives (rebates on stormwater fees, reduced permit and inspection fees, etc.) for water conservation measures (e.g. cisterns, conservation fixtures and rain gardens).

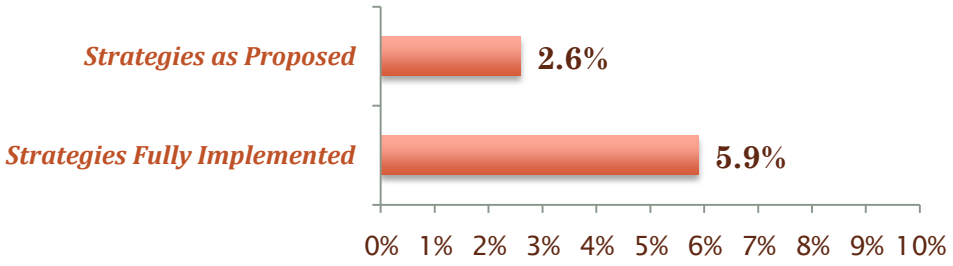
Strategy 2C: Develop Green Bike Program

- Enhance bicycle use and safety across the City, particularly within the urbanized core
- Increase public safety announcements regarding cycling safety and rules of the road to improve knowledge and awareness
- Make more streets crossable for bicyclists and pedestrians
- Install sensors in pavement to change lights at intersections for bikes

Quantification of Policy Outcomes

Transportation & Land Use Strategies

Estimated Reduction in Community GHG Emissions
Over Business-as-usual in 2020



- Cumulative minimum cost to implement proposed strategies by 2020: $3,600,000
- Cumulative minimum cost savings from proposed strategies by 2020: $17,600,000

Estimated costs and savings include those incurred by public and private entities in community (e.g. individual citizens, businesses, City of Greensboro).

Assumptions

Policy 1: Strategies 1A, 1B, and 1C.

A review of modeling studies found that similar strategies resulted in VMT reductions of 10 percent or more as a lower bound[iv]. The "As Proposed" case applies these reductions only to the projected growth in VMT and emissions between 2010 and 2020. The "Fully Implemented" case considers community-wide adoption of these strategies. The costs of implementing the policies suggested are likely negligible with respect to baseline planning costs. However, the indirect costs of these strategies in terms of infrastructure and development are not easily quantified. Therefore, neither costs nor cost savings for these strategies are included.

Policy 2: Strategy 2A.

The same review of modeling studies found that simply expanding transit infrastructure only resulted in a 1 percent reduction in VMT. However, individualized marketing of transit services was found to result in an average VMT reduction of about 7 percent, with Durham, North Carolina realizing an 11 percent reduction[v]. The "As Proposed" case reaches 120,000 households over 5 years at a 6.75% reduction in VMT, while the "Fully Implemented" reaches all households in Greensboro and achieves an 11% reduction in VMT. Costs for individualized marketing are $30 per household[vi]. Cost savings are based on reduced VMT a $0.03/mile savings for avoided single occupancy vehicle trips.

Assumptions, continued

Policy 2: Strategy 2B and 2C.

Nationally, about 1 percent of trips are made by bicycle. Rates 5 to 10 times higher are achieved in communities with strong bicycle infrastructure and programs. The “As Proposed” and “Fully Implemented” cases both apply the same 1 percent reduction. The costs of developing cycling infrastructure to facilitate this rate of cycling are not easily quantified. Therefore, neither costs nor cost savings for these strategies are included.

5.2 Green Jobs and Buildings

Buildings are major users of energy in Greensboro and nationwide. According to the U.S. Green Building Council, in the U.S. today buildings consume approximately 70 percent of electricity and account for nearly 40 percent of CO_2 emissions[vii]. There are significant opportunities in Greensboro to increase energy efficiency and conserve energy in residential, commercial and institutional buildings. Increasing efficiency not only lowers energy bills for the City and Greensboro citizens, it also helps to reduce community GHG emissions.

Energy efficiency, water conservation and other elements of green design can also be promoted and encouraged in new buildings and renovations. New development can be energy and resource efficient, use renewable and recycled building materials, provide for healthy working and living environments, reduce building operating costs and help reduce GHG emissions.

Finally, to support energy efficiency, green building and economic development in Greensboro, the City can support and promote the expansion of its skilled green workforce. Partnerships with higher education institutions and other community organizations can be used to develop training programs so that the City's workforce can meet the growing demand for these skills and services and create jobs.

The following section identifies key policies the City of Greensboro can adopt to encourage energy and water efficiency, green building and green job development. Each policy is supported by a number of recommended strategies.

Policy 3 – Green Jobs and Buildings:

Develop a coordinated City program to provide technical support, energy audits and education and outreach to increase energy efficiency and conservation in commercial and residential buildings.

Strategy 3A: Promote Existing Energy Conservation Opportunities

- Utilize the City's communication systems, such as Channel 13 and the City's website, to educate and promote available energy conservation opportunities
- Develop energy conservation and green building programming to highlight City leadership in energy conservation activities and results

Strategy 3B: Increase Availability of Energy Assessments for Property Owners

- Make energy assessments and energy upgrade programs available to more commercial and residential property owners
- Conduct personal home visits to perform basic upgrades like replacing incandescent light bulbs with compact fluorescent lamps (CFLs) and installing programmable thermostats
- Make property owners and residents aware of weatherization assistance opportunities
- Utilize the revolving loan fund program in the City's EECS for funding energy assessments and upgrades

Strategy 3C: Coordinate with Local Utilities

- Engage Duke Energy and Piedmont Natural Gas in continuous discussions about local energy use and energy conservation programs for residential and commercial buildings

Supporting Energy Efficiency in the Home: More Ideas

Other ideas for promoting energy efficient homes in Greensboro include:

- Training home energy assessment teams
- Preparing a catalogue of available home improvement resources, including government, private, philanthropic and faith community resources
- Outreach to priority areas based on analysis of City-wide levels of inefficient housing stock
- Pre- and post-energy assessments and evaluation

Still another opportunity is to work with active older adults on community-based energy-efficient housing and lifestyle modification projects, encouraging all participants to share their expertise, knowledge, passion and years of experience.

- Align weatherization and energy efficiency programs with other community initiatives
- Formalize energy use information sharing between the City and energy supplier companies

Strategy 3D: Expand Energy Education Programs

- Create mobile exhibits with local colleges and universities that demonstrate simple energy conservation techniques for community functions
- Provide educational programming on energy conservation and cost savings potential of lower energy use
- Pair neighborhood associations with trained community organizers to spread the word to neighbors about the health and money saving benefits of repairing substandard homes and making better energy choices
- Work with preservation interests to promote energy efficient practices and energy tax credits for older and historic buildings
- Publicize demonstration projects for energy efficient upgrades on historic buildings

Green Building Certification Systems

Certification systems such as the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED), National Association of Home Builders Green Building Program (NAHBGreen) and the federal ENERGY STAR designation for buildings can also be used to promote green building, including energy and resource efficiency, choices in building materials and the design of healthy indoor environments.

Strategy 3E: Promote Energy Conservation in Rental Units

- Work with the Rental Unit Certificate of Occupancy (RUCO) Board to promote energy conservation in policy and the inspection process

Policy 4 – Green Jobs and Buildings:

Use a combination of code changes, incentives, partnerships and education to promote green building in Greensboro.

Strategy 4A: Promote Green Building in the Land Development Ordinance (LDO)

- Conduct a sustainability audit of the LDO to identify impediments to green building
- Develop a permit fee rebate program and other development incentives, such as rebates on the stormwater fees and permit and inspection fee modifications, for certified green construction and substantial renovation
- Expedite permit processing for construction pursuing green building certification

Strategy 4B: Evaluate Housing Code Updates

- Review the Minimum Housing Code to identify current provisions for energy efficiency standards and revisions to match current building code and standard practices

- Develop cost/benefit analyses to minimize impacts on housing affordability and provide financial incentives where necessary

Strategy 4C: Form Green Building Partnerships

- Form partnerships with local green building organizations to share educational information through web links, discussions about legislative and policy actions and co-sponsored educational sessions and awards programs
- Provide links to directories of certified green building and service firms to make information readily available to the community
- Develop partnerships to integrate home energy measures into the Healthy Homes Initiative focused on elderly, poor and marginalized populations
- Seek additional grant resources for healthy-green repairs such as weatherization-ventilation-indoor air quality, lead-safe work practices, integrated pest management, moisture intrusion and energy efficiency

Strategy 4D: Develop and Implement Green Building Advocacy Initiatives

- Work with state and federal legislative delegations to ensure consistent and permanent tax credits for energy conservation upgrades to residential and business properties
- Support efforts to increase energy efficiency and resource conservation standards in state building codes
- Support state statutes allowing grey water re-use for non-potable uses and enabling legislation allowing communities to provide a full range of green building incentives

Strategy 4E: Promote Green Building Success Stories

- Promote work the City of Greensboro has accomplished to achieve energy savings and environmental benefits
- Promote local green building successes through award programs with community partners, lunch and learn sessions with local colleges and universities and support of green building design competitions
- Provide links to project registries of certified green building renovation and construction, including residential, commercial, industrial and institutional projects
- Promote green building programs through community partnerships and local economic development agencies
- Work with local and state green building organizations to hold educational sessions for local code inspectors and contractors to share issues about green building standards and challenges

- Publicize information over local television, radio and newspaper media and through presentations to civic organizations
- Develop an Integrated Design Roundtable Program where design, development and operations teams from successful projects share the "how and why" of projects for students and young professionals

Policy 5 – Green Jobs and Buildings:

Work with community partners to encourage green job creation, training and placement.

Strategy 5A: Facilitate Green Jobs Creation

- Leverage the City's EECS green jobs strategy to create an ongoing organizational structure to facilitate green jobs creation, training and placement
- Partner with higher education, community colleges, workforce development, K-12 schools, other community organizations, City and county human resources and others
- Coordinate and partner with local schools, colleges and universities to develop a green industries certificate program
- Expand green jobs resource materials at all public libraries

Other Potential Ideas and Best Practices

Other potential ideas and practices that have been developed by other cities for green jobs and buildings include:

- Develop a new near-net-zero-energy-use community demonstration housing project
- Provide training for building operators
- Research the ability to link business license fees to energy use and energy audits
- Work with the Water Resources Department to report on high water use locations through water billing

Policy 6 – Green Jobs and Buildings:

Promote more efficient use of water through education, partnerships and pilot projects.

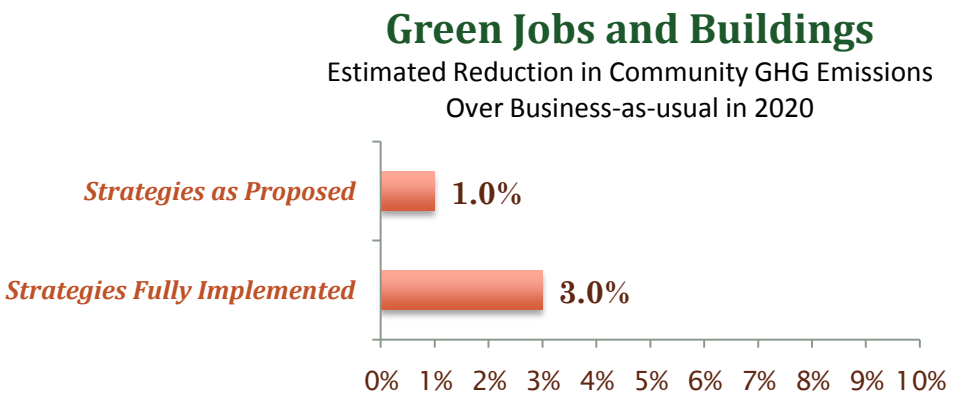
Strategy 6A: Develop a Water Conservation Demonstration Project

- Obtain funding and implement a demonstration neighborhood water conservation program in at least two model neighborhoods
- Provide education about water-wise lawn and planting systems
- Work with community partners to model projects that promote conservation of outdoor water use, including reducing the amount of high maintenance lawn plantings, use of native and low-water-use plants and water-saving lawn and gardening management processes
- Subsidize the cost of water saving equipment (rain barrels, bio-swales, low flow fixtures and appliances) and replacement of paving and plant materials
- Monitor the impact on water use in demonstration neighborhoods
- Develop a report on annual water use savings compared with typical neighborhoods

Strategy 6B: Promote Water Conservation through Billing System

- Provide past water usage information on monthly City Services billing statements.

Quantification of Policy Outcomes



- Cumulative minimum cost to implement proposed strategies by 2020: $2,900,000
- Cumulative minimum cost savings from proposed strategies by 2020: $4,000,000

Estimated costs and savings include those incurred by public and private entities in community (e.g. individual citizens, businesses, City of Greensboro).

Assumptions

Policy 3: Strategy 3A.

Research indicates that education alone can result in 5 to 30 percent energy savings[viii]. Based on programs in other communities, the "As Proposed" case assumes an adoption rate of 2.5 percent for the efforts to promote existing energy conservation programs and an energy savings of 5 percent. The "Fully Implemented" case assumes penetration of 5 percent and energy savings of 20 percent. These savings are for residential electricity and natural gas consumption as projected in 2020. Cost savings are based on typical energy rates, while the cost to implement is an annual cost based on maintaining an outreach program as developed under the EECBG grant program. The outreach program would likely need to be funded consistently for a number of years to attain "Fully Implemented" performance.

Assumptions, continued

Policy 3: Strategy 3B.

The "As Proposed" case assumes continued implementation of a residential energy assessment program as developed under the EECBG grant that reaches approximately 250 households per year and achieves conservative savings of 5 percent in electricity and natural gas consumption per household. In addition, through the assessments and general outreach, compact fluorescent lamp (CFL) and efficient heating, ventilation and air conditioning (HVAC) system upgrades are estimated to achieve penetrations of 0.8 and 0.2 percent, respectively, community-wide. The CFLs are projected to result in consumption savings of 2.5 percent of electricity, while HVAC upgrades are projected to result in savings of 10 percent of natural gas for affected households. The "Fully Implemented" case assumes the audit program reaches all Greensboro households, while the penetration of CFL and HVAC upgrades reach 25 percent and 5 percent, respectively. Cost savings are based on typical energy rates, while the cost to implement is an annual cost based on maintaining the audit program developed under the EECBG grant program. The audit program would need to be active continuously from the end of EECBG funding through 2020 to attain "As Proposed" performance.

Policy 3: Strategy 3C, 3D and 3E.

These strategies support the performance of the above strategies but will not have direct GHG reductions in addition to Strategies 3A and 3B.

Policy 4: Strategy 4A.

This strategy supports the performance of the other strategies but will not result in direct GHG reductions that are quantifiable at this time.

Policy 4: Strategy 4B.

Building energy codes are adopted at the state level and North Carolina is currently using an amended version of the International Energy Conservation Code (IECC) 2006[ix]. Building energy modeling for residential buildings indicates that updating the code to IECC 2009 could result in energy cost savings of 15 percent for Greensboro's climate zone. The "As Proposed" case assumes adoption of the IECC 2009 residential energy code, and perhaps additional code updates before 2020. The "Fully Implemented" case adds the adoption of Standard 90.1-2007 for commercial buildings, which results in a modeled energy savings of 3.9 percent for non-residential buildings in Greensboro's climate zone[x]. The incremental costs of building under these updated codes are not known; therefore, costs and cost savings are not included for this strategy.

Policy 4: Strategy 4C.

The "As Proposed" case assumes that 20 percent of new buildings constructed in Greensboro between 2010 and 2020 will implement a minimal level of green building that results in 10 percent energy savings. The "Fully Implemented" case assumes a 30 percent penetration and 15 percent energy savings. The cost of this strategy to promote partnerships to facilitate green building is presumed to be negligible. The incremental building costs and associated cost savings are not included since they are not the direct result of promoting partnerships, although it has been shown that the incremental costs of green building can be minimal[xi].

Policy 4: Strategies 4D and 4E.

These strategies support the performance of the above strategies but will not result in direct GHG reductions in addition to Strategies 4A, 4B and 4C.

Assumptions, continued

Policy 5: Strategy 5A.

This strategy supports the performance of the above strategies by providing the necessary skilled workforce but will not result in direct GHG reductions exclusive of the other strategies.

Policy 6: Strategies 6A and 6B.

These strategies support a holistic approach to green building by supporting water conservation but will not result in a significant GHG reduction.

5.3 Waste Reduction and Recycling

By world standards, waste in the U.S. is a large and growing problem. Major facilities and tracts of land are required to accommodate generated waste, and monitoring and mitigation are needed long after disposal. In addition, landfills produce methane (CH_4), a potent GHG, from the decomposition of waste. While landfills can also sequester carbon such as yard waste (wood, food, leaves, etc.), these types of products can sit for years and be unproductive in distributing various nutrients back into the soil. Actions that promote diversion of solid waste from landfills, such as recycling, can reduce GHG emissions, prolong the life of landfills and potentially reduce collection and disposal costs.

Recent data from the U.S. Environmental Protection Agency indicates that almost 30 percent of carbon emissions associated with purchased goods can be attributed to the "life cycle" of these goods[xii]. These emissions occur at multiple stages of a product's life cycle, from extraction and processing of raw materials to manufacture, distribution, storage and disposal. As a result, reducing the use and amount of purchased goods from the start can not only save the City and community money, it can also help reduce energy and water consumption and GHG emissions associated with products.

The following section identifies key policies the City of Greensboro can adopt to encourage waste reduction and recycling. Each policy is supported by a number of recommended strategies.

Policy 7- Waste Reduction and Recycling:

Employ a combination of expanded recycling infrastructure, regulations and incentives to increase Greensboro's solid waste diversion and recycling rates.

Strategy 7A. Expand Multifamily Recycling

- Continue and expand current programs to bring city solid waste services to multifamily housing communities.
  - Currently six multifamily communities that receive private garbage service will start receiving City Solid Waste Services, including recycling.
  - The city will continue to work with the Greensboro Housing Authority to begin a recycling pilot for public housing units.
  - Currently the city has a grant to provide recycling services to Multi-family communities who currently receive City fee-based garbage services. Over 30 communities have signed up for the pilot with a goal of 60 complexes – 12 in each of the 5 City Council districts.
  - Continue to recruit condo/townhome/multifamily complexes for the program as more funding sources become available.
- Continue to create new recycling drop sites. For example, each new fire station/recreation center would become a drop site.

Strategy 7B. Develop New Recycling Planning and Regulations

- All users of solid waste pick up services should be charged on the same basis; that is, all users be charged solely through the general fund, or all users be charged through the general fund and a fee basis that is the same for all.
- Recycling services be provided to all users at no other charge than through the general fund or standard service fee.
- Modify the Land Development Ordinance to incentivize the provision of recycling facilities on site. After the first two recommendations are achieved, modify the Land Development Ordinance to require new developments to offer recycling facilities onsite.
- After the three preceding recommendations have been implemented, Greensboro will then consider how to achieve the goal of mandatory recycling, with an appropriate enforcement mechanism.

Strategy 7C. Develop a Recycling Incentive Program

- Continue to pursue partnering opportunities with third-party providers of recycling incentive programs.
- Consider a smaller scale pilot program, perhaps a 10,000 home pilot.
- Incentives would be based on a coupon program where recycling customers would receive coupons to receive discounts for products based on their participation. Coupons would be for local businesses when possible

Strategy 7D. Eliminate Plastic Bags

- Develop a zero plastic bag policy for over-the-counter sales in cooperation with local retailers

Other Potential Waste and Recycling Strategies

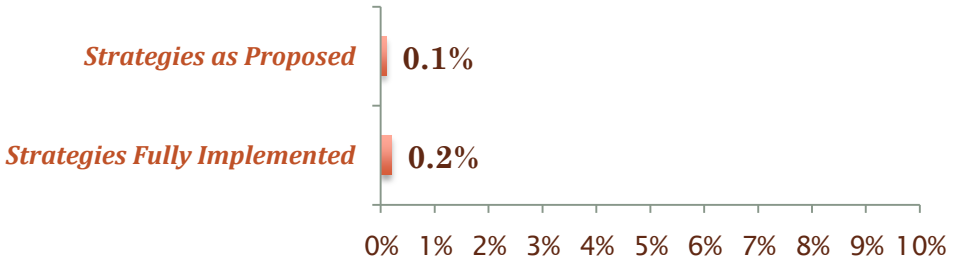
Practices that have been developed by other cities to reduce GHG emissions associated with waste reduction and recycling include:

- Establish composting for municipal or community locations
- Promote “zero waste” events

Quantification of Policy Outcomes

Waste Reduction and Recycling

Estimated Reduction in Community GHG Emissions
Over Business-as-usual in 2020



- Cumulative minimum cost to implement proposed strategies by 2020: $2,300,000
- Cumulative minimum cost savings from proposed strategies by 2020: $2,300,000

Estimated costs and savings include those incurred by public and private entities in community (e.g. individual citizens, businesses, City of Greensboro).

Assumptions

Policy 7: Strategy 7A.

The benefits of expanded multi-family recycling are covered under the City's EECS projects.

Policy 7: Strategy 7B, 7C and 7D.

The "As Proposed" case assumes a 5 percent reduction in GHG emissions from solid waste, while the "Fully Implemented" case assumes a 10 percent reduction. The costs to implement efforts such as increasing the number of recycling drop-off sites, mandatory recycling, and incentive programs that can lead to this level of increase in diversion vary widely by community from cost reductions of up to 15 percent to cost increases of up to 20 percent over current diversion program costs. It was assumed that the City's adopted recycling program budget for 2009-2010 would increase by 5 percent. Cost savings are for disposal costs for recycling ($21/ton) compared to the cost of landfill disposal ($41/ton).

5.4 City Operations

Greenhouse gas emissions from municipal operations account for about 2 percent of Greensboro's total emissions. While this may present a small opportunity to directly reduce GHG emissions, the City is in a position to leverage community-wide sustainability and GHG reduction measures through leading by example. Opportunities include standards for resource efficient, well designed new buildings and renovations, greater energy efficiency in existing City facilities and more efficient City operations to reduce solid waste.

The following section identifies a key policy the City of Greensboro can adopt to integrate sustainability, resource efficiency and cost savings into its own operations while leading the community by example. The policy is supported by a number of recommended strategies.

Policy 8 – City Operations:

Develop standards, infrastructure, practices and projects to make City operations more energy, resource and cost efficient.

Strategy 8A. Establish a Cash Flow Sustainability Account to Fund Future Projects

- Establish a Cash Flow Sustainability Account that diverts 50 percent of savings from new energy efficiency and conservation measures in City operations to help fund future sustainability initiatives that require some upfront money[xiii](cash flow from already established energy savings contracts is already budgeted and will not be part of this fund)

Strategy 8B. Develop Green Building Standards for New or Renovated City Facilities

- Adopt a green building certification standard and/or sustainable building standard for new construction and substantial renovations of City facilities

Strategy 8C. Develop Infrastructure for the Energy Management Program

- Purchase software, hardware and associated equipment to implement an Energy Management Program for the 25 City facilities with the highest energy use to leverage savings from new and existing building automation systems, monitor energy use and costs, identify issues and prioritize savings opportunities

Strategy 8D. Re-commission City Buildings

- Over the next three years, re-commission (return building equipment to original performance) 10 of the City's facilities with the highest energy use in addition to the six buildings already scheduled to be re-commissioned

Strategy 8E. Further Develop Energy Management Team

- Implement a "City Green Team" to share best practices across the organization.
- Establish a long range plan to seek additional resources to expand the Energy Management Team to include a dedicated HVAC specialist to identify savings opportunities in mechanical systems equipment and operations

Strategy 8F. Reduce Solid Waste in City Operations

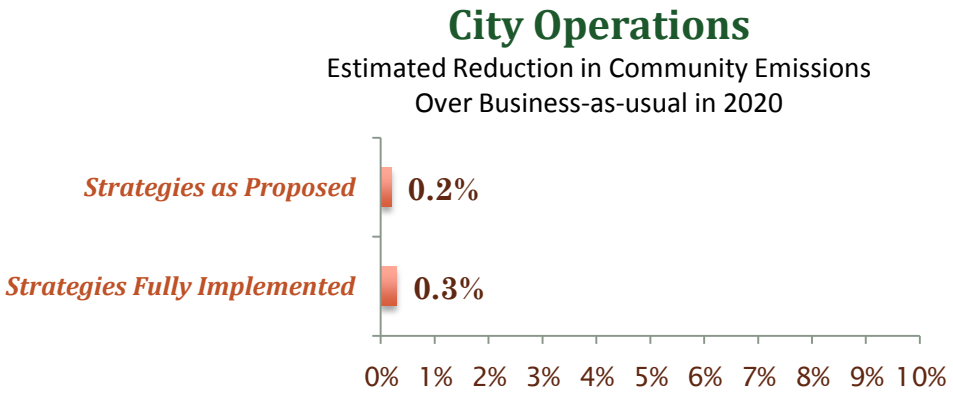
- Make waste reduction a priority goal and facilitate and encourage recycling at all City buildings and facilities, particularly parks and recreation facilities and sites where high amounts of plastic drink bottles are generated
- Provide recycling infrastructure at all City run facilities, such as under desk recycling canisters at each work station, in cubicles, etc.
- Establish policies and minimum standards to target source reduction, including:
  - Recycled content for paper and double-sided copying
  - Routine recycling of paper after City meetings (City Council, Boards and Commissions)
  - Paperless meetings
  - Avoiding single-use plastic water bottles
  - Replacing plastic drink cups with recycled paper cups
  - Establishing an ink cartridge return service
  - Providing adequate resources for education

Other Potential Ideas and Best Practices

Other ideas and practices that have been developed by other cities to reduce GHG emissions in municipal operations include:

- Reduce fossil fuel consumption by City fleet vehicles
- Engage employees in "green teams" and building energy challenges
- Adopt computer and other information technology power management practices
- Increase efficiency in irrigation of City grounds

Quantification of Policy Outcomes



- Cumulative minimum cost to implement proposed strategies by 2020: $500,000
- Cumulative minimum cost savings from proposed strategies by 2020: $600,000

Estimated costs and savings include those incurred by public and private entities in community (e.g. individual citizens, businesses, City of Greensboro).

Assumptions

Policy 8: Strategy 8B.

The "As Proposed" case assumes that a green building standard will be implemented for City facilities. Between 2010 and 2020, it is assumed that space accounting for 25 percent of existing energy consumption will be subject to major renovations, achieving 26 percent energy reduction, a moderate green building reduction under LEED for Existing Buildings (EB). Energy consumption is projected to grow 1.5 percent year-over-year due to the construction of new facilities. A 30 percent reduction in energy consumption in these new facilities is projected from this strategy, based again on moderate green building performance (LEED-NC)[xiv]. The "Fully Implemented" case assumes energy consumption reductions of 44 and 48 percent, respectively, in major renovations and new construction (LEED-NC). Though some studies have shown negligible to no additional cost for green buildings, these costs vary on a case-by-case basis and it is difficult to estimate the incremental cost[xi]. Therefore, costs and cost savings are not included for this strategy.

Policy 8: Strategy 8C.

The benefits of an energy management program are included in the City's EECS projects.

Policy 8: Strategy 8D.

The benefits of re-commissioning have been generally estimated to be between 5 and 30 percent energy savings by a number of sources, such as the federal Environmental Protection Agency's ENERGY STAR program[xv]. The "As Proposed" and "Fully Implemented" cases assume that 40 and 70 percent, respectively, of electricity and natural gas consumption in City buildings are consumed for heating and cooling uses and that 7 percent of this consumption will be saved through re-commissioning. Costs are based on projected time to complete re-commissioning of the City's major energy using facilities that have not recently received re-commissioning. Cost savings are based on average utility rates.

Policy 8: Strategy 8E.

The benefits of this strategy are largely covered under Strategy 8D.

Policy 8: Strategy 8F.

The benefits of reducing solid waste in City operations are included in the City's EECS projects.

5.5 Nature in the City

Providing for and enhancing Greensboro's green infrastructure – its parks, greenways, stream corridors and other natural areas – offer many community benefits. In addition to providing habitat and serving as a visual amenity, urban forests and green spaces can increase sequestration of CO_2 and protect buildings from sun and wind, helping to use energy more efficiently. Trees and other vegetation also help maintain water quality and manage stormwater runoff, and they can benefit neighborhoods by increasing property values and lowering crime.

Aside from their recreational value, parks, natural spaces and other open or under-utilized spaces in Greensboro offer many other potential benefits to citizens. Research shows that quality of life, health and educational benefits occur when children and adults have access to the natural world. Such areas can also be used to produce local food, providing both health and economic benefits and reducing fuel consumption and GHG emissions associated with transporting food long distances. Finally, they can serve to showcase green technologies and practices, such as renewable energy, urban gardening and low-water use landscaping techniques (grasses, other landscaping, irrigation practices, etc.).

Remembering Thomas Berry (1914-2009)

Thomas Berry was a Catholic priest, cultural historian and eco-theologian, widely published author and recipient of numerous honors and awards.

A native of Greensboro, Berry contributed significant scholarship and writing to inspiring thought around humankind's place on the earth and in the broader universe. His contributions have become a foundation for sustainability and inspired some of the ideas put forth in this Action Plan.

Berry believed that, "All human professions, institutions and activities must be integral with the Earth as the primary self-nourishing, self-governing and self-fulfilling community. To integrate our human activities within this context is our way into the future."

The following section identifies a key policy the City of Greensboro can adopt to promote "Nature in the City." The policy is supported by a number of recommended strategies.

Policy 9 - Nature in the City:

Establish and enhance green corridors, parks and other City spaces to be used for community gardens, green technologies, recreation, habitat and other community benefits.

Strategy 9A. Promote Urban Agriculture

- Identify parcels of City-owned land that could be used for community gardens and training citizens in community gardening

- Use the participatory technique and create partnerships for designing and establishing a sustainable community-based food system
- Create an urban demonstration garden in the downtown area that showcases sustainable techniques such as sheet-mulching, composting, rainwater catchment, herb spirals and multi-level plantings
- Provide funding and support from grants and work done by volunteers from the community or local colleges and universities
- Continue to support the City and regional Farmer's Markets and other activities that highlight the benefits of locally grown foods

Greening the Downtown Greenway Project

The Downtown Greenway, a planned 4.1-mile loop around downtown Greensboro, offers opportunities to utilize green technologies and educate the community while providing for engagement and enjoyment in the area's signature greenway system. Ideas include solar electric panels, alternative transportation methods and urban agriculture methods. Such projects can reduce the urban heat island effect by increasing green space, enhance pedestrian activity and convert impervious areas to productive community gardens and open space.

Strategy 9B. Establish Green Corridors and Wild Spaces

- Work in concert with local land conservation organizations to restore and protect healthy ecosystems by designing and creating space for wild areas in parks and greenways that enhance biodiversity and connections with the natural world.
- Expand naturalization of stream banks to more public lands
- Identify opportunities to link preservation of natural areas and landscapes with preservation of historic buildings, campuses and villages

Strategy 9C. Establish a Revolving Loan Fund to Support Sustainability and Greening Projects

- Support urban sustainability and greening projects with micro-loans and/or a low-interest revolving loan fund

Quantification of Policy Outcomes

While it is difficult to quantify direct outcomes for Policy 9, Nature in the City, implementation of this policy offers many indirect and supporting benefits. For example, life-cycle GHG emissions associated with the growing and transporting of food long distances can be reduced by supporting local agriculture, which also supports community health and local economies. Healthy native vegetation can help reduce GHG emissions by sequestering carbon, as well as managing stormwater runoff and providing habitat.

5.6 Education and Outreach

While this Action Plan identifies many potential policies and strategies addressing specific topic areas such as transportation and green buildings, successful implementation will ultimately hinge on the community's awareness and willingness to take action. Education and outreach efforts should integrate with and build on existing outreach efforts through networks and partnerships, focus on building long-term leadership and capacity in the community and provide incentives and recognition for outstanding efforts.

The City can greatly advance the residents' awareness of what is happening in the community and opportunities for them to contribute by helping to identify existing local efforts and initiatives, publicize the efforts and contributions of local individuals and organizational award recipients, and through the City and the CSC's own efforts.

The following section identifies key policies the City of Greensboro can adopt to encourage and support education and outreach efforts. Each policy is supported by a number of recommended strategies.

Policy 10 – Education and Outreach:

Support development of community leadership and volunteer programs to further community energy and sustainability efforts.

Strategy 10A. Develop Youth Energy Leadership Project

- Identify youth between ages of 12 to 21 (middle school to college) through schools and community organizations to participate in leadership development on energy and sustainability
- Establish resources to train at-risk youth in practical skills for jobs such as weatherization and energy auditing

Strategy 10B. Develop Neighborhood Leadership Program

- Encourage neighborhood leaders and organizations to promote and advance green initiatives
- Offer workshops and seminars to provide detailed instruction regarding energy audits and weatherization
- Support efforts with potential grants from community organizations for selected programs and projects

Strategy 10C. Develop Environmental Educators Network for Community Education

- Encourage neighborhoods and community organizations to identify volunteers to participate as trained environmental educators in Greensboro schools, organizations and neighborhoods and as community organizers

- Involve local university and college students with interest and skills in community assessment and organization in training and supporting volunteers

Policy 11 – Education and Outreach:

Provide technical support, awards and recognition to individuals and organizations furthering Greensboro's energy and sustainability efforts.

Strategy 11A. Provide Residential and Commercial Energy Audit Templates and Support

- Include on the CSC web site a section with residential and commercial energy audit templates (or a link to sites)
- Establish residential awareness programs at City libraries and recreation centers and pursue acquiring home energy awareness tools, such as "kill-a-watt" type meters, for each of the branch libraries that residents can sign out

Green Star Awards: Proposed Criteria

A Greensboro Green Star Awards program would recognize recipients for:

- Energy use or carbon footprint reduction, energy efficiency, innovative design or planning for energy efficiency (restoration, preservation, advocacy)
- Education for changing behavior related to energy use
- Sustainability into the future
- Partnership development, collaboration and inclusiveness of different groups in the community or within a community
- A youth component

Strategy 11B. Link with and Improve Communications with Community Non-profit Resources

- Include on the CSC web site links to local non-profits that have made a sustained and compelling contribution to the environmental health and well being of the community, as well as a calendar of upcoming events
- Have the CSC participate in the local Earth Day and similar events to help publicize organizations and their award recipients
- Encourage a local non-profit to create a web site highlighting select local environmental success stories, awards and award recipients

Strategy 11C. Incentivize Action with Green Stars and Other Programs

- Develop and issue Greensboro Green Star Certificates of Appreciation by nomination to support local awareness of outstanding contributions
- Develop and issue annual Greensboro Green Star Awards for energy/sustainability leadership for small business, education, nonprofits, neighborhood or community action and youth projects
- Communicate awards to local media and the community

Strategy 11D. Support Energy and Sustainability Outreach Coordination

- Support energy outreach and coordination by City staff, including the coordination strategy identified in the City's EECS

- Communicate best practices, support CSC efforts, provide "Green Moments" on Channel 13, maintain a web site, provide a speakers' bureau on energy and sustainability topics and coordinate events and awards

Strategy 11E. Develop Education on Carbon Footprint Reduction

- Create teaching “moments” focusing on practices that reduce GHG footprints as individuals and as a community in vegetation management, such as reducing water and energy use associated with lawns and maintaining best tree and plant choices for GHG reductions
- Expand public-private partnerships with other organizations and institutions to foster ecologically sustainable practices, enhance beauty and reduce the community GHG footprint
- Refer to Strategy 4E for other education and outreach strategies

Other Potential Ideas and Best Practices

Practices that have been developed by other cities to reduce GHG emissions through education and outreach include:

- Social marketing campaigns for specific energy/sustainability initiatives
- Energy challenge websites to engage citizens in learning about their own energy usage patterns
- Block parties to learn about energy efficiency upgrade programs

Quantification of Policy Outcomes

These education policies and their supporting strategies will, in turn, be supported by the education measures included in the City’s EECS. The GHG reduction benefits of education and outreach, particularly as they relate to energy, were quantified as part of the EECS. Refer to the assumptions for Policy 3, Strategy 3A in this Plan for an additional discussion of the benefits of education for reducing energy use and associated GHG emissions.

5.7 Green Technologies

The City of Greensboro has available a number of additional local green technology resources to support the policies and strategies in this Action Plan. As this Action Plan is implemented and updated in the future, it is recommended that the City continue to explore the following local green technologies and resources:

- Biofuels/landfill gas
- Active solar hot water
- Solar photovoltaics (PV)
- Industrial scale waste heat recovery
- Smart grid

5.8 Adaptation

In addition to taking action to reduce Greensboro's GHG emissions and become more resource efficient and sustainable, the City can begin to consider and plan for future scenarios under a changing climate. While the original process of developing policies and strategies for this Action Plan did not include adaptation as a topic area, it is becoming increasingly recognized as an important best practice to include in community climate action and sustainability plans. Communities will likely begin to experience the effects of climate change, if they have not already, before GHG reduction strategies are fully implemented and begin to have their desired effect. Thus, adaptation is included here as an introductory concept, and as an important complementary piece to the GHG reduction strategies developed in this Action Plan.

The term "adaptation" is commonly used and generally refers to efforts that respond to the *impacts* of climate change – adjustments in natural or human systems to actual or expected climate changes to minimize harm or take advantage of beneficial opportunities. This includes identifying potential vulnerabilities and risks, as well as developing a framework to adapt to conditions as they change over time. In fact, with or without climate change, adapting to future trends and changes, from demographic shifts to energy volatility, can benefit both Greensboro's citizens and its economy in many ways including protecting public health and benefitting from trends, such as training the work force for the emerging clean energy economy.

Outcomes resulting from changes in Greensboro's climate are difficult to predict, but such changes may impact Greensboro's infrastructure, result in changes to native vegetation and species composition such as introduction of invasive species, impact air quality due to hotter summers and stress the regional and state water supply. Providing a way to track and respond to such trends will benefit the community as a whole.

The CAPAG adopted a recommendation to create a state-sanctioned Blue Ribbon Commission on Adaptation to Climate Change to develop a comprehensive state Climate Change Adaptation Plan identifying opportunities to address adaptation issues and risks. The City can monitor the progress of future efforts to ensure Greensboro is part of such a state-wide coordination effort.

The following policy articulates how Greensboro can establish a framework for adapting to a changing climate.

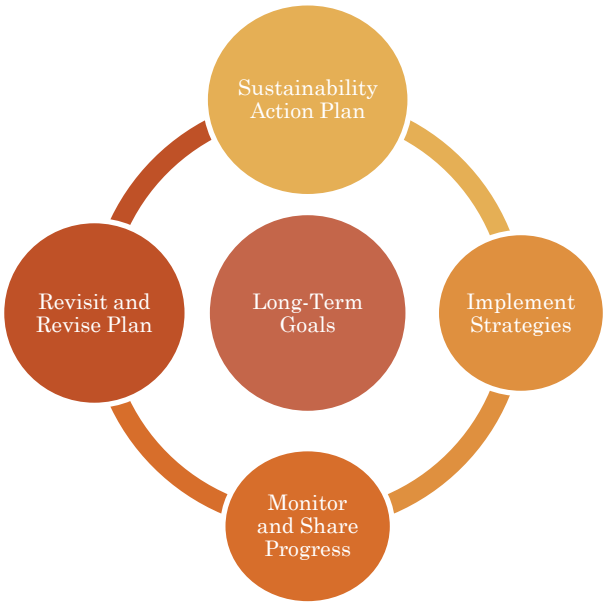
Policy 12 – Adaptation:

The City should develop a framework for adapting to a changing climate and integrating adaptation into its plans, ordinances and programs.

Strategy 12A. Develop Beneficial Adaptation Strategies and Partnerships

- Give priority to adaptation strategies that initiate, foster, and enhance existing efforts that improve economic and social well-being for Greensboro's citizens, public safety and security and public health.
- Establish and retain strong partnerships with federal, state and local governments, private business and landowners, and non-governmental organizations to develop and implement collaborative adaptation strategies over time.

6.0 Plan Implementation



The development of this first Sustainability Action Plan for Greensboro is a major step toward reducing the community's GHG emissions as well as furthering community sustainability. This Action Plan is considered the first version of what will be a "living document," subject to further review and revision as strategies are implemented, progress is monitored, new strategies developed and goals revisited. The implementation framework outlined below is intended to guide this process.

6.1 Collaborating to Support Implementation

Implementing the Action Plan will benefit from collaboration among City staff, the CSC and the community. A next step in implementing the strategies in this Action Plan is to identify who will be responsible for implementing them, and who can play a supporting role. The diverse nature of the strategies in this Action Plan provides an opportunity for broad collaboration across the community in this effort.

As discussed under many of the strategies, partnerships are a particularly important component of implementation. Greensboro is fortunate to have many community partners with an interest in sustainability in general, as well as specific strategies in the Action Plan. Valued partners can include Greensboro's many colleges, universities and other higher education institutions; non-profit and community organizations; the business community; the building industry and professional organizations; communities of faith; and others. Such partnerships can not only be leveraged to share resources and expertise, they can also ensure that sustainability becomes part of the fabric of the community, and not an effort dependent on a small handful of champions.

6.2 Developing Interim Milestones for Progress

While this Action Plan sets a GHG reduction goal for 2020, establishing interim milestones for implementing policies and their supporting strategies will help make tangible progress toward this goal over time. Certain strategies contained in the Action Plan could be implemented in a fairly short period of time, while others will need to be phased over time, such as land-use planning strategies, green

building in new construction and long-term public education programs. Establishing specific timelines for implementing the various policies and strategies will ensure that there is enough time to complete them before the target goal year is reached. Regular milestones should also be developed for updating the Action Plan itself.

6.3 Monitoring and Reporting

The City now has completed GHG inventories for both municipal operations and the community. These inventories, along with a baseline understanding of City programs and practices related to sustainability, can be used to monitor progress over time as policies and strategies are implemented. Implementation of strategies should be documented for future reference and reporting to the community and to decision makers. For instance, what was the actual cost of the strategy, and when was it implemented? Who was involved, and what were their tangible indications of success such as number of participants, number of residences retrofitted or kilowatt hours (kWh) of electricity reduced? This type of information can be used to celebrate success, adjust strategies as desired or develop new strategies.

In addition to documenting the implementation of strategies, other ways to quantify progress toward Action Plan goals could be developed. Along with quantifying GHG reductions, the City may also wish to select a handful of other "key indicators" that align with the proposed policies and strategies, can be easily measured over time and that can be used to communicate progress to the community. These could include, as examples, per capita percentage reductions in electricity use by sector (commercial, residential), percent increase in the community's diversion of solid waste or number of new green jobs created. Such indicators could then be used to not only monitor progress from year to year, but also to develop a concise report and "community sustainability dashboard" to be shared periodically with the community (Table 4).

Table 4. A Sample Community Sustainability Dashboard

Indicator	Units	2007 (baseline)	2010	2011
Energy	% reduction in electricity use/household			
Water	% reduction in kgals/capita			
Solid Waste	% increase in diversion rate % decrease in solid waste to the landfill			
Transportation	% decrease in per capita VMT			
Community	% increase in green jobs			
Greenhouse Gas Emissions	% reduction in eCOs2 tons/capita			

6.4 Funding for Ongoing Efforts

With limited funds available from City budgets, Greensboro has various other creative financing options available for GHG emission reductions and other sustainability strategies identified in this Action Plan. This Action Plan itself has already identified one strategy, a Cash Flow Sustainability Account, whereby the City starts by implementing energy saving measures that have no or minimal upfront costs and then uses money savings from these measures to establish the account. This fund can then be used, in turn, to help fund future sustainability initiatives that require some upfront money.

Some other popular and successful financing mechanisms for local governments include grants and performance contracts, because neither of these options rely on capital funding. While the City has already engaged in a performance contract for its own facilities, the City should continue to pursue state and federal grants, as well as private funding opportunities to fund implementation of Action Plan policies and strategies. This is yet another area where partnerships can be used to leverage resources, such as collaborating with the higher education community on grant proposals; exploring joint public-private partnerships; and seeking out “in-kind” assistance for implementation, such as academic research projects or volunteer programs.

Glossary of Terms and Acronyms

Accessory Dwelling Unit: An extra living unit on a property located either inside, attached to, or detached from the primary home on the property.

Biomass: When referring to fuel, means plant-derived fuel including clean and untreated wood such as brush, stumps, lumber ends and trimmings, wood pallets, bark, wood chips or pellets, shavings, sawdust and slash, agricultural crops, biogas, or liquid biofuels, but shall exclude any materials derived in whole or in part from construction and demolition debris.

Business-as-usual forecast: A forecast of future conditions assuming no changes to current practices.

Carbon Dioxide (CO2): The major heat-trapping gas whose concentration is being increased by human activities. It also serves as the yardstick for all other greenhouse gases. The major source of CO2 emissions is fossil fuel combustion. Carbon dioxide emissions also result from clearing forests and burning biomass. Atmospheric concentrations of CO2 have been increasing at a rate of about 0.5 percent a year, and are now more than 30 percent above pre-industrial levels.

Carbon Sequestration: The uptake and storage of carbon. Trees and other plants, for example, absorb CO2 then release the oxygen while storing the carbon.

Carbon Sinks: The processes or ecological systems that take in and store more carbon than they release. This process is called carbon sequestration. Forests and oceans are large carbon sinks.

Climate Change: A significant change from one climatic condition to another, often used in reference to climate changes caused by increase in heat-trapping gases since the end of the 19th century.

CO2e: Carbon dioxide equivalent, a measure that is used to express the concentration of all heat-trapping gases in terms of CO2.

CSC: Community Sustainability Council.

Density by Right: The allowable density on a parcel of land allowed under applicable land use code.

DSM: Demand-side management includes end-use measures that conserve electricity. They include energy efficient products and design, and load management strategies.

EECBG: Energy Efficiency Community Block Grant, a federal grant program to promote energy efficiency and conservation.

EECS: Energy efficiency and conservation strategy. Refers to a strategy required by the federal government for allocation of a local government's EECBG funds.

Embodied Energy: The total expenditure of energy involved in the creation of the buildings and materials. In terms of a full lifecycle of a product, it can also refer to the energy that is required to extract, process, package, transport, install, and recycle or dispose of materials and products.

Emissions: Refers to all air emissions other than GHG emissions, such as particulate matter, nitrous oxides, etc.

EPA: United States Environmental Protection Agency.

Floor: Area Ratio: The ratio of the total floor area of buildings on a certain location to the size of the land of that location, or the limit imposed on such a ratio. The Floor Area Ratio is the total building square footage (building area) divided by the site size square footage (site area).

Fossil Fuel: A general term for combustible geologic deposits of carbon in reduced (organic) form. Fossil fuels are of biological origin, and include coal, oil, natural gas, oil shales and tar sands. A major concern is that they emit CO2 when burned, significantly contributing to the enhanced greenhouse effect.

Generation: The process of making electricity. The term may also refer to energy supply.

Greenhouse Gas (GHG): Any gas that absorbs infrared radiation (traps heat) in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide, (N2O), halogenated fluorocarbons (HCFCs), ozone (O3), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs).

HVAC: Heating, ventilation, and air conditioning.

Intentional Community: A planned residential community composed of a group of people who have chosen to live together with a common purpose, working cooperatively to create a lifestyle that reflects their shared core values.

KWh: Kilowatt-hour, a unit of energy typically used for electricity consumption. One kWh equals 3,412 BTU's of energy.

LEED (-NC): The Leadership in Energy and Environmental Design program of the United States Green Building Council. LEED-NC is a green building standard for new construction and major renovations.

MMBtu: A million British Thermal Units, a standard unit of measurement to denote heat energy in fuels.

MTCO2e: A metric ton of CO2 equivalent, a metric ton is equivalent to 1.102 short tons or 2,204 pounds.

MW, Megawatt: A measure of electricity capacity. One MW is generally sufficient to provide power to 700 to 1,000 homes.

MWh: Megawatt-hour, a unit of energy typically used for electricity consumption (1 thousand kilowatt-hours).

PPM: Parts per million.

PV: Photovoltaic; a treated semiconductor material that converts sunlight to electricity.

Re-commissioning: The act of testing and adjusting existing building systems and equipment so that they perform once again as originally designed.

Source: Any process or activity that releases into the atmosphere a greenhouse gas, an aerosol or a precursor to a greenhouse gas.

VMT: Vehicle-miles traveled.

Weatherization: The practice of protecting a building and its interior from the elements, particularly from sunlight, precipitation, and wind, and of modifying a building to reduce energy consumption and optimize energy efficiency.

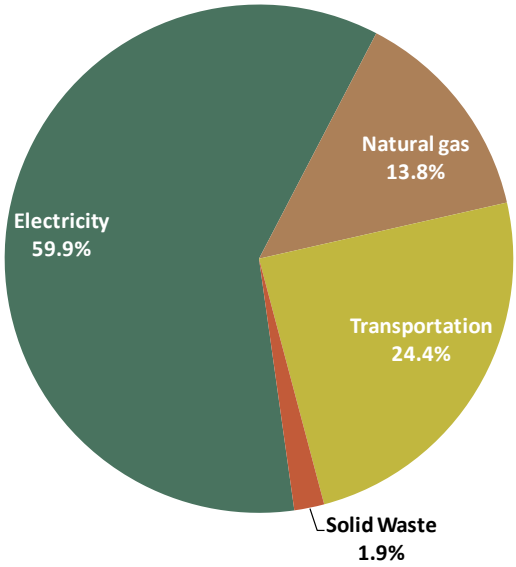
APPENDIX A: GREENHOUSE GAS INVENTORY METHODOLOGY

The first greenhouse gas (GHG) inventory for the community, *Greenhouse Gas & Criteria Air Pollutant Emissions Inventory, Greensboro, NC,* was prepared by the Center for Energy Resource and Technology at North Carolina A&T State University (hereafter referred to as CERT Inventory) and completed March 31st, 2009. This CERT Inventory was reviewed during the course of the CSC's work and found to be a sound foundation for benchmarking, forecasting, and goal setting. The following section outlines the methodology of that inventory and associated results. Benchmarking conducted as an aspect of the CSC's work is also included.

The GHG inventory was conducted for a baseline year of 2007 using the community-oriented methodology and software, Clear Air and Climate Protection (CACP), provided by Local Governments for Sustainability (ICLEI). The CACP software has been used widely by cities and counties nationwide. Deviations from this software and methodology are noted below.

The City of Greensboro's community-wide GHG emissions in 2007 are estimated to have been 5,517,198 metric tons of carbon dioxide equivalent (MTCO2e). These emissions are the result of residential, commercial, industrial, and institutional activities including energy consumption in buildings and processes (e.g. lighting, heating, cooling, fans, equipment, cooking), transportation (e.g. vehicle transportation on roads - cars, trucks and buses) and solid waste disposal.

City of Greensboro 2007 Emission Sources (community-wide) 5,517,198 Metric Tons CO2e



Electricity and Stationary Fuel Combustion

Data Source(s): Consumption data from Duke Energy (electricity) and Piedmont Natural Gas (via CERT Inventory)

Methodology: CACP

Comments: Electricity emission factors in ICLEI are out-of-date with respect to newer data available from the Environmental Protection Agency's eGRID that may be more relevant to 2007 year inventories. Using ICLEI factors will be consistent with other ICLEI communities, and appropriate for benchmarking, but may underestimate emissions with respect to newer emission factors. Kerosene and fuel oil consumption would represent less than 1/10 of 1 percent of Greensboro's emissions, assuming consumption is uniform state-wide on a per capita basis, and are therefore excluded from the inventory.

Emissions Summary

Sector	Fuel	Total Energy (MMBtu)	GHG Emissions (MTCO2e)
Residential	Electricity	5,456,746	1,054,325
Residential	Natural gas	5,764,050	323,068
Commercial	Electricity	8,096,659	1,564,396
Commercial	Natural gas	4,455,000	249,698
Industrial	Electricity	3,537,277	683,636
Industrial	Natural gas	3,383,589	189,647
TOTAL		30,693,321	4,064,770

*Most municipal and institutional uses are included under the Commercial sector.

Possible Benchmarking Metrics

Sector	Greensboro Metric	Comparison (s)
Residential	Square footage of residential buildings not available.	33.9 MMBtu/square foot (region) 38.8 MMBtu/square foot (climate zone)
	101.2 MMBtu/household	76.1 MMBtu/household (region) 76.4 MMBtu/household (climate zone)
Commercial	Square footage of commercial buildings not available.	89.0 MMBtu/square foot, all buildings in this climate zone and region
Industrial	Normalized benchmarks for the industrial sector tend to be less meaningful because of the broad range of processes and energy intensities found in this sector.	
Benchmarks are from the Energy Information Administration's Residential and Commercial Building Energy Consumption Survey		

Transportation

Data Source(s): Vehicle miles travelled (VMT) and vehicle type distribution from North Carolina Department of Natural Resources (NCDR) for Guilford County

Methodology: CACP

Comments: The CERT Inventory apportions VMT in Guilford County to Greensboro on the basis of population (53.1 %). This probably yields a reasonable estimate of emissions when combined with the methodology in CACP and will be easily replicable and comparable to other communities using CACP. Furthermore, it is the best approach available with current modeling data. Two considerations for future inventories, when improved modeling data and tools are available, are other approaches to apportioning VMT in Guildford County to Greensboro and the appropriateness of the vehicle mix fraction in the ICLEI model.

Another approach to apportioning VMT would be to consider the transportation model's fraction of urban VMT (85%) and then apportion that fraction of the total County VMT to urban areas based on their populations. Using this approach the VMT per capita in Greensboro increases to about 10,070 which is more consistent with national average.

The vehicle type distribution provided by NCDR does not readily map into the vehicle type categories in CACP. CACP's default distribution may overestimate emissions because it has a higher percentage of VMT in the light gasoline truck class than is suggested by the NCDR distribution of vehicles.

Emissions Summary

Fuel	Total Energy (MMBtu)	GHG Emissions (MTCO2e)
Gasoline	14,336,617	1,111,739
Diesel	2,991,549	235,559
TOTAL	17,328,166	1,347,298

Possible Benchmarking Metrics

Greensboro Metric	Comparison (s)
9,255 VMT/capita (this study) ~10,070 VMT/capita (apportion VMT by urban/rural first, then by Greensboro's fraction of the urban population)	• 11,433 VMT/capita for North Carolina (Bureau of Transportation Statistics) • 10,045 VMT/capita for United States (Bureau of Transportation Statistics) • 10,083 VMT/capita for United States (Brookings Institution)

Greensboro Metric	Comparison (s)
10,198 VMT/capita (Brookings Institution for Greensboro-High Point, NC)	Greensboro-High Point ranks 54 out of the top 100 metropolitan areas (by employment) for VMT/capita

Solid Waste

Data Source(s): City of Greensboro Environment Services Department (CGESD)

Methodology: CACP

Emissions Summary

Total MSW Disposed in Landfill (tons)	GHG Emissions (MTCO2e)
199,400	105,094

Possible Benchmarking Metrics

Greensboro Metric	Comparison (s)
3.11 lbs/person/day discards to landfill after recovery	3.08 lb/person/day discards to landfill after recovery or combustion for energy, national average from EPA
4.95 lb/person/day MSW generation before recovery, from data in 2004-05 Key Trends and Indicators	4.62 lb/person/day MSW generation before recovery, national average from EPA
27% diversion rate in 2004-05	33% diversion rate, national average from EPA
1.45 tons/year/capita	1.35 tons/year/capita Guilford County targeted per capita disposal rate

Other Emission Sources

There are a number of emission sources that were excluded from this inventory for one or more of the following reasons:

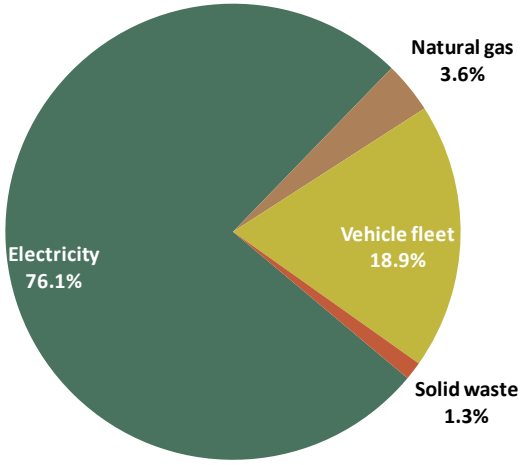
- Insufficient information to estimate emissions
- Few or no options for reducing emissions from source
- Relatively minor with respect to included emissions
- Occurs outside the boundary of Greensboro (Scope 3)
- Already subject to State or Federal regulations

Some of these sources include airline travel by Greensboro residents or visitors, vehicle trips that cross Greensboro's city limits, closed landfills, fertilizer application, refrigerant losses, wastewater treatment, and livestock.

City of Greensboro Operations

A GHG inventory was also prepared for the City of Greensboro's internal operations. These emissions are included in the previously described community-wide inventory. The same emissions factors were used for the City inventory except for fleet vehicles, which were calculating using approaches from The Climate Registry. The City's operational GHG emissions are about 2.2% of the community's total GHG emissions.

City of Greensboro 2007 Emission Sources
(city operations)
122,458 Metric Tons CO2e



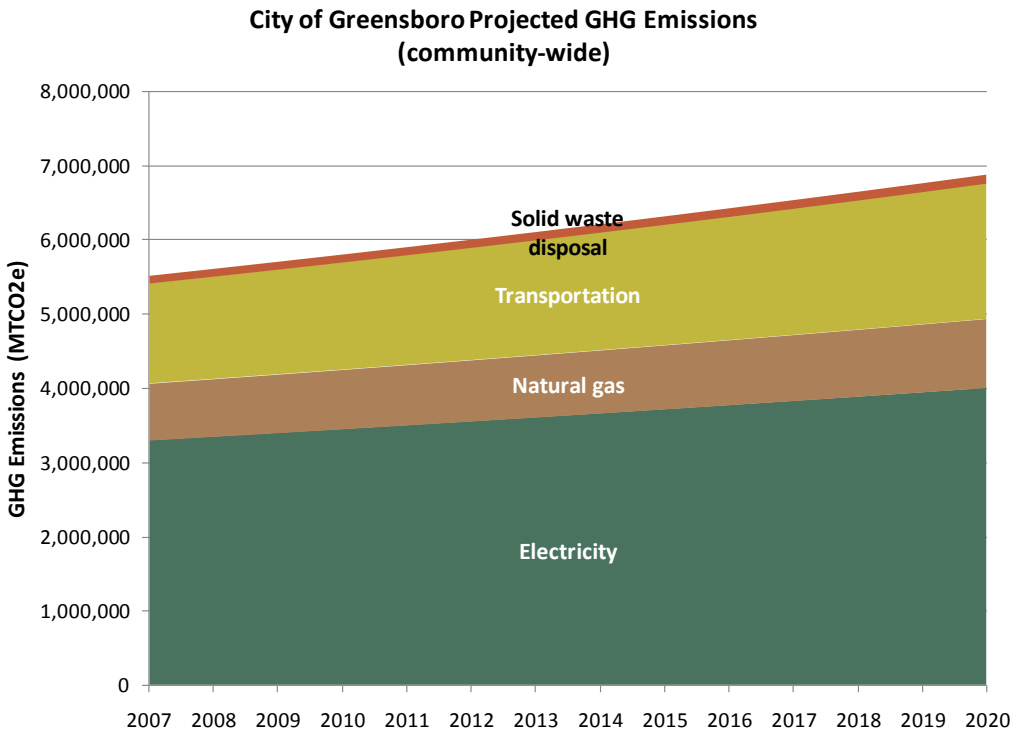
Changes to City Boundaries

In the event of future changes to the City of Greensboro's boundaries, such as through annexation, the impact to the greenhouse gas inventory will be evaluated. Cumulative changes that alter the City's inventory by 5 percent or more will lead to a modification of the baseline year inventory to account for the modified community boundaries.

GHG Emissions Forecast

The forecast for Greensboro's GHG emissions was developed using the same growth factors applied in the State of North Carolina's Climate Action Plan Advisory Group and County-level estimates for solid waste. These growth rates may exceed the projected population growth in Greensboro, but both energy consumption and transportation are generally growing at rates that outpace population. This is likely a high-end estimate of future emissions for Greensboro.

Emission Source	Growth Rate Applied (year-over-year)	Source
Electricity	1.50%	State-wide population growth rate 2000-2020, North Carolina Office of State Budget and Management
Natural gas	1.50%	State-wide population growth rate 2000-2020, North Carolina Office of State Budget and Management
Transportation	2.40%	Federal Highway's Highway Performance System (HPMS) and North Carolina DENR
Solid waste	1.20%	Guilford County Solid Waste Management Plan Update 2009


City of Greensboro Projected GHG Emissions
(community-wide)
GHG Emissions (MTCO2e)
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Solid waste disposal
Transportation
Natural gas
Electricity

APPENDIX B: FULL TEXT OF COMMUNITY SUSTAINABILITY COUNCIL REPORTS (VIRTUAL APPENDIX)

During preparation of the Sustainability Action Plan in 2009-2010, a series of reports were prepared by sub-committees to the CSC to support development of the policies and strategies in this Plan. Specifically, these sub-committees addressed the following topics:

- Land Use and Transportation
- Green Jobs and Buildings
- Recycling and Waste Reduction
- City Operations
- Nature in the City
- Education and Outreach
- Green Technologies – in progress

You can read copies of these sub-committee reports and learn more about the Sustainability Action Plan and activities of the CSC by visiting the CSC website at: http://www.greensboro-nc.gov/citygovernment/sustainability/.

APPENDIX C: DEVELOPMENT OF COST ESTIMATES FOR POLICIES

In Section 5.0, Sustainability Action Plan Policies and Strategies, the following table is presented to convey the estimated cost of implementation, cost savings, and greenhouse gas reductions associated with the recommended policies and strategies. This Appendix elaborates on the assumptions stated in Section 5.0 to better document the process of estimating the costs and cost savings for these policy topics.

Policy Topic	Minimum Cumulative Cost to Implement by 2020 (as proposed case only)	Minimum Cumulative Cost Savings by 2020 (as proposed case only)	GHG Reductions in 2020 [MTCO2e] (as proposed, fully implemented)	Percentage Reduction of Business-as-usual GHG Emissions in 2020 (as proposed, fully implemented)
Transportation and Land Use	$3,600,000	$17,600,000	181,000 - 403,000	2.6% - 5.9%
Green Jobs and Buildings	$2,900,000	$4,000,000	67,000 - 204,000	1.0% - 3.0%
Waste Reduction and Recycling	$2,300,000	$2,300,000	6,000 - 12,000	0.1% - 0.2%
City Operations	$500,000	$600,000	13,000 - 22,000	0.2% - 0.3%
SUBTOTAL	$9,300,000	$24,500,000	267,000 - 641,000	3.9% - 9.3%
Funded EECS Strategies	$3,100,000	$4,570,000	9,000 - 9,000	0.1% - 0.1%
TOTAL	**$12,400,000**	**$29,070,000**	**276,000 - 650,000**	**4.0% - 9.4%**

****Notes:** Numbers in the above table may not sum exactly due to rounding. No direct GHG reduction benefits from Nature and the City were quantified. The benefits of Education and Outreach are included under the Funded EECS Strategies. See Sections 5.5 and 5.6 of the Action Plan for further discussion. Only a portion of Funded EECS Strategies are assumed to still be in effect in 2020.

This Appendix only includes strategies for which costs and cost savings were estimated. Costs and cost savings were not estimated for the unlisted strategies due to lack of available information on which to base an estimate or because the cost and cost savings for the strategy are already captured by another strategy or one of the funded EECS strategies.

Transportation and Land Use

Policy 2: Strategy 2A.

Individualized marketing of transit and alternative transportation services is the basis of this strategy.

The cost of implementing this strategy is based on reaching 120,000 households in Greensboro over five years. The Portland SmartTrips program delivered individualized transit marketing to households for $30 per household[xvi]. Therefore, the cost of achieving similar marketing for Greensboro is estimated to be *120,000 households * $30/household =* ***$3,600,000***.

Individualized marketing of transit services in a number of communities resulted in an average VMT reduction of about 7 percent[xvii]. Assuming that a 7 percent VMT reduction is achieved over a 5-year program roll-out, with one-fifth of households receiving marketing each year, the annual VMT reduction would be approximately *2,900,000,000 VMT/yr (2020 est.) * 7 percent * (24,000 households/120,000 households year) = 39,000,000 VMT/yr*.

While strict fuel cost savings are as much as $0.13/mile (based on $2.64/gallon of fuel and 19.7 miles/gallon), cost savings are estimated to be $0.03/mile for reduced VMT to account for the additional costs associated with other modes including transit passes, the purchase of a bike and associated equipment, etc. At this conservative rate of savings, the annual cost savings is *39,000,000 VMT/yr *$0.03/VMT = $1,200,000/yr*. Cumulative performance of the strategy over 5-years would proceed as follows:

Year	Total Households	Annual VMT Reduction (Million VMT)	Annual Cost Savings (Million Dollars)	Cumulative Cost Savings (Million Dollars)
1	24,000	39	$1.2	$1.2
2	48,000	78	$2.3	$3.5
3	72,000	117	$3.5	$7.0
4	96,000	157	$4.7	$11.7
5	120,000	196	$5.9	$17.6

The total cumulative cost savings over 5-years are estimated to be **$17,600,000**.

Green Jobs and Buildings

Policy 3: Strategy 3A.

Research indicates that education alone can result in 5 to 30 percent energy savings[xviii].

The cumulative cost to implement an educational outreach program is estimated to be equivalent to one full-time employee at *$75,000/yr * 10 yr = $750,000*.

Based on programs in other communities, the "As Proposed" case assumes an adoption rate of 2.5 percent for the efforts to promote existing energy conservation programs and an energy savings of 5 percent for participants. Cost savings are based on typical energy rates, which are conservatively estimated at $0.04/kWh and $10/Dth.

Electricity: *1,940,000,000 kWh/yr (est. 2020) *2.5 percent * 5 percent *$0.04/kWh =$97,000/yr*

Natural Gas: *7,000,000 Dth/yr (est. 2020) *2.5 percent * 5 percent *$10/Dth = $87,000/yr*

Annual savings for electricity and natural gas are approximately $184,000 *($97,000 + $87,000)*. Over the course of 10-years, the cumulative savings would be approximately $1,840,000.

Policy 3: Strategy 3B.

The cost of assessment program is estimated to be $250/household based on assessment programs offered by other utilities nationwide: *250 households/yr * $250/household * 10 yr = $625,000*.

The cost of the additional outreach and implementation support to achieve compact fluorescent lamp (CFL) and efficient heating, ventilation and air conditioning (HVAC) system upgrades, with community-wide penetrations of an additional 0.8 and 0.2 percent per year, and assuming an average upgrade cost of $150/household: *100,000 households *(0.8+0.2) percent/yr *$150/household * 10 yr = $1,500,000*.

Assessments are anticipated to achieve energy savings of 5 percent per household per year. Cost savings are based on typical energy rates.

Electricity:

*53 MMBtu/household (CERT) * 5 percent *250 households/yr * $0.04/kWh * 10^6 Btu/MMBtu / 3,413 Btu/kWh = $8,000/yr*

Natural Gas:

*56 MMBtu/household (CERT) * 5 percent *250 households/yr * $1/Therm* 10 Therm/MMBtu = $7,000/yr*

The annual cost savings from assessments is $15,000 (*$8,000 + $7,000).*

The savings from increased penetration of CFLs and HVAC upgrades are estimated to be 2.5 percent and 10 percent, for electricity and natural gas respectively, per household.

Electricity:

*53 MMBtu/household (CERT) *100,000 households * 0.8 percent penetration*2.5 percent savings * $0.04/kWh * 10^6 Btu/MMBtu / 3,413 Btu/kWh = $12,000/yr*

Natural Gas:

*56 MMBtu/household (CERT) * 100,000 households * 0.8 percent penetration*10 percent savings * $1/Therm* 10 Therm/MMBtu = $11,000/yr*

The total annual cost savings from audits and implementation support are approximately $40,000 (*$15,000 + $12,000 + $11,000*). The cumulative savings are expressed in the following table

Year	Cumulative Savings ($)
1	$40,000
2	$80,000
3	$120,000
4	$160,000
5	$200,000
6	$240,000
7	$280,000
8	$320,000
9	$360,000
10	$400,000
Total	$2,200,000

The total cost of strategies under Green Jobs and Buildings is **$2,900,000** *($750,000 + $625,000 + $1,500,000*). The total cost savings are approximately **$4,000,000** *($2,200,000 + $1,840,000*)

Waste Reduction and Recycling

Policy 7: Strategy 7B, 7C and 7D.

These strategies are collectively assumed to be capable of reducing emissions from solid waste generation by at least 5 percent.

The cost to implement efforts such as increasing the number of recycling drop-off sites, mandatory recycling, and incentive programs that can lead to this level of increase in diversion vary widely by community from cost reductions of up to 15 percent to cost increases of up to 20 percent over current diversion program costs. It was assumed that the City's adopted recycling program budget for 2009-2010 would increase by 5 percent and that those funds would be required each year to maintain diversion levels: *$4,531,710 budget * 5 percent * 10 yr=* ***$2,300,000****.*

Savings are the result of the cost difference between recycling ($21/ton) and landfill disposal ($41/ton). For a 5 percent reduction in landfilled material: *232,000 tons waste (est. 2020) * 5 percent * $20/ton savings * 10 yr =* ***$2,300,000****.*

City Operations

Policy 8: Strategy 8D.

The benefits of re-commissioning have been generally estimated to be between 5 and 30 percent energy savings by a number of sources, such as the federal Environmental Protection Agency's ENERGY STAR program[xix].

The cost to implement recommissioning is estimated to be $0.25/square foot of building space and recommissioning is estimated to be applicable for approximately 2 million square feet of City buildings: *2,000,000 sq. ft. * $0.25/sq. ft. =* ***$500,000****.*

The "As Proposed" and "Fully Implemented" cases assume that 40 and 70 percent, respectively, of electricity and natural gas consumption in City buildings are consumed for heating and cooling uses based on data from the Commercial Buildings Energy Consumption Survey. It is estimated, conservatively, that 7 percent of this consumption will be saved through re-commissioning. Cost savings are based on average utility rates for the City.

Electricity: *30,000,000 kWh for City * 40 percent * 7 percent *$0.05/kWh = $40,000*

Natural Gas: *300,000 therms for City * 70 percent * 7 percent *$1.14/therm = $20,000*

Annual savings for electricity and natural gas are approximately $60,000 *($40,000 + $20,000)*. Over the course of 10-years, the cumulative savings would be approximately **$600,000.**

Endnotes

[i] Appalachian State University Energy Center. (2008) Secondary Economic Impact Analysis of Greenhouse Gas Mitigation Options for North Carolina Prepared for the Center for Climate Strategies, Washington, D.C.

[ii] U.S. Conference of Mayors Climate Protection Agreement: http://www.usmayors.org/climateprotection/agreement.htm

[iii] As an example, a policy/strategy as proposed may result in GHG reductions from retrofitting of 1,000 homes with more energy efficient equipment. A "full implementation" scenario would assume retrofitting of all of Greensboro's homes.

[iv] Johnston, Robert A. (2006) Review of U.S. and European Regional Modeling Studies of Policies Intended to Reduce Motorized Travel, Fuel Use, and Emissions. Victoria Transportation Policy Institute, Victoria, BC.

[v] Victoria Transportation Policy Institute: http://www.vtpi.org/tdm/tdm23.htm

[vi] Walkinginfo.org: http://www.walkinginfo.org/library/details.cfm?id=3961

[vii] U.S. Green Building Council. (2009) Green Buildings for Cool Cities: A Guide for Advancing Local Green Building Policies. http://www.usgbc.org/ShowFile.aspx?DocumentID=6445

[viii] Doppelt, Bob and Markowitz, Ezra M. (2009) Reducing Greenhouse Gas Emissions through Behavioral Change: An Assessment of Past Research On Energy Use, Transportation and Water Consumption. Climate Leadership Initiative Institute for a Sustainable Environment, University of Oregon, Eugene, OR.

[ix] U.S. Department of Energy. (2009) Impacts of the 2009 IECC for Residential Buildings at State Level. Pacific Northwest National Laboratory, Richland, WA.

[x] U.S. Department of Energy. (2009) Impacts of Standard 90.1-2007 for Commercial Buildings at State Level. Pacific Northwest National Laboratory, Richland, WA.

[xi] Davis Langdon. (2007) The Cost of Green Revisited: Reexamining the Feasibility and Cost Impact of Sustainable Design in the Light of Increased Market Adoption. Davis Langdon US, www.davislangdon.com.

[xii] http://www.epa.gov/climatechange/wycd/waste/downloads/greengas.pdf.

[xiii] Savings from the City's current Energy Performance Contract would not be included in the account.

[xiv] U.S. Green Building Council. (2009) Leadership in Energy and Environmental Design for New Construction (LEED-NC) Checklist. www.usgbc.org.

[xv] http://www.energystar.gov/ia/business/BUM_recommissioning.pdf

[xvi] Walkinginfo.org: http://www.walkinginfo.org/library/details.cfm?id=3961

[xvii] Victoria Transportation Policy Institute: http://www.vtpi.org/tdm/tdm23.htm

[xviii] Doppelt, Bob and Markowitz, Ezra M. (2009) Reducing Greenhouse Gas Emissions through Behavioral Change: An Assessment of Past Research On Energy Use, Transportation and Water Consumption. Climate Leadership Initiative Institute for a Sustainable Environment, University of Oregon, Eugene, OR.

[xix] http://www.energystar.gov/ia/business/BUM_recommissioning.pdf