

City of Winston-Salem



Greenhouse Gas Inventory and Local Action Plan to Reduce Emissions

August 2008

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City of Winston-Salem
Greenhouse Gas Inventory and Local Action Plan to Reduce Emissions
July 2008

Executive Summary

Background Summary

In May of 2007, Winston-Salem City Council adopted a resolution supporting the U. S. Conference of Mayors' Climate Protection Agreement with the following specific commitments:

- The City of Winston-Salem is committed to the long-range goal of stabilizing atmospheric concentrations of greenhouse gases, and will do its part to achieve that goal.
- An interdepartmental task force will be established to conduct an inventory of greenhouse gas emissions during fiscal year 2008 and develop an action plan for proposed implementation of the Climate Protection Plan.
- The City will join the membership of the International Council for Local Environmental Initiatives ('ICLEI', now called ICLEI-Local Governments for Sustainability) to facilitate the efficient and effective planning of the greenhouse gas emissions inventory.

The City joined ICLEI and began implementing the five milestone process outlined by ICLEI to reduce green house gas emissions. The ICLEI Five Milestone process is:

- Milestone 1: Conduct a baseline emissions inventory and forecast.
- Milestone 2: Adopt an emissions reduction target.
- Milestone 3: Develop a Local Action Plan.
- Milestone 4: Implement Policies and Measures.
- Milestone 5: Monitor and verify results.

The year 2000 was chosen as a baseline year for measuring greenhouse gas (GHG) emission levels for this study, with FY06 chosen as the interim year for comparison purposes. Although this process applies to the City of Winston-Salem, the most reliable data is available by county; therefore, the community information is based on data for Forsyth County and, where applicable, is referred to in the report as "Winston-Salem Community" information. Greenhouse gas emissions were estimated as "carbon dioxide equivalents" (CO₂e) using the current ICLEI protocol. This protocol is in the process of being amended and a new protocol (i.e. multipliers) for calculating CO₂e emissions may cause significant changes in future CO₂e values. However, the community's historical energy use data will not change so historical CO₂e values could be easily recalculated as required by future protocols.

Winston-Salem Community Emissions Inventory Summary

Fig. 1: Winston-Salem Community Greenhouse Gas Emissions by Source and Sector

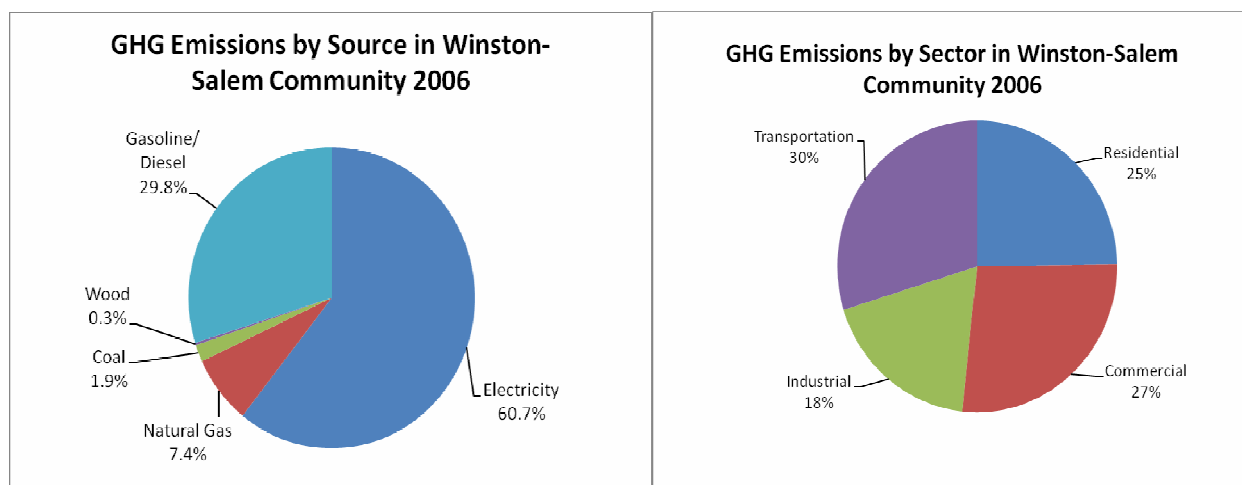
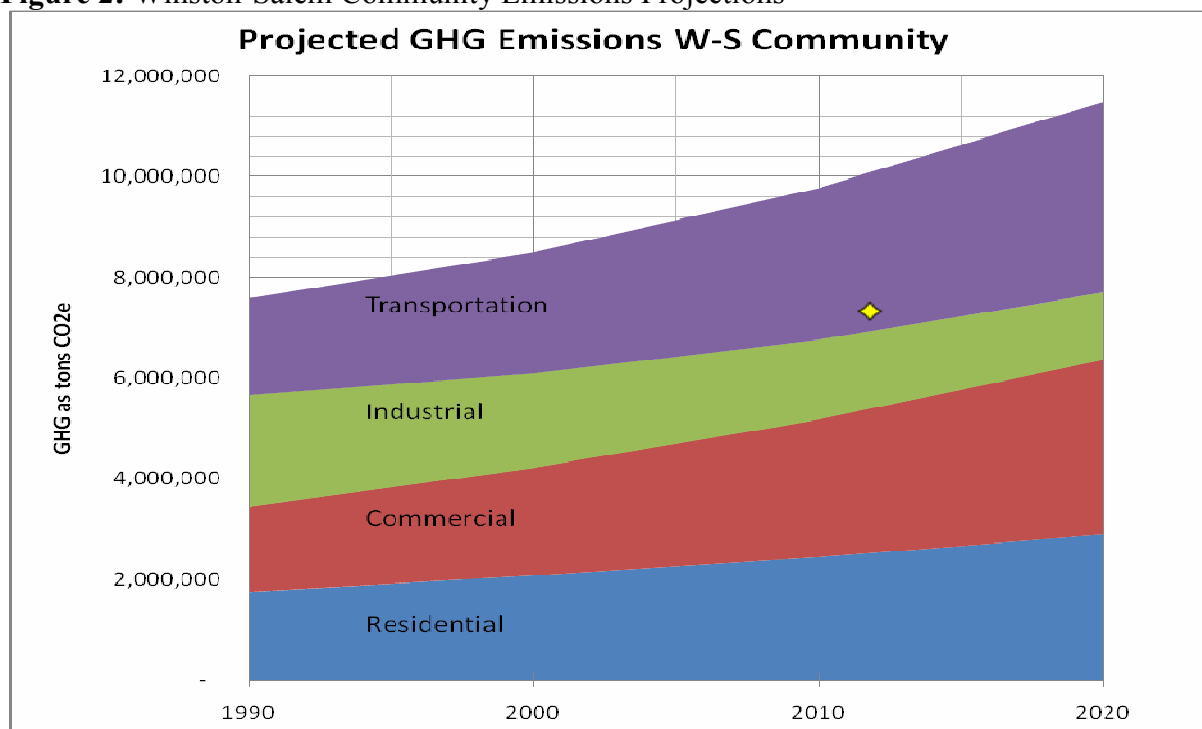


Figure 1 shows the breakdowns of emissions in the Winston-Salem Community by energy source and sector. The source of most emissions (60.7%) is from electricity use. Transportation is the highest sector contributing to GHG emissions, followed closely by the commercial and residential sectors, respectively. GHG emissions from electricity are indirect emissions that occur outside the community due to electricity use by the citizens and businesses within the community. Emissions from transportation and fuels are direct emissions that occur within the community.

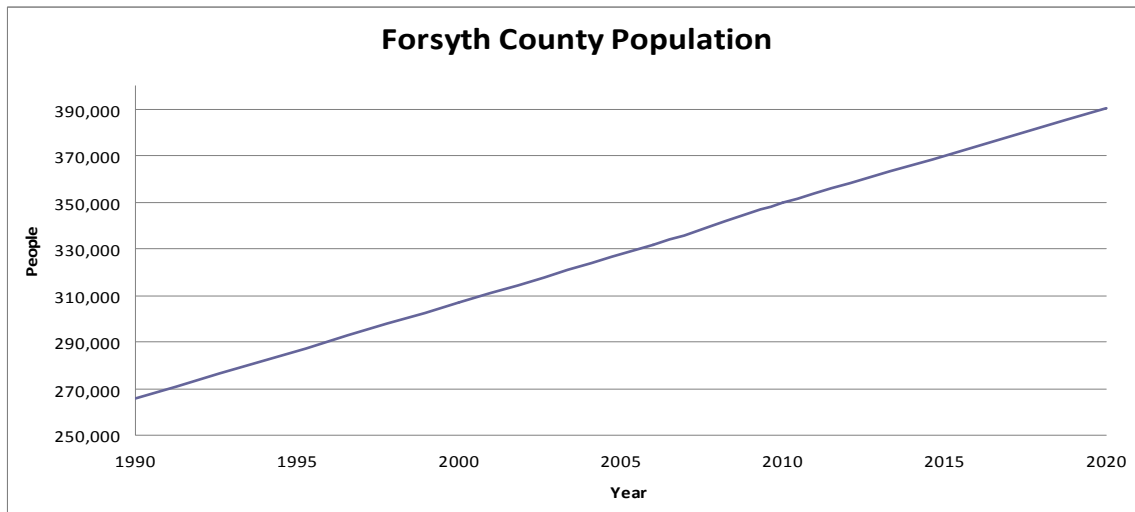
Figure 2: Winston-Salem Community Emissions Projections



◆ Represents Kyoto Protocol Target (7% reduction of 1990 emissions levels by 2012)

Figure 2 shows the projected growth in greenhouse gas emissions through 2020. This assumes energy use and growth continue the same as during the 1990-2006 period based on projected population increases (Figure 3). Note - The Kyoto Protocol Target in 2012 is 7% below 1990 levels, which is 17% below actual 2000 levels and 25% below current levels.

Fig. 3: Winston-Salem Community (Forsyth County) Population



The population in the study area has steadily increased since 1990 at slightly more than 1% per year. Energy use levels and thus emission levels are generally related to population. As the population increases, emission levels in transportation, residential, commercial and industrial sectors will continue to increase in a business as usual scenario.

City of Winston-Salem Operations Emissions Inventory Summary

(Note: City operations are a part of the commercial sector)

Fig. 4: City Operations as a Portion of Winston-Salem Community Emissions

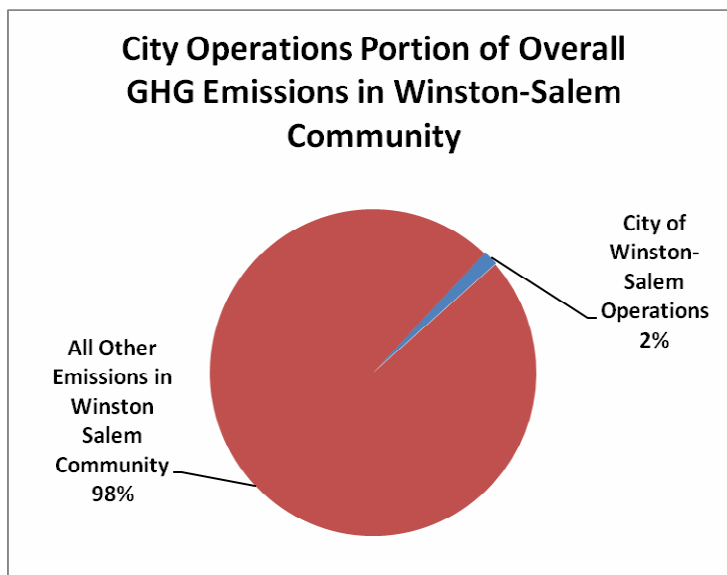
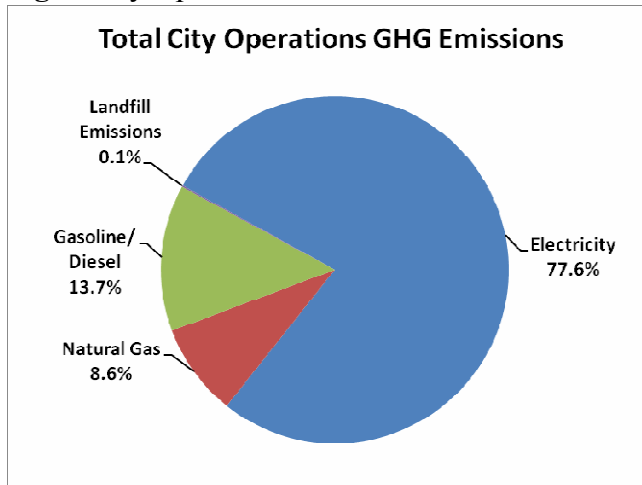
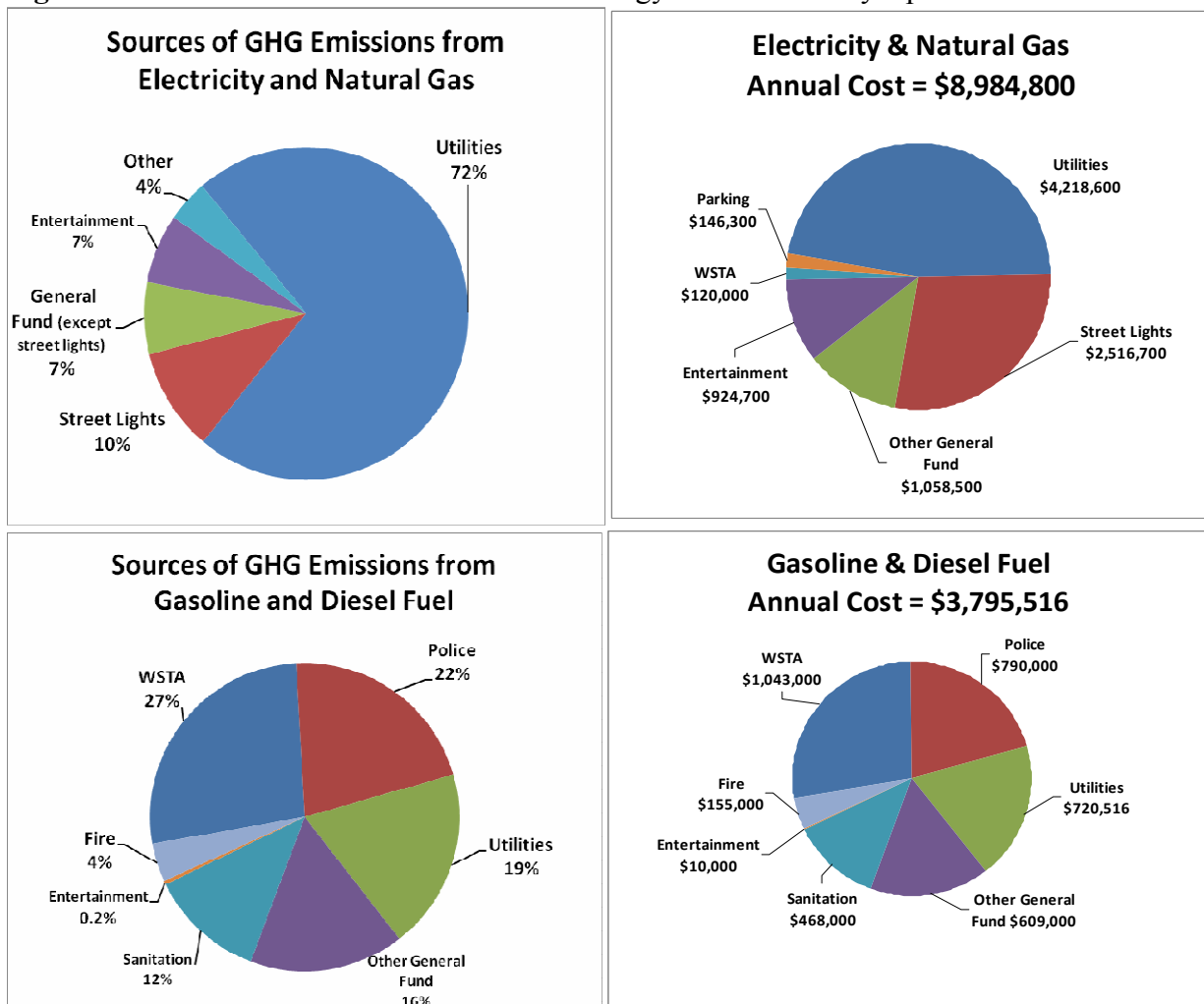


Figure 4 illustrates that City Operations cause 2% of total community GHG emissions.

Fig. 5 City Operations GHG Emissions

GHG emissions from City Operations are dominated by the 86.2% of emissions due to electricity and natural gas use. 13.7% of emissions are from fuel used in City vehicles.

Figure 6 shows the areas of City Operations responsible for “Electricity and Natural Gas” emissions and “Gasoline and Diesel Fuel” emissions, as well as their respective costs. Utilities Operations generate over 70% of the electric and natural gas GHG emissions while Street Lights contribute 10% of emissions.

Fig. 6 Sources of GHG Emissions & Annual Energy Costs from City Operations

Next Steps and Recommendations:

To address the goal of stabilization of greenhouse gas emissions stated in the Council resolution in May 2007, all affected stakeholders should have an opportunity to participate in the process of development of the local action plan. An open process is recommended to begin enlisting the participation of citizens, business, industry, government, education and other interested groups in the development of the action plan and setting of targets.

To address the goal of stabilizing GHG emissions, City Operations should set a target of no increase in emissions for the target year of 2010. The City of Winston-Salem interdepartmental task force should continue to function to determine the steps necessary to meet this goal and develop an action plan for City operations.

Representatives of the interdepartmental task force should also participate in the broader community-wide stakeholder process to foster communication and sharing of ideas. The community-wide stakeholder process should be managed to develop the tenets of the local action plan, from which the City council can move on to “Milestone 4: Implement Policies and Measures”.

Recommendations:

Community Action Plan:

- Establish a community-wide stakeholder process to further develop the Local Action Plan.
- Designate a full-time Sustainability Manager to manage both the community-wide and internal operations processes.
- Establish a Community Sustainability Program Committee.
- Develop a Community Sustainability Awards Program.
- Develop public/private/community partnerships to promote the Local Action Plan and encourage participation in the process.
- Develop a public education program.
- Promote and expand energy conservation and sustainability measures in the residential, commercial, and industrial sectors.
- Expand and enforce sustainable land use planning strategies.
- Promote the use of alternative vehicles and fuels in the transportation sector.
- Promote the use of alternative transportation measures within the community.

City Operations Action Plan:

- Establish a goal of stabilizing GHG emissions in City operations by setting an interim target of stabilizing emissions by 2010
- By 2010, determine the costs and best methods for reducing GHG emissions from City operations to 2006 levels.

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Local Action Plan for Emissions Reduction

Background

The City of Winston-Salem's Commitment

In May of 2007, Winston-Salem City Council adopted a resolution supporting the U. S. Conference of Mayors' Climate Protection Agreement, committing the City of Winston-Salem to the long-range goal of reducing greenhouse gas emissions (GHG) from city government operations and throughout the Winston-Salem community. The resolution directed the City to obtain membership in the International Council for Local Government Initiatives (ICLEI) to facilitate the efficient and effective planning of a greenhouse gas inventory. Staff was also authorized to establish an interdepartmental task force to assist in conducting the greenhouse gas emissions inventory during FY08, set an emissions reduction target, and to develop an action plan for the proposed implementation of the Climate Protection Plan. These actions are outlined in the ICLEI Five Milestone process:

- **Milestone 1: Conduct a baseline emissions inventory and forecast.**
Calculate greenhouse gas emissions for a base year and a forecast year based on energy consumption and waste generation.
- **Milestone 2: Adopt an emissions reduction target.**
Establish an emissions reduction target. The target fosters political will and creates a framework to guide the planning and implementation of measures.
- **Milestone 3: Develop a Local Action Plan.**
Develop a Local Action Plan that describes the policies and measures the City will take to reduce greenhouse gas emissions and achieve its emissions reduction target.
- **Milestone 4: Implement Policies and Measures.**
Implement the policies and measures contained in the Local Action Plan.
- **Milestone 5: Monitor and verify results.**
Monitoring begins once measures are implemented and continues for the life of the measures, providing important feedback that can be used to improve the measures over time.

The year 2000 was chosen as a baseline year for measuring greenhouse gas emission levels in the community. FY05-06 was chosen as the interim year for comparison purposes in the community and base-line information for the City's operations. Under the U. S. Mayors' Climate Protection Agreement which endorses the Kyoto Protocol, the Kyoto reduction goal is to reduce GHG emissions to 7% below 1990 levels by 2012.

Recent State, Federal and Local Actions

N.C. Government Actions:

In 2006, the North Carolina Department of Environment and Natural Resources (DENR) convened the first meeting of the Climate Action Plan Advisory Group (CAPAG). The purpose of the CAPAG was to develop public recommendations to DENR and the Division of Air Quality for a state level climate action plan, focusing in particular on economic opportunities and co-benefits associated with potential climate mitigation actions. The goal of the CAPAG was to seek consensus on a comprehensive series of individual proposed actions to reduce GHG's emissions in North Carolina. Some of these actions have already been adopted, such as the Renewable Portfolio Standard adopted in 2007. With so many of the sources of GHG emissions being under their direct or indirect control, local governments will undoubtedly play a key role in enabling North Carolina to achieve any emission reduction target it establishes. Because the City of Winston-Salem, other local governments, and the State of North Carolina are planning for climate change action concurrently, they are poised to aid one another in achieving their mutual goals of climate change mitigation and social and economic vitality.

Gov. Mike Easley announced on June 30, 2008 that North Carolina received a \$50,000 grant from the National Governors Association to develop an innovative program to increase energy building code inspections that could yield utility cost savings of up to \$15 million a year. North Carolina is one of 12 states to receive the grants from the association's Center for Best Practices. "If North Carolina and our nation are to be energy independent, we must start with cutting down on energy use in our homes and businesses," Easley said. "Our building codes already include many energy conservation requirements that if our builders and inspectors are better informed, could result in significant savings with little expense." The grants, awarded by a group of independent reviewers, comes from the association's "Securing a Clean Energy Future" initiative that is designed to help states overcome obstacles to energy efficiency and conservation and use clean energy resources. The other states that received the grants are Alabama, Colorado, Delaware, Florida, Hawaii, Kansas, Maine, Maryland, Michigan, Montana and Utah. The State Energy Office will oversee the effort to increase energy efficiency and conservation by increasing and improving compliance with existing energy codes and help make sure the state keeps its energy codes up-to-date. Historically, enforcement of building codes has focused mainly on safety issues. But, with North Carolina being among the 10 fastest growing states in the nation, also focusing on energy efficiency requirements will make a significant cut in North Carolina's growth in energy, power and water consumption. The grant, which is being matched by a portion of state funds and in-kind resources, will be used to improve training for building code officials including inspectors, builders and architects. The effort will also include working with the building inspection departments in the state's 100 counties and 180 municipalities.

The effort goes hand-in-hand with the State Energy Plan, first adopted in 2005, along with Senate Bill 668, that was signed into law last year and requires state, university and community college officials to include energy efficient materials and products in new and renovated buildings. The goal is to save taxpayers' money, improve conservation of natural resources and protect the environment. The law calls on the state to reduce energy use for all state buildings by 20 percent by 2010 and 30 percent by 2015.

The North Carolina General Assembly adopted a final budget for the 08-09 fiscal year on July 8, 2008. The budget was presented to the Governor and requires the Governor's signature before becoming final. The proposed budget includes several energy-related provisions, explained here.

The budget appropriates funds to various energy-related funds and initiatives, including the Green Business Grant Fund (\$1 million), the Biofuels Center (\$5 million), and the Community Development Initiative (\$1 million), an initiative that offers grants for green affordable housing.

Other featured items of the proposed budget include the Energy Efficiency Reserve Fund for State Buildings administered by the State Energy Office (\$5 million), the NCSU Advanced Transportation Energy Center (\$250, 000), the Energy Production Infrastructure Center at UNC-Charlotte (\$57.2 million in certificates of participation), and the Williamsdale Farm Agriculture Extension and Research Facility for biofuel crops (\$1.25 million).

Special provisions to the adopted budget include a UNC study of the feasibility of wind energy in coastal North Carolina, an Energy Star Sales Tax Holiday during the first weekend of November for Energy Star efficient appliances (e.g. clothes washers, dishwasher, heat pumps, ceiling fans), and a Renewable Energy Equipment Tax Credit for anyone donating funds to a tax-exempt government agency for renewable energy equipment.

Federal Actions

The Energy Independence and Security Act of 2007 signed into law by Congress in December 2007 phases out the use of inefficient incandescent lights and imposes improved energy efficiency standards on a wide variety of products. According to the American Council for an Energy-Efficient Economy (ACEEE), the new standards for light bulbs require them to use about 20%-30% less energy by 2014, while requiring the federal Department of Energy to set standards for light bulbs to cut their energy use at least 35% by 2020. The Alliance to Save Energy (ASE) calls the act "the most significant energy-efficiency legislation in three decades" and notes that the lighting standards alone will cut electric bills by \$13 billion per year. The same law requires federal buildings to set a goal to cut their energy use by 30% by 2015.

The National Oceanic and Atmospheric Administration has proposed the formation of a National Climate Service. The Service would be a means by which NOAA and other federal government agencies would communicate relevant climate information to local governments and other decision makers to working on climate mitigation and adaptation. This service would be of great benefit to local governments in the fulfillment of Milestone 5 to monitor and verify results.

Local Actions

The City of Winston-Salem is a signatory to the Triad Early Action Compact. This Triad-wide effort has led to improved air quality in our region using voluntary measures through a partnership of local governments, businesses and industry. The Northwest and Piedmont Council of Governments are very involved with this effort. The stakeholder group is chaired by Councilman Dan Besse.

Why Winston-Salem Should Take Action

Due to population density, urban and suburban areas will be more susceptible than rural areas to the negative impacts of climate change. This density, however, also provides cities with unique opportunities for efficiency and emission reductions, through shared infrastructure. Apart from Winston-Salem's responsibility to do its part to reduce its greenhouse gas production, there are numerous other benefits of reducing emissions in the region that include, but are not limited to:

- **Improved Service Delivery**

Through the implementation of energy efficiency initiatives in facilities and operations and throughout the community, the City will be able to offer services more efficiently and economically.

- **Reduced Costs**

By reducing energy consumption, the City and local citizens will save money on energy bills. While energy efficiency initiatives may require an initial capital investment, paybacks of between four and seven years can be expected in many cases and savings will continue well beyond the payback period. Furthermore, by reducing energy consumption, the City and its citizens will be less vulnerable to fluctuations in the market price of energy.

- **Improved Air Quality and Public Health**

The combustion of fossil fuels used to produce electricity, heat buildings, and power vehicles, emits a variety of pollutants into the atmosphere that are known to have negative health impacts and reduce local air quality. Reduced energy consumption will result in a reduction in local air pollutants such as sulfur dioxide (SO₂), nitrogen oxides (NO_x), ozone (O₃), particulate matter (PM₁₀), and carbon monoxide (CO). The Triad area is in non-attainment status for ozone, a pollutant that is harmful to human respiratory systems, vegetation, and crops. Since emissions may be linked to the increased spread of diseases, in the long term, taking steps to reduce greenhouse gas emissions reduces the likelihood of climate-related health problems.

- **Asset Management**

Asset management involves developing a plan to systematically review the state of facility operations and implementing a logical repair or upgrade schedule that focuses on a proactive approach to facility improvements. Preventative maintenance improves the value of the City's assets by reducing facilities' operating costs, modernizing equipment, and decreasing deferred maintenance. Furthermore, increasing the efficiency of facilities and operations leads to better-run operations, greater client satisfaction, along with increased energy efficiency and the resulting cost savings emission reductions.

- **Community Leadership**

By taking concrete steps to reduce the emissions of greenhouse gases from their own facilities and operations, Winston-Salem will be able to provide a solid example to the community to follow.

- **Quality of Life for Citizens/ Healthy Cities**

By reducing expenditures on energy and fuel, the City can apply the savings towards improving community services, such as reducing crime, community beautification and youth programming. Some programs that reduce emissions, such as an increase in number of bike paths, improved public transit and greener public areas, also contribute to an increased quality of life in the community by improving air quality, promoting active lifestyles and creating a more beautiful community. Together, these types of measures can help build healthier, more sustainable communities

- **Job Creation**

The transition to a low emissions society will require a certain degree of innovation and effort. This transition is likely to result in the creation of new jobs, as homes will need to be retrofitted with new energy-efficient improvements, educational programs will need to be developed and new technologies will need to be implemented as they come on the market. These new jobs are likely to be particularly concentrated in the construction and engineering sectors. Businesses that produce "green" products may grow and prosper as the need for new technologies increases. This job creation will, in turn, stimulate the local economy. A strong local economy is an essential aspect of a healthy and sustainable community.

The City of Winston-Salem: Taking the Role of Leadership

In 2007, the City of Winston-Salem passed a resolution to join the Cities for Climate Protection (CCP), an international campaign of local governments who are committed to achieving quantifiable reductions in local greenhouse gas emissions, improved air quality, and enhanced urban livability and sustainability. Over 770 municipalities in 29 countries worldwide participate in the CCP campaign. In the United States, over 160 municipalities have joined the CCP. Together, these communities are home to 55 million Americans - 20% of the total US population. Collectively, American CCP participants plan to reduce greenhouse gases by 23 million tons per year, equivalent to the emissions produced annually by four million passenger vehicles, or 1.8 million households. These communities also plan to reduce local air pollutants by more than 43,000 tons per year and save over \$535 million in energy and fuel costs.

Further actions are also being taken by the City of Winston-Salem to signify its commitment to sustainability. In the Winston-Salem Strategic Plan 2006-2009, the City Council has identified areas of focus that directly or indirectly mesh with the Local Action Plan to reduce emissions:

Economic Vitality and Diversity

- The development of new jobs and recruitment of new businesses (EVD-1, EVD-2)
- Strengthen transportation infrastructure including bus, bicycle, and rail (streetcar and regional) (EVD-6).

Social Vitality

- Complete and implement parks, open space, and greenways plans (SV-4).

Service Excellence

- Improve service delivery and handling of complaints through e-government and other methods (SE-1).

Environment

- Take actions to improve air quality, protect water quality, and protect sensitive lands (EN-2).
- Combat sprawl through careful infill development and improved planning (EN-3).
- Identify dumping issues in neighborhoods, and develop strategies to eliminate and prevent them. (EN-4)
- Make more effective use of landfill and recycling program and define how funded (EN-5).

Governance

- Develop land use and design guidelines as well as area plans to address use conflicts applicable to all areas of the City, including areas/buildings of historic significance. (G-6)

This report and the action plan will help the City achieve the goals of the Winston-Salem Strategic Plan 2000-2009.

By authorizing the development of the greenhouse gas inventory and local action plan, the City of Winston-Salem has indicated its desire to take a leadership role in climate change mitigation and air quality improvement within the larger community.

Local Government Inventory, Forecast, and Target

An inventory of city government operations was conducted and found that City of Winston-Salem government operations contributed approximately 141,500 tons of greenhouse gases in the year 2006. These emissions are from the energy used for city buildings, city-owned vehicles, streetlights, the decomposition of solid waste generated from city operations and the total energy use of the water and wastewater treatment operations.

Electricity and Natural Gas Energy

Responsibility	Annual Cost	BTU's (million)	Carbon Dioxide (tons)	Other Pollutants (tons)
Street Lights	\$2,516,700	67,400	12,173	56.0
General Fund (except Street Lights)	\$1,058,500	57,500	8,475	36.2
City Parking Decks	\$ 146,300	9,937	1,794	8.2
Entertainment Facilities	\$ 924,700	55,563	8,210	35.1
City/County Utilities	\$4,218,600	271,509	87,314	540.1
WSTA	\$ 120,000	8,049	3,160	4.0
TOTAL	\$8,984,800	469,958	121,126	679.6

Notes - General Fund does not include the leased Bryce A. Stuart Building. Entertainment Facilities includes the Coliseum Complex, Bowman Gray Stadium and the Benton Convention Center. Duke Energy publishes CO2 emissions as being 1.05 pounds per kWh in the Carolinas and over 2 pounds per kWh in their mid-west region. The Clean Air & Climate Production Software utilizes 2.1 pounds per kWh, based on the fuel mix for power plants in the southeastern U.S. The 2.1 pounds/kWh multiplier was utilized for these calculations to maintain consistency with ICLEI protocols. When state and national protocols for tracking CO2 emissions are developed, the multipliers may change.

Gasoline and Diesel Fuel in City Vehicles

Responsibility	Annual Cost	Gallons of Fuel	BTU's (million)	Carbon Dioxide (tons)	Other Pollutants (tons)
Police	\$790,000	383,952	48,223	4,111	149.7
Sanitation	\$468,000	219,299	26,804	2,323	35.6
Fire	\$155,000	72,935	8,944	774	14.1
General Fund (ex. Police, Sanit, Fire)	\$609,000	289,962	35,968	3,104	75.6
Entertainment Facilities	\$10,000	4,635	576	50	1.3
Utilities	\$720,516	339,866	41,924	3,635	64.8
WSTA	\$1,043,000	487,505	59,482	5,159	71.3
TOTAL	\$3,795,516	1,798,154	221,921	19,156	412.4

Waste Production & Methane Recovery

City Operations generated 2,550 tons of waste in FY06 which added 1,235 tons of CO₂ to the atmosphere.

The City of Winston-Salem has a long history of reducing GHG emissions at the sewage treatment and landfill facilities, the primary producers of biogas in city operations. From 1958 until the 1980's, the Archie Elledge Wastewater Treatment Plant generated 100% of their electrical requirements on-site utilizing the biogas recovered from the plant's anaerobic digesters. Today the Elledge plant utilizes the biogas in their boilers to heat the buildings and to maintain the proper digester temperature. Elledge also utilizes the biogas as a primary fuel for the new BioSolids Dryer. The Muddy Creek Wastewater Treatment Plant utilizes 100% of the biogas to heat the digesters, heat buildings and to power motors used in the aeration process. Using the methane to power the motors alone saves over \$45,000/year in electricity. The Hanes Mill Landfill biogas is utilized by an on-site contractor to generate over 37 million kWh/year of electricity which is sold to Duke Energy as "green power". The electric energy produced at the Hanes Mill site off-sets over 37,000 tons of greenhouse gas that Duke Energy would emit to generate the same amount of electricity.

Emissions Resulting From Employee Commute

In addition to the above, the daily commute of the 2,500 employees of City of Winston-Salem is estimated to total approximately 9 million miles annually. Using generally accepted averages for vehicle fuel mileage, the daily commute of city employees requires over 500,000 gallons of fuel, generates over 4,800 tons of carbon dioxide, and 166 tons of other pollutants annually.

Other City of Winston-Salem Emissions Reductions Measures:

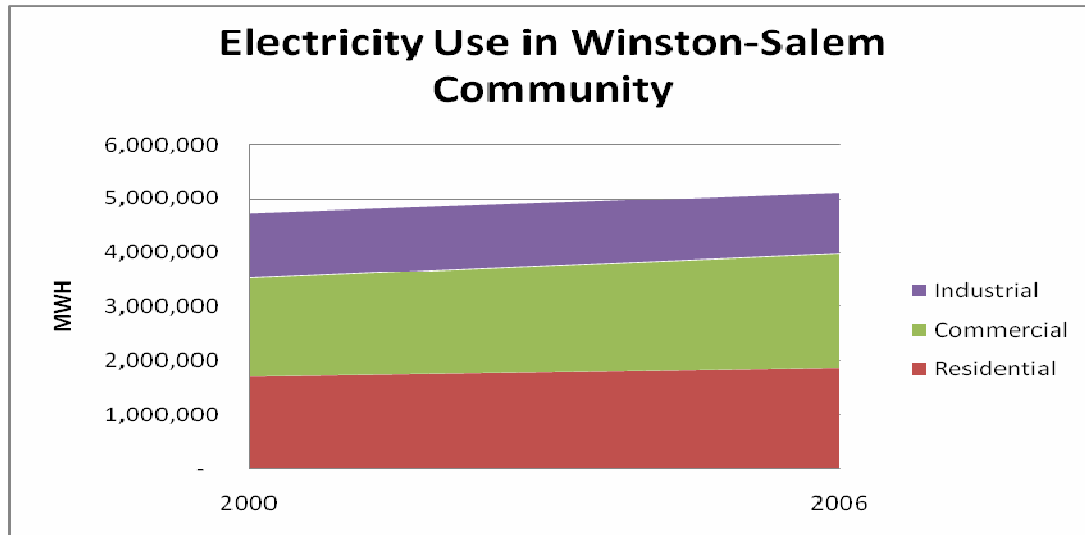
Information gathered from the interdepartmental task force members shows that many measures, generally put in place for reasons other than protecting the environment, have been initiated in past years that have had the beneficial effect of reducing or avoiding increased greenhouse gas emissions. One example is the bike patrol of the Winston-Salem Police Department which uses bicycles instead of patrol cars. The use of hybrid and electric vehicles in the city fleet has reduced emissions and fuel usage. WSTA has bought hybrid buses to reduce fuel costs and emit fewer pollutants. Over 100 new measures have been proposed by the Interdepartmental Task Force or are being evaluated for implementation in the future and can be reviewed in Appendix B5.

Community Inventory, Forecast, and Target

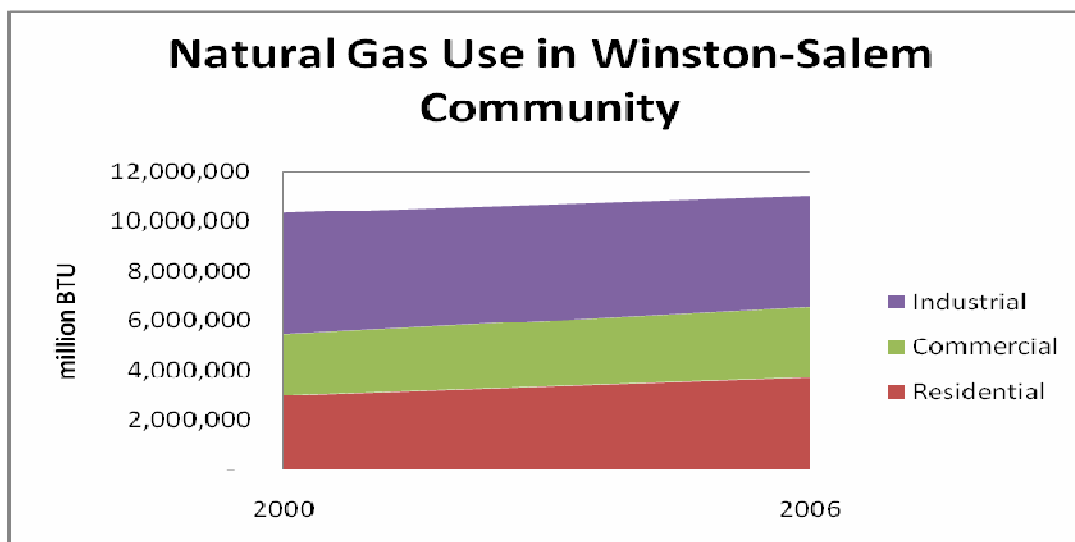
The community inventory provides an estimate of all of the greenhouse gas and criteria air pollutant emissions produced within the Winston-Salem community by residents in their homes and by local businesses and industries as they carried out their operations in the 2006 baseline year. In 2006, Winston-Salem produced approximately 5,500,000 tons of GHGs. Figure 2 illustrates the contribution of each sector to Winston-Salem's community emissions profile. Transportation is the largest single sector, however if the residential, commercial, and industrial sectors are combined, it is clear that electricity and natural gas used within buildings and in Utilities operations are the most significant source of GHG emissions in the community.

Electricity Use Within Winston-Salem Community

Year	Residential kWh (Thousands)	Commercial kWh (Thousands)	Industrial kWh (Thousands)	Total kWh (Thousands)	Carbon Dioxide (tons)
2000	1,713,278	1,820,268	1,189,660	4,723,207	9,918,765
2006	1,871,552	2,103,491	1,120,168	5,095,211	10,699,943

**Natural Gas Use Within Winston-Salem Community**

Year	Residential million BTU	Commercial million BTU	Industrial million BTU	Total million BTU	Carbon Dioxide (tons)
2000	2,991,975	2,457,000	4,880,863	10,329,838	638,177
2006	3,693,450	2,829,500	4,485,379	11,008,329	680,095



Vehicle Miles Traveled (VMT) Within Winston-Salem Community

The PART Long Range Transportation Plan Update published on 5/15/08 lists the following (interpolated) VMT. The gallons of fuel used, the Carbon Dioxide and Other Pollutants were estimated/calculated from the Clean Air and Climate Protection Software:

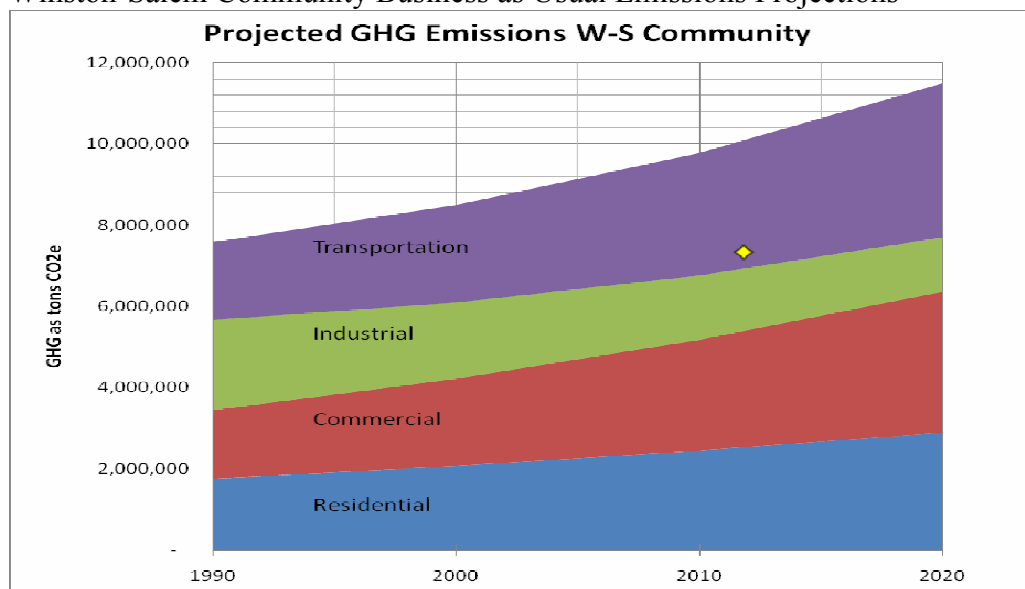
Year	Daily VMT (Millions)	Annual VMT (Millions)	Gallons of Fuel (millions)	Carbon Dioxide (tons)	Other Pollutants (tons)
2000	9.622	3,512.0	225	2,416,973	75,204
2006	11.042	4,030.3	258	2,773,669	86,441
Percent Increase	14.8%	14.8%	14.7	14.8%	14.9%

Waste Information for W-S Utilities Landfills

Year	Hanes Mill Solid Waste LF (tons)	Old Salisbury Rd C&D (tons)	Equivalent CO2 Emissions
2000	305,000	77,000	183,360
2006	266,504	102,058	176,910

A business-as-usual emissions forecast scenario (figure below) was developed for the community for the target year 2020 using socioeconomic growth factors to help determine what level of emissions reduction could be achieved. It was estimated that by 2020, if energy use and waste production continue to follow existing patterns, the community would produce approximately 11,500,000 tons of greenhouse gases or a 50% increase from 1990 emissions.

Winston-Salem Community Business as Usual Emissions Projections



◆ Represents Kyoto Protocol Target (7% reduction of 1990 emissions levels by 2012)

Numerous benefits come from reducing emissions in the community including increased efficiency for local government operations, improved air quality, and public health, leading to a better quality of life for all citizens, reduced energy costs which will in turn lead to the community becoming less vulnerable to the market prices of energy, and job creation within new fields as well as construction.

Local Action Plan Recommendations:

The Local Action Plan section of the report highlights many areas in which emissions reductions could be wrought in both the community and local government sectors. As the level of government closest to their citizens, the City has a unique ability to influence the community. The local governments have a major role to play in encouraging the public to reduce emissions through education and incentives. City government can also help to coordinate the efforts of local businesses and non-profit groups in the community. Land use and transportation planners have a significant influence on the shape that a community will take and their decisions can impact not only the emissions profile of Winston-Salem but can also help to make Winston-Salem a more socially, environmentally and economically sustainable community. In terms of the local governments' own operations, energy efficiency initiatives will result in financial savings which can be redirected into other community programming.

Designate a full-time Sustainability Manager:

A full-time Sustainability Manager would invest the City's sustainability program with greater emphasis and credibility, establishing the program so that it becomes self-sustaining both on an internal and community-wide basis. The duties of the Sustainability Manager would be to engage the whole of city government to get the best results from departmental initiatives. Engaging community groups and convincing the community at-large of the benefits of a sustainable lifestyle will be a key to the success of the overall program.

Formation of a Community Sustainability Program Committee:

A previous recommendation in this report is that all affected stakeholders should have an opportunity to participate in the process of developing and implementing the local action plan. The development of the community-wide local action plan is recommended to be an open process, enlisting the participation of citizens, business, industry, government, education, the interdepartmental task force, and other interested groups. The committee would focus on community-wide discussion of ideas, targets, energy-reduction alternatives, and initiatives to encourage sustainable community principles. A Sustainability Steering Committee or Advisory Committee could give direction to this effort. The cities of Raleigh, Greensboro and others in North Carolina have formed advisory committees.

Develop a Community Sustainability Awards Program:

An awards program similar to the City of Raleigh Environmental Awards Program should be established to recognize outstanding work in sustainable development and environmental stewardship. The program would award individuals or organizations that have demonstrated a commitment to the environment in categories such as sustainable development, environmental awareness, leadership or teaching, lifelong contribution, natural resource conservation, green design, regional conservation activities, pioneering efforts, youth activities, urban stewardship, and green market development.

Develop Public/Private/Community partnerships:

Partnerships with local industries, educational institutions, and non-profit organizations are essential to the long-term health and vitality of the sustainability program. Present examples are the cooperation between the City and the Piedmont Triad Research Park to encourage “green” development practices. City staff is also working with Wake Forest University on an undergraduate course regarding sustainability issues.

Public education:

A major component of the local action plan should include the education of the different parts of the community: citizens, homeowners, commercial, industrial, governmental and other leaders. Educational sessions on energy-saving measures and emission reduction opportunities specific to each of these groups should be developed and promoted within the Winston-Salem community.

Promote and expand energy conservation measures:

Conservation measures in both existing facilities and new construction in the commercial, residential, and industrial sectors of the Winston-Salem Community should be promoted through education and awareness campaigns, partnerships, energy audits and design standards. The benefits of conservation measures should be emphasized to help area businesses become more efficient and able to compete in the marketplace.

Expand and enforce land use planning strategies:

Consider policies to encourage increased use of public transportation and to encourage new development that does not increase urban sprawl.

Promote the use of alternative fuel vehicles in the transportation sector:

Policies and practices to encourage the use of alternative fueled vehicles should be a high priority.

APPROVED

Appendix A: Background Information

A1. Background on Report Content and Structure

Introduction to Climate Change

At its most basic level, climate change is a variation in the long-term average weather (temperature, precipitation, wind patterns) that a given region experiences. On a global scale, climate change refers to variations in the Earth's climate as a whole. The Earth's temperature is regulated by a natural system known as the greenhouse effect whereby a delicate balance of naturally-occurring gases trap some of the sun's radiation near the earth's surface. This radiation heats the atmosphere and creates the conditions which make life on earth possible. The most common, naturally occurring greenhouse gases (GHG) include: water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (NO), and ozone (O₃).

It is theorized that human activities, principally the burning of carbon based fuels, have added to an increase in the concentration of greenhouse gases which has caused the earth's atmosphere to warm. While some variations in the climate have taken place over millions of years, the current atmospheric greenhouse gas concentrations are unprecedented and could negatively impact the world's climate. Due to the scale of change in atmospheric concentrations of GHG, climatic conditions can no longer be accurately gauged using historical rates of change and variability.

The temperature of the Earth is believed to be approximately 1.44°F above 1750 levels with the majority of this change taking place during the 20th century. Many experts agree the average global temperatures could rise further during the next century. Since the climate exists as a delicate balance, marginal warming has the potential to affect temperatures, precipitation, wind patterns, water levels and climate systems which could affect life on the planet as we know it.

The gasses that trap heat in the atmosphere are called green house gases. The primary green house gases generated by human activity are carbon dioxide, methane and nitrous oxide. CO₂ is a byproduct of burning gasoline, diesel fuel, oil, natural gas and coal. CO₂ emissions within the study area are primarily due to electricity and natural gas use within the community and tailpipe emissions from motorized vehicles. The use of electricity by the residential, commercial, and industrial sectors causes CO₂ emissions to occur at coal-fired and natural gas fired electric power generating plants. Methane has a global warming potential over 20 times greater than CO₂, but its concentration in the atmosphere is significantly lower than CO₂. Methane is converted to equivalent CO₂ in the Clean Air and Climate Protection Software. NO_x and SO_x refer to various nitrogen oxides or sulfur oxides which are typically classified as pollutants because they combine with other molecules to create acid rain or smog and have been linked to ozone depletion.

Introduction to Emissions Analysis

The purpose of a GHG inventory is to provide a baseline against which a community can measure progress towards the reduction of greenhouse gases. The baseline inventory expresses greenhouse gas production as the number of tons of carbon dioxide equivalent (eCO₂) produced by energy use and waste generation in the community. The reduction targets that a community chooses is expressed as a percentage reduction from this baseline emission. For example, if a community is producing 100,000 tons of greenhouse gases in its baseline year and they commit to a 20%

reduction in emissions by its target year, it is committing to produce only 80,000 tons of greenhouse gases by its target year.

The forecast section of the report helps a community take into account any growth that it will experience between the baseline year and the forecast year. If a community continues to grow and continues to consume energy at current rates, emissions will grow beyond current levels. For example, a community with a baseline inventory of 100,000 tons of greenhouse gas emissions may grow in size and produce 120,000 tons of greenhouse gases by the forecast year if current energy consumption patterns continue (this is called a business-as-usual scenario). In order for this community to reach its target of 80,000 tons, or a 20% decrease from baseline year emissions, the community must really offset 40,000 tons of emissions, rather than 20,000 tons. In this way, the forecast is an essential and useful tool for ensuring that targets are met in spite of growth.

Winston-Salem's inventory and forecast capture emissions from all areas of local government operations (i.e. city-owned and operated buildings, streetlights, transit systems, vehicle fleets, wastewater treatment facilities and waste generated by government operations) and from energy and waste related community activities (i.e. residential and commercial buildings, motor vehicles, waste streams, industry). The inventory excludes emissions from certain other sources such as agriculture, paving, air and marine traffic in accordance with the CCP protocol. This is because these sources are typically out of a local government's control and they are accounted for in state-level and national inventories.

The inventory and forecast provide a benchmark against which the City of Winston-Salem can measure progress towards reducing emissions. In combination with an analysis of the impacts of existing climate mitigation activities in the community, the inventory will also enable Winston-Salem to identify those areas in which the local government and the community at large have successfully reduced emissions and those areas that are auspicious for new mitigation activities. In this sense, the inventory and forecast are policy development tools.

A2. Methodology

City staff used the Clean Air and Climate Protection (CACP) software from ICLEI to develop a greenhouse gas emission inventory, forecast, target and local action plan. The CACP software applies fuel and sector-specific GHG and CAP emission factors to inputs of energy consumption in order to determine the emissions generated by the energy use. The inputs gathered for this study included electricity, natural gas, transportation fuels and landfilled solid waste usage for city operations and the community for the base year (2000), the interim year (2006) and a projected year (2020).

A3. Community Inventory and Forecast Data Collection

City staff gathered data from numerous sources to compile this section of the report. Census records, electrical usage data, natural gas usage data, transportation data, and other information were used to develop the community emissions profile.

A4. Local Government Operations Inventory and Forecast Data Collection

Members of the Interdepartmental Task Force provided energy consumption data, vehicle miles traveled, landfill data and cost data for local government operations for this study. Where data was missing or unavailable, estimates of total energy use and/or cost were made. These cases are described in detail throughout the report. Interdepartmental Task Force members were asked to submit information on sustainable practices that presently exist in their departments and also for

sustainable practices that may be considered for the future in the action plan. The existing practices are in Appendix B.4 of this report and the sustainable practices to be considered in the future are in Appendix B.5. Actual greenhouse gas reduction figures will have to be documented and calculated for the adopted measures. In addition, Bohanon Engineering, PLLC collected various data and provided professional assistance to develop the GHG inventory and report.

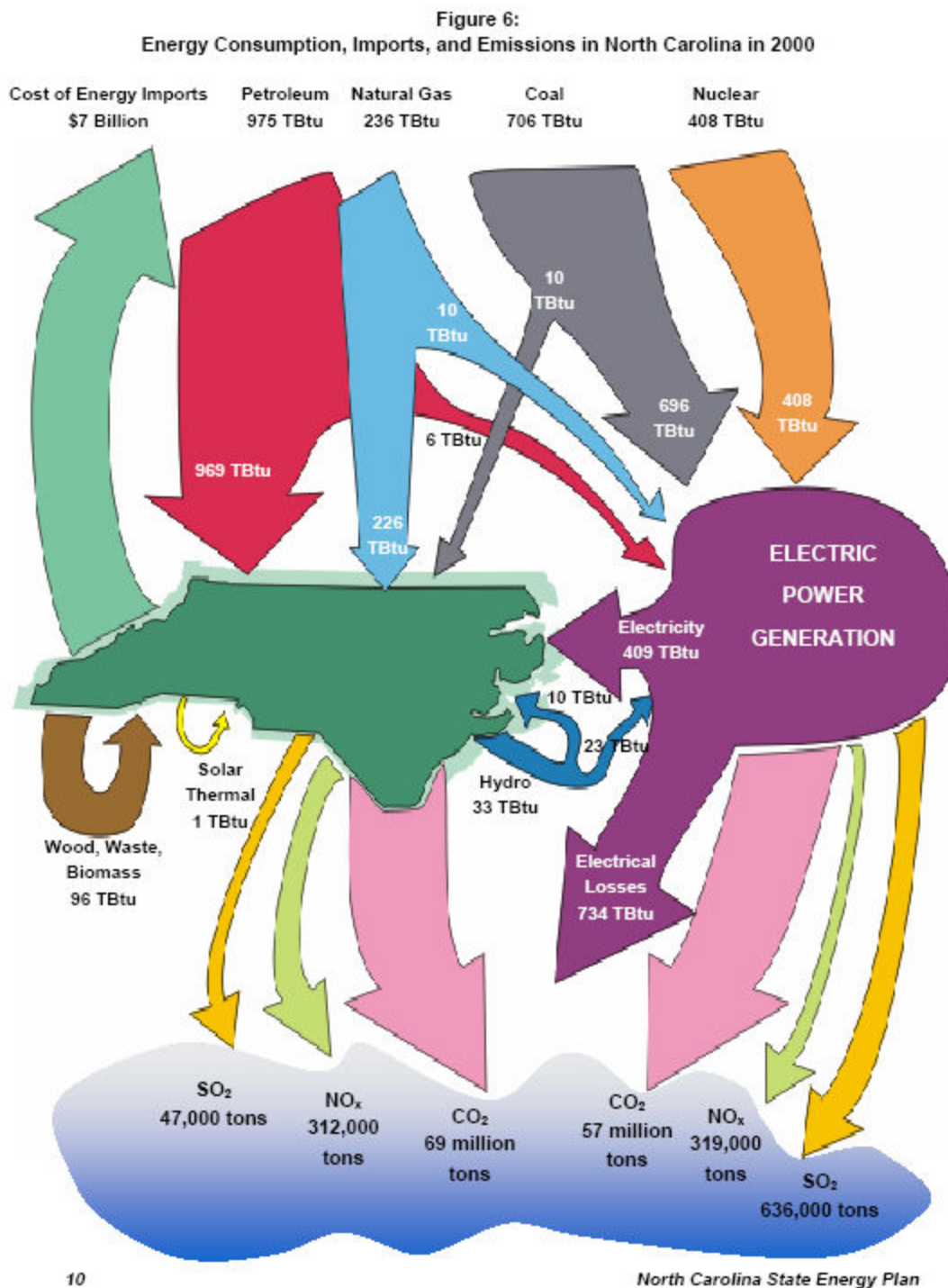
Appendix B

Resource Information for Further Development of the Local Action Plan

B1: List of Acronyms

- BAU: Business As Usual - growth, energy use and waste production continue to follow existing patterns.
- Btu: British Thermal Units - standard unit of measure equivalent to the quantity of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit.
- Biogas: Gas produced by biological activity in waste, primarily landfill or wastewater. It generally contains a large percentage of methane which has a GWP over 20 times that of CO₂.
- CACP: Clean Air Climate Protection - Software used by ICLEI to calculate emissions due to energy use.
- CAP: Criteria Air Pollutant - a category of air pollutants including lead, nitrogen oxides (NO_x) sulfur oxides (SO_x), carbon monoxide (CO), particulate matter (PM), and ozone (O₃), which have adverse effects on human health.
- CCP: Cities for Climate Protection - a program developed by ICLEI to help local governments reduce greenhouse gas emissions from their operations and communities.
- CO₂e: Equivalent Carbon Dioxide; used to describe all greenhouse gas emissions in an equivalent volume of carbon dioxide.
- GHG: Greenhouse gases, primarily consisting of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O).
- GWP: Global Warming Potential, an index of relative strength of various greenhouse gases as compared to carbon dioxide.
- ICLEI: 'ICLEI-Local Governments for Sustainability' (formerly the International Council for Local Environmental Initiatives).
- kWh: Kilowatt hours - a unit commonly used to measure electricity (1 kWh = 3,412 BTU's)
- LAP: Local Action Plan
- LRTP: Long Range Transportation Plan.
- Tons: the unit of measure in which greenhouse gas emissions are usually calculated, equivalent to 2000 lbs.
- MMBtu: One Million BTUs.
- VMT: Vehicle Miles Traveled - a measure of the total distance traveled within a community. This is used to estimate fuel consumption and greenhouse gas emissions.

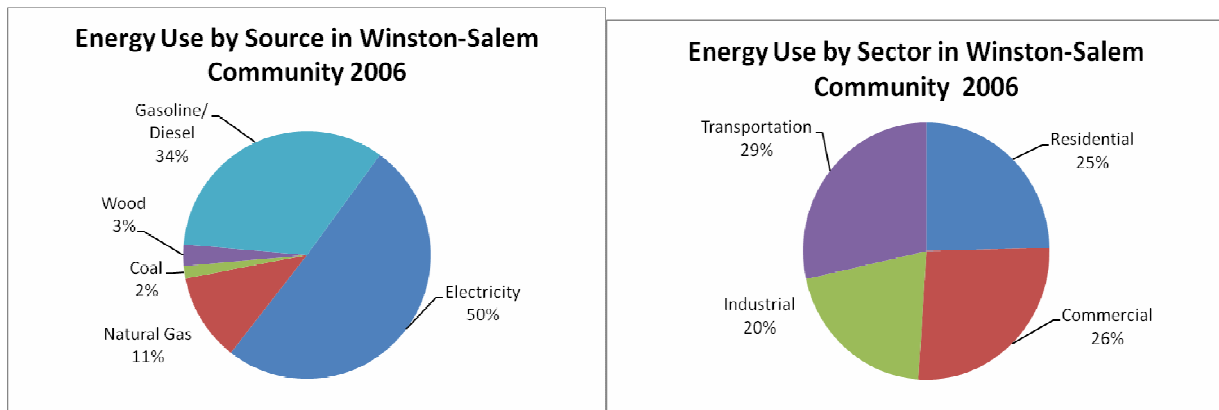
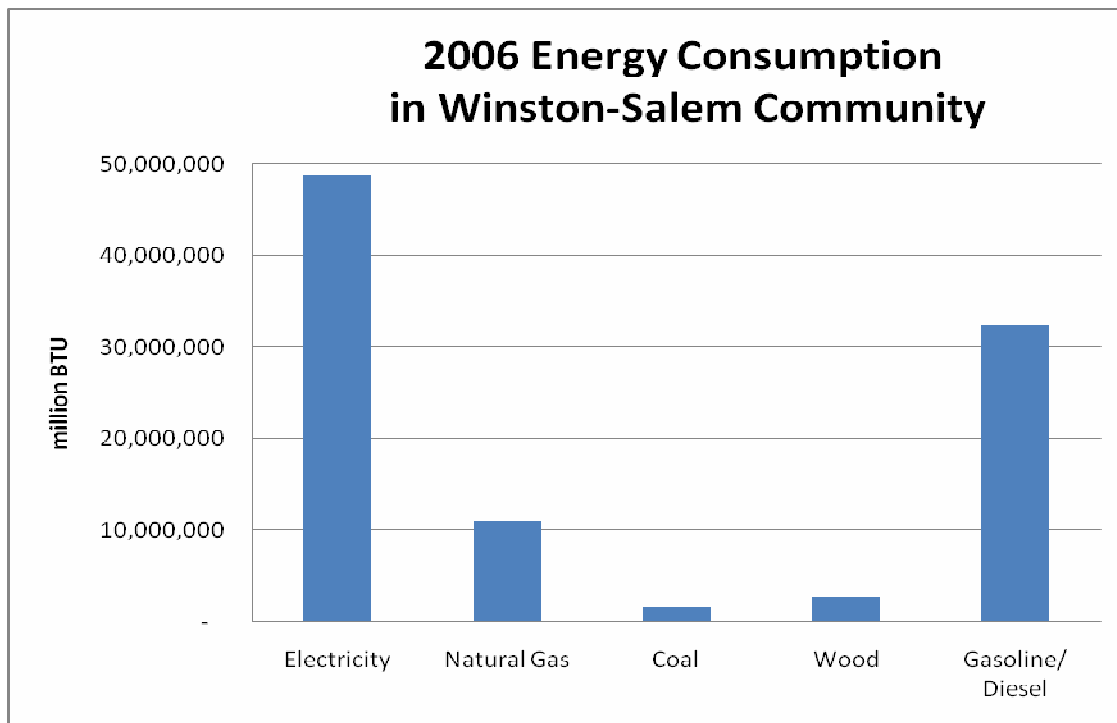
B2: Energy Consumption, Imports, and Emissions in North Carolina in 2000



Note: A TBtu (one trillion BTUs) is roughly equivalent to the amount of energy contained in 166,000 barrels of oil.

B3: Energy Data

Energy Data for 2006 for the Winston-Salem Community was obtained from Duke Energy, Piedmont Natural Gas, Local Industry, and PART. Forecasts and back casts were developed using some information provided by the preceding organizations, plus information from NC Department of Energy, DOE, and the Census Bureau. The following graph is based on submitted data with the electrical energy adjusted to reflect energy required to generate the electricity and distribution losses. It is more than the delivered energy.



B4: Existing Reduction Measures in Winston-Salem Government Operations

Stormwater Division:

- Stormwater Plan Review: Review plans for all development projects to eliminate the adverse effects of stormwater runoff.
- Watershed Master Planning: Conduct inventories of the storm sewer systems in each watershed to prioritize capital improvement projects for our storm sewer infrastructure and to model pollutant loading into our watersheds. This effort will allow city staff to determine areas of greatest interest for water quality pollution.
- Sampling and Monitoring Program: Sample and monitor 46 locations along our creeks and streams in Winston-Salem to identify illicit discharges and track water quality trends.
- Public Education and Involvement: Community Educator creates programs to educate and involve general public and business owners regarding how to prevent pollution of creek and streams. Programs such as creek crawls, creek clean up's, storm drain stenciling, involve citizens and business owners with making improvements to water quality.
- Illicit Discharge Investigation and Elimination: Staff is trained to track and eliminate illicit discharges to the storm drainage system when discovered.
- Stormwater Pollution Prevention Plans for Municipal Operations: Staff is creating stormwater pollution prevention plans for municipal operation which have the potential to pollute creeks and streams. These plans will implement operations practices which will eliminate pollution or have action plans for response in the event of a spill.
- Adoption of new ordinances: Work with other city divisions to create new ordinances to reduce erosion, flooding and pollution to creeks, stream and rivers.

Office of Budget, Audit and Performance Reporting:

- Operating and Capital Budgeting: Review requests and recommends funds for energy upgrades and facilities renewal projects which extend the life of existing facilities, reduce energy use such as more efficient streetlights, and vehicles.
- Budget Reporting: Work with Fleet Services to track and report monthly fuel use by department compared to department fuel targets and communicate results; Monitor capital project status, including the purchase and installation of energy-related equipment and construction materials.
- Audits: Identify obsolete equipment; Prevent assets/inventory loss through fraud investigations and tagging of equipment valued more than \$5,000; identify inefficient and wasteful processes.
- Daily Energy Use: Turn off lights when not in use and turn off computer equipment when not in use; print on both sides of paper; reduce number of copies of documents.

Winston-Salem Entertainment and Sports Complex:

- The Lawrence Joel Veteran's Memorial practices off-peak pre-cooling for major events to avoid high demands on the electrical system and the associated charges.
- The Complex recycles plastics, paper, cardboard, and food products
- Animal waste, shredded paper, straw bedding, and food are composted on-site and used in the landscaped areas
- Cooking oil from concession operations is processed on-site into biodiesel and used in the Complex vehicles
- An employee "green" committee has been formed and is meeting regularly to initiate new sustainable ideas.

Fleet Services:

- Recycling – Fleet recycles as much as possible, including paper and cardboard, scrap metal, oil, antifreeze, other lubricants, tires, and batteries.
- Alternative Fuel Vehicles –purchases hybrids, E85, CNG, and electric vehicles.
- Remanufactured Parts – When feasible purchase remanufactured parts instead of new.
- Policies – Fuel management and vehicle acquisition policy developed to guide City purchases to help reduce and conserve fuel.
- Rightsizing Effort – City fleet being evaluated to assure each vehicle/equipment is right size for its function. Smaller vehicles usually mean fewer emissions.
- Waste Disposal – Contracts with licensed companies to dispose of hazardous materials.

Information Systems Department:

- Use of virtualization technologies to consolidate number of computer servers
- Updated power management equipment in the data center.
- Policies to turn off PCs at night.
- Printing devices go into power save mode when inactive
- Surplus computers are donated to nonprofits or sold to employees for extended use

City-County Inspections Department:

- Erosion Control Program: Review and approve grading plans and conduct in-field inspections and site evaluations of earthwork and other land disturbing activities to prevent water pollution and other damage to lakes, watercourses, and other public and private property by sedimentation.
- Watershed Protection Program: Review and approve watershed development permits within identified water-supply watershed areas to protect drinking water quality.
- Use of Existing Automation: Utilize Hansen and InspectNet to communicate issues and results to applicants and permit holders concerning permit applications and active building permits and sites. This has reduced paper use and postage due to better real-time communication via electronic means.
- North Carolina Energy Code: Review, approval and inspection of building construction in compliance with the North Carolina Energy Code, which regulates the design and construction of buildings for adequate thermal resistance and low air leakage to increase energy efficiency.
- Interconnectivity Requirements of the UDO: Minimum connectivity requirements and requirements for new subdivisions to connect to existing stub streets provide a more efficient network of streets, reducing VMTs and reducing fuel usage.

City-County Planning:

- Email distribution list to community and government stakeholders for pending text amendments, Newsletter and other pertinent information
- Reductions in printing: Area Plan(s): drafts, process, final document (>100 pages with photographs), and checklists, application forms, Toolkit handouts; all printed information produced by the Planning Dept. available for viewing, searching and downloading on website:
- Unified Development Ordinances available on web (MuniCode); limited copies for key staff

- Implementation of Legacy: i.e. street standards (reduction of pavement width, adds sidewalks, and street trees); sign ordinance; PRD; Infill; reduction of parking requirements for structures built before 1968, within the PB and MU-S zones, and when transit and bike racks are available; etc.
- RUCA (Revitalizing Urban Commercial Areas); streetscape, lighting, landscaping, parking, and building improvements to urban low income, deteriorated and underutilized commercial areas (3 sites currently funded {\$1.5 mil total})
- “Z” signs redesigned: size and message standardized, ability to reuse indefinitely
- Vanpool for Sign check: monthly vanpool of staff and Planning Board members to rezoning sites
- Reusable insulated (hot-cold) glasses to reduce reliance on disposable products
- Email distribution of Interdepartmental comments to petitioners; electronic acceptance of preliminary sketch plans and staff change inquiries

Property Maintenance Department:

- Collaboration and Partnerships: Property Maintenance Department oversees the City’s Sustainability Program and has developed relationships with local universities, local utilities, and other entities to collaborate and share information on sustainable practices and issues.
- Asset Management: Perform building condition assessments and evaluations of life-cycle costs of various building systems, including energy costs and maintenance costs. Strategically coordinates upgrades with operating and capital budgets
- USGBC LEED certification: City staff is presently reviewing candidate city buildings for LEED certification.
- Energy Management Coordinator: In 2003, an Energy Management Coordinator position was created and a qualified person hired. To date, this person has been responsible for over \$300,000 in energy savings. The Energy Management Coordinator is also responsible for conducting energy audits of city facilities, selecting and specifying new HVAC and electrical systems, reviewing rates and reviewing contracts for electrical service, and educational programs. The Energy Coordinator assisted greatly in the writing of this report.
- Integrated Pest Management (IPM) in City Buildings: Has implemented IPM, a pest control strategy that uses an array of complementary methods: mechanical devices, physical devices, genetic, biological, legal, cultural management, and chemical management. These methods are done in three stages: prevention, observation, and finally intervention. It is an ecological approach that has its main goal is to significantly reduce or eliminate the use of pesticides.
- Lighting Retrofits/Upgrades: Many city buildings that formerly used old T-12 systems have been retrofitted with energy-efficient T-8 fixtures, CFLs, and other types of lighting. Many of these systems are being used with occupancy sensors that turn the systems off when the room is unoccupied.
- HVAC system upgrades: HVAC system replacements are done with high efficiency units. Programmable thermostats and other energy-saving systems are installed where feasible.
- Recycling of fluorescent lamps: fluorescent lamps are collected and sent to a recycling facility where the complete lamp is recycled, not sent to a landfill. Recycling allows for complete re-use of the materials in the lamp and absolves the city from any responsibility associated with landfill disposal.
- Property Maintenance Department requires city HVAC technicians to be certified in the handling of refrigerants, some of which have very high GWPs. The department maintains

an inventory of refrigerants removed and installed in the HVAC systems of city buildings in keeping with EPA regulations.

Recreation and Parks Department:

- Use composite lumber made of recycled plastics to replace worn park benches and trash cans container in various park locations.
- Reduced the number of take-home vehicles for employees to decrease gas consumption.
- Use electric golf carts instead of gas carts at Winston Lake Golf Course
- Maintain greenways to allow people to use alternative transportation that will allow citizens to bike to work, shop, exercise and get to school.
- Continue to work with Property Maintenance to increase the efficiency of lighting and HVAC systems at existing recreation facilities.
- Built and improved the drainage filtration of all the water run off with stone at the Dog Park before the water drains into the creek.

Sanitation Division, Curbside Recycle Today Program:

- Curbside recycling program provides collection service to single family homes, multifamily dwellings, and small business. Program collects the following materials:
Aluminum Beverage Cans; Steel Food, Beverage, and Aerosol Cans; Glass Jars/Bottles (clear, green, brown); Plastic Bottles (with small necks only); Newspaper; Magazines; Telephone Directories; Junk Mail & Office Paper; Chipboard (cereal boxes, paper towel rolls, etc.) and Corrugated Cardboard
- Provide cardboard only drop-off sites at nine city fire stations.
- Education/promotion activities (brochures, container decals, promotional items, presentations, newspaper, radio, television ads; website, special events, etc.)
- Promote reducing unwanted junk mail.
- Provide in-house recycling program for paper, metal, plastic, and glass.
- Provide recycling of inkjet/laser toner cartridges and cell phones.
- Promote Dell/Goodwill Reconnect computer recycling program

Utilities Division, Solid Waste - Core Operations:

- Conducts master planning in solid waste disposal, composting, and recycling
- Extracts & combusts methane containing landfill gas from Hanes landfill to produce electricity
- Extracts and flares methane containing landfill gas from Ebert Road landfill
- Provides limited recycling of construction & demolition debris at Hanes Mill Road Landfill supporting LEED certification for construction projects
- Extracts and recycles CFCs from used appliances
- Recycles used appliances and other metals
- Recycles used tires
- Accepts and composts or reuses all yard waste and leaves collected by the City of Winston-Salem Sanitation Division and some amounts from private companies
- Funds and provides, under contract, 3 drop-off recycling centers for use by all residents of Forsyth County
- Funds and provides, under contract, household hazardous waste collection and disposal program for use by all residents of Forsyth County
- Funds and provides, under contract, the City of Winston-Salem's curbside recycling program for use by residents of the City of Winston-Salem
- Maintains required certifications for staff to insure proper waste management

Utilities Division, Solid Waste - Fleet/Transportation:

- Staff uses an ultra low emissions vehicle CNG vehicle in its fleet
- Equipment idling time is limited to save fuel and reduce emissions
- Total Maintenance and Repair insurance on all major off-road equipment is provided to insure optimum performance
- Staff carpools to other locations when appropriate
- Provides kitchen area at many facilities so staff can bring lunches to reduce vehicular traffic during lunch hours

Utilities Division, Solid Waste - Utilities/Information Systems:

- Teleconferences meetings when appropriate
- Prints many documents double-side when appropriate
- Encourages double-sided printing on all copies and printed materials
- Reduces ambient, overhead lighting by using fewer fluorescent tubes in each fixture
- Encourages the use of non-disposable tableware and serving pieces in kitchen areas at all facilities
- Uses energy saving compact fluorescent lights in offices where appropriate
- Recycles all printer and copier toner cartridges
- Turns off all personal computers at night
- Turns off all unnecessary lights at night

Utilities Division, Solid Waste - Community Education/Awareness:

- Provides volunteers to work at environmental events such as Piedmont Earth Day Fair, American Recycles Day and other environmental initiatives
- Provides educational speakers to the community for environmental issues related to recycling and waste reduction
- Provides tours of facilities to encourage and foster greater environmental awareness of recycling, composting and solid waste disposal
- Collaborates with environmental groups such as the Piedmont Environmental Alliance, the Sierra Club and others to exchange ideas and foster more cooperation for greater environmental benefits
- Subscribes to listservs dedicated to pollution prevention, recycling, waste reduction and waste management
- Subscribes to trade journals dedicated to pollution prevention, recycling, waste reduction and waste management

Utilities Division – Water and Sewer Operations:

- Since 1985 the Muddy Creek Wastewater Treatment Plant has utilized 100% of the methane produced to fuel engine blowers that supply air to the activated sludge basins and boilers that heat the digesters at the plant
- From 1958-1995 the Elledge Wastewater Treatment Plant utilized 100% of the methane produced to fuel engine generators that powered the plant operations. The heat generated from these engine generators also heated the digesters at the plant.
- From 1995-2008 the Elledge Wastewater Treatment Plant utilized methane to heat the digesters at the plant. The surplus methane was flared.
- In 2008 100% of the methane produced at the Elledge Plant began being utilized to fuel a biosolids dryer that converts liquid biosolids into a pelletized product that can be marketed
- The biosolids processing at the wastewater treatment plants has now been converted from

a totally liquid product (4% solids) that was trucked to farms for application to a pelletized product (~100% solids) that is trucked to farms and applied. This conversion has removed 25 tanker truck loads of liquid biosolids from the highway and replaced it with a single truck load of pellets.

- In 1996 a competitive assessment of wastewater treatment was conducted to identify areas that could be optimized and thus reduce costs resulting in annual electrical cost savings of over \$1.5 million at the wastewater facilities for each of the last 10 years.
- In 2001 a competitive assessment of water treatment was conducted to identify areas that could be optimized and thus reduce costs resulting in electrical costs savings due to off peak consumption of electricity. Cost savings achieved to-date has provided for the addition of the Northwest Water Treatment Plant to come on-line in 2004 with only a \$300,000 increase in total electrical cost.
- Every 10 years a hydraulic master plan of the water distribution system is performed that evaluates energy consumption at the water pumping stations. As conditions have changed and pumps have become less efficient, the master plan recommends upgrades and modifications that optimize the energy consumption needed to efficiently supply water to meet current and future demands.

Department of Transportation:

- Conversion of traffic signals from incandescent to LED at all city owned traffic signals resulting in lower electricity consumption.
- Reuse and recycle traffic sign blanks and posts.
- Limit vehicle idle time.
- Crews are instructed to take breaks in their area.
- For employees that pack their lunches, employees use microwave and break areas at the nearest Recreation facility to their assigned work area.
- Crews keep their truck beds clear of any unnecessary debris to reduce weight.
- Switched from petroleum based traffic paint to water based paint.
- Periodically re-evaluate traffic signal timing to reduce congestion.
- Plan and build greenways, bike lanes, and pedestrian facilities as alternative transportation modes.
- Safety improvement program implements and tracks actions taken at over 200 locations per year in an effort to reduce accidents, which also reduces congestion.
- Parking enforcement officers use GEM electric scooters instead of gasoline scooters.

Vegetation Management Division:

- Tree Planting: plant approx 1000 trees per year
- Trees planted in rights-of-way and parks.
- Litter control
 - Collect litter from rights of way which prevents litter from reaching waterways.
 - Big Sweep-litter control from streams
- Riparian Buffer Maintenance
 - Riparian buffers lower storm water velocity, water turbidity, collect litter, cool water temps and increases water O2 levels. Buffers are in several city parks.
- Landscaping projects to reduce turf
 - Shrub, perennial plantings to reduce turf mowing needs.

Winston-Salem Transit Authority:

- Choose only energy-efficient office equipment
- Operate equipment for energy and paper savings
- Choose earth-friendly supplies
- Ensure energy-efficiency in facilities
- Reduce-Reuse-Recycle
- Walk the 'Green' walk-talk the 'Green' talk by setting an example, supporting car-pooling, transit, bicycling, walking

B5: Future Reduction Measures for Local Government Operations

Office of Budget, Audit and Performance Reporting:

- Reduce weekend commuting costs by working from home office (install programs to allow access to shared folders and FMS budget system).
- Use only half of the installed light switches in individual offices (except those with no windows or natural lighting).
- Reduce use of paper for documents/increase electronic document publication.
- Employ formal methods for favoring and/or increasing the funding priority for sustainability efforts in budget processes.
- For public meetings coordinated by Budget, Audit and Performance Reporting, schedule no meetings after 5 p.m.

Winston-Salem Entertainment and Sports Complex:

- “Green” purchasing practices for various products including cleaning chemicals and concession products are being evaluated
- Methods of educating and directing Complex event patrons in proper methods of recycling are being discussed.

City-County Inspections Department:

- Fee rebates, up to 50%, for projects that receive various levels of LEED certification and Energy Star achievement
- UDO changes to allow alternative energy equipment (solar panels, windmills) to vary from existing dimensional requirements
- Education programs on LEED Certification and Energy Star programs as part of Development-Related education series
- Alternative work schedules, e.g. modified 4-day work weeks to reduce employee VMTs
- Real-time mobile solution for field inspectors, reducing office trips, reducing VMTs (personal and work vehicles), thus creating fuel savings
- Route optimization module for Hansen to plan inspection schedule, reducing VMTs, reducing idling emissions and increasing efficiency
- Electronic plan submissions for all development-related reviews, saving paper and toner and reducing long-term storage needs
- Enhanced recycling stations for newspapers, office paper, cans, plastic, cardboard

Fleet Services:

- More Alternative Fuels – Plans are to use biodiesel (B20)
- Fleet Utilization Policy – Vehicle utilization being evaluated to possibly reduce the size of fleet.
- More Alternative Fuel Vehicles – Plans are to pursue more electrics and hybrids.
- “Green Cleaning Methods” – Investigate more eco-friendly cleaning materials to replace items such as solvents for cleaning automotive parts.
- Extending Maintenance Schedules – Fewer PM services would reduce the need for oil.

Information Systems Department:

- To become Energy Star compliant on desktop management
- Further consolidate servers through more aggressive virtualization technologies
- Monitor, report, and track power consumption in the data center

City-County Purchasing Department:

- Concentrate on vehicle procurement that specializes in low emissions
- Recycle surplus items by selling surplus items instead of sending them to the landfill
- Sell scrap material from surplus.
- On the intranet, post sites that departments can link to find out about recycled items

City-County Planning:

- Immediate and active participation of various citywide boards and commissions resulting: Historic Resources Commission, Planning Board, Utilities Commission, Zoning Board of Adjustment, Community Appearance Commission
- Utilize/empower Community Appearance Commission to spearhead various efforts to set policy, educate and get buy-in from public and private stakeholders
- Provide alternatives for restaurants to donate their left over food to area farms for their animals, compost and/or give away to homeless and other shelters
- Increase acceptance of electronic zoning applications; i.e. site plans and plats (eliminates multiple hard copies of changing information); reduces paper and trips to City Hall by applicants; continue to work towards development review 'one-stop shopping' center
- Increase availability of electronic documents, mailing lists, circulation of information, etc.; double-side packets to Planning Board, City Council, etc.

Property Maintenance Department:

- LEED certification: New and existing buildings will be considered for LEED certification.
- City staff members will be pursuing LEED Accredited Professional certification to assist with the LEED assessments of existing buildings and new construction.
- Strategic Energy Plan Development and Implementation: Development of a city-wide energy plan is necessary to set policy, standards and measures the city will implement to become more energy-efficient, reduce energy consumption, and introduce sustainable building techniques, both in existing facilities and new construction. Department is presently developing a draft SEP for internal review and comment.
- Include a comprehensive energy audit when conducting facility condition assessments for city facilities. Audit will identify building systems that need to be upgraded or replaced for energy or water conservation, a cost estimate, and a payback period for the recommended systems to allow prioritization of improvements.
- Solar-assisted heating and hot water systems: Candidate buildings for installation of solar-assisted hot water systems will be determined and, if found feasible, funds will be requested for installation.
- "Green" cleaning methods and products will be evaluated for city custodial services.
- Water conservation measures: low-flow fixtures will be installed as applicable.
- "Cool" roofs: Utilize EnergyStar compliant and high emissivity roofing materials to reduce heat islands where applicable.
- Infrared surveys to determine insulation deficiencies
- Identify potential projects for potential Energy Efficiency Block Grants (EEBG) should the grants be funded by the federal government.

Recreation and Parks Department:

- Develop an Environmental Management System (EMS) to prompt us to set department and division level goals for rainwater harvest and impervious surface reduction.
- Implement recycling of aluminum cans, plastic bottles and paper products at select recreation facilities

- Plant more trees in parks and around recreation facilities.
- Implement environmentally-friendly maintenance practices at Winston Lake Golf Course. E.g., allow “natural” growth in certain areas so mowing and fertilizing no longer required.
- Minimize use of chemical pesticides – use IPM (Integrated Pest Management) to prevent pest problems. Reduces water pollution and helps improve soil life.
- Use pervious asphalt, pervious concrete or other pervious material to build new or resurface existing access roads or parking lots.
- Increase connectivity of greenways so citizens have more opportunities to bike to work, shop and schools.
- Maintenance staff moves to a four-day work week. Would reduce fuel usage and GHG emissions. Reduced crew would work the additional day with park sites.
- Reduce frequency of mowing at lesser-used park facilities.
- Buy promotional/marketing items that are eco-friendly.
- Capturing rain water to use for irrigation; pressure washing
- Using synthetic turf on ball fields that will reduce the amount of mowing, water, and daily maintenance on fields.

Stormwater Division:

- Special projects to install stormwater treatment ponds, rain gardens and other controls.
- Retrofit projects for existing developments with heavy stormwater runoff.
- Cutting edge treatment systems such as UV treatment on stormwater ponds to reduce pathogen loading to waterways.

Department of Transportation:

- Upgrade signal system to improve signal timing and reduce traffic congestion.

Utilities Division, Solid Waste - Core Operations:

- Increase the amount of used latex paint used in the landfill daily cover process
- Further study expansion of construction & demolition recycling
- Investigate the recycling of leachate in daily cover application
- Expand landfill gas extraction and combustion systems when and where appropriate

Utilities Division, Solid Waste - Fleet/Transportation:

- Reduce the number of hours that solid waste facilities are operated, thus saving fuel

Utilities Division, Solid Waste - Utilities/Information Systems:

- Increase the use of non-disposable or compostable tableware, serving pieces, etc. in the kitchen areas at all facilities

Utilities Division – Water and Sewer Operations:

- Replacement of the 80 + year old Thomas Water Treatment Plant will provide a modern more energy efficient facility to meet current and future demands for water for the next 50 years
- The new Thomas Water Treatment Plant operations building will be built with many of the LEED certification requirements
- The new Elledge Wastewater Treatment Plant headworks and primary clarifier improvement project will replace 50 year old infrastructure with a modern, more energy efficient facility that will meet the current and future growth for the next 25 years
- The new administration building at the Elledge Wastewater Treatment Plant will be built

- with many of the LEED certification requirements
- Future water distribution master plans will continue to evaluate energy consumption and recommend improvements that reduce energy costs
- Mobile solutions for work management will be implemented to reduce redundant vehicular trips for field operations
- Automated Meter Reading technology is currently being piloted to evaluate its implementation over the next 10 years. This potentially could eliminate 8 meter reading vehicles per day from the City/County roadways.

Vegetation Management:

- Reforestation of open areas to reduce mowing. Less mowing equates to less fuel usage, less air pollution. Trees can store 2.3 tons of carbon annually, and use enough CO2 per year to equal the amount produced by driving a car 26,000 miles (Nowak, 1993)
- Decrease mowing of primary routes from once every two weeks to once every three weeks resulting in reduced fuel usage and exhaust, reduced crew sizes and composition.
- Reduction in city maintenance of neighborhood flower beds to significantly reduce the maintenance the city provides to annual flower beds at neighborhood entrances resulting in savings on fuel and reductions in exhaust.
- Installation of wells for athletic field irrigation to reduce demand on potable water supply and reduce costs.
- Installation of groundcovers in residential cul-de-sacs to reduce mowing costs, fuel usage, and mower exhaust

Winston-Salem Transit Authority:

- Purchase hybrid electric buses

B6: Emission Reduction Resources Available to Community

North Carolina Department of Environment and Natural Resources:

- Environmental Education (http://www.enr.state.nc.us/html/environmental_education.html) web-site provides educational resources and support materials.
- P2Pays Website (<http://www.p2pays.org/>) Website – Sponsored by NCDENR's Division of Pollution Prevention and Environmental Assistance provides resources for citizens, industries, small businesses and governments to reduce energy, reduce waste, conserve water, and purchase environmentally compatible products.

NC Department of Energy:

- Design Review Services:
Design reviews are available for individuals and businesses through the North Carolina Solar Center, to evaluate and suggest cost effective improvements to increase the energy efficiency and show how solar technologies can be incorporated into new buildings in the design stage.
- Energy Efficient Mortgages:
The State Energy Office has joined with Residential Services Network (RESNET) and Fannie Mae to promote Fannie Mae's new energy efficient mortgages program. Through this program, prospective homeowners can finance energy efficient systems through the home mortgage. Several key lenders, including Wachovia and Countrywide, have actively joined the program.
- NC HealthyBuilt Homes:
A green builder program has been launched in North Carolina for small to medium size homebuilders that may not have the resources to compete in the rapidly emerging field of green building. Builders can currently receive technical assistance, design reviews, workshops, and consultation from the North Carolina Solar Center to increase their knowledge of green building principles. The new program is expected to provide marketing assistance and third party monitoring through field review services. The first community partner is the Western North Carolina Green Building Council. A comprehensive checklist of green building techniques has been developed by a statewide advisory board.
- Energy Code Assessment
This project provided residential and commercial training to design professionals, code officials and builders on the specifics of the International Energy Conservation Code. It also developed a design assessment procedure for residential and commercial buildings and developed a working relationship with building inspection offices for the purposes of this assessment. A web site on North Carolina energy codes was also maintained.
- Energy Code Update
Working with Appalachian State University, this project evaluates the effectiveness of the residential and commercial codes that were updated by the 1995 grant and train design professionals and builders on the International Energy Conservation Code.
- Energy Improvement Loan Program
Low interest loans are available to North Carolina businesses and industry, schools and community colleges, non profit organizations and local governments when energy

efficiency improvements are made to their facilities. Read the brochure for more information.

- Energy Management Program

This program provides workshops and industrial energy surveys, which identify opportunities and demonstrate techniques for optimizing energy use in various building systems, promoting energy conservation in industrial, institutional, commercial, and governmental buildings. Industrial surveys perform comprehensive audits of common system inefficiencies (such as leaky compressed air systems, poorly-adjusted steam traps, etc.) and provide recommendations for energy improvements. Workshop topics include: preventive maintenance; HVAC control strategies; air compressor maintenance; chiller and cooling tower optimization; energy-efficient lighting systems; steam traps and steam systems; energy-efficient motors and variable speed drives; electric costs and peak shaving; process energy analysis; industrial ventilation and dust collection; power quality and energy storage; and pumping system assessment.

The tasks involved in this project include: performance of energy surveys; development of energy-saving recommendations; providing technical assistance; development of workshop promotional and educational material; and marketing efforts.

Since its establishment in 1988, the Energy Management Program has conducted over 400 workshops, training nearly 10,000 people in energy saving techniques. Over 600 energy surveys have been completed to date, with recommended cost savings exceeding \$33 million per year.

- High Performance Guidelines

The General Assembly of North Carolina enacted House Bill 1272 which requires the implementation of a Pilot Program to review the use of Triangle J Council of Governments' High Performance Guidelines in the renovation or construction of Universities, Community Colleges and State facilities. The High Performance Guidelines are based on the U.S. Green Building Councils' L.E.E.D. Green Building Rating System. Entities participating in this Pilot program will design buildings and surrounding environments using features that are energy efficient, incorporate reusable and renewable resources, provide natural lighting, are non-toxic, require low maintenance, incorporate water conservation measures, and cause minimum adverse impact to the environment. A case study directory of North Carolina experts associated with techniques listed in High Performance Guidelines will be developed and made available for the Pilots. High Performance Guideline Assessments will be provided to the Pilots, as well as, charrettes and workshops. This project will also provide expert reviews of schematics, designs and construction documents. Triangle J Council of Governments, in cooperation with the State Energy Office, coordinates the professional support necessary to make it easy for projects to implement the Guidelines.

- North Carolina Green Builder Training Certificate Program

This project supports the startup costs for an ongoing certificate program for builders, subcontractors and designers. It will provide training in the basic content and specific energy related areas of the NC Green Builder Program and will have the support of both a university setting and a green builder program. The major objective of the NC Green Builder Program is transformation of the housing market in North Carolina using community based programs with statewide support and consistency.

- Public School Improvement

The State Energy Office has contracted with the Mechanical & Aerospace Engineering Department and the Industrial Extension Service of North Carolina State University to

Design and implement a pilot Energy Efficiency, Evaluation and Education Program for North Carolina Schools. The goal of the project is to develop a methodology that will facilitate a reduction in energy cost per square foot in schools across all of North Carolina. Under this program, energy assessments will be conducted of selected schools to identify and implement energy and cost saving opportunities. This program will serve as a model for similar programs to be conducted for other school systems across North Carolina.

- Rainwater Collection System

Innovative Design, Inc., Raleigh will develop a computer design tool for a rainwater collection system as a guide for engineers and designers to use when developing collection systems for school buildings. A companion manual, Rainwater Collection Systems Design Guide, will be developed and both the program and guide will be distributed through the Sustainable Buildings Industry Council and at seminars and workshops throughout the state. In this type of system, rainwater from school roof buildings is collected in one or more cisterns and recycled for non-potable use, such as irrigation and school toilets.

- Waste Reduction Partners

Waste Reduction Partners is a volunteer group of retired engineers sponsored by Land-of-Sky Council of Governments, that perform energy audits are performed for public, non-profit, local government, state government, commercial and industrial buildings west of I-77. An energy self-assessment tool for public buildings, schools, or commercial buildings has been developed and made available electronically. Also, ten fact sheets to help institutions and commercial clients to determine energy savings potential have been developed.

- NCSU Industrial Assessment Center

The NCSU Industrial Assessment Center (IAC) has been funded by the North Carolina State Energy Office to reduce emissions from the private sector. The two main goals of the program are to provide energy conservation and cost reduction assessments to small and medium sized manufacturers and to educate the next generation of energy managers in conservation practices. Advanced undergraduate and graduate students from the Mechanical and Aerospace Engineering Department at NCSU conduct a one-day assessment of a facility with an experienced faculty member. Data on plant operations and energy costs are collected and analyzed to determine potential conservation measures. These measures are compiled into a technical report detailing the recommended actions, the potential savings, the estimated cost of implementation and simple payback period. This program has benefits for local industry, students, and community emissions.

Duke Energy

Duke Energy provides a number of resources to assist residential and commercial customers to save energy. Many are listed on their website:

<http://www.duke-energy.com/north-carolina/savings.asp> . Here one can find:

- Energy Savings Tips for:

Winter, Summer, Home Owners, Business Managers and Renters

- Energy Saving Tools

An online tool is available on the website to help customers determine methods and actions to reduce energy usage.

- Advantages of Compact Fluorescent Light Bulbs

Save money and help the environment with energy saving light bulbs that are 75% more energy efficient than standard incandescent bulbs.

- EnergySmart Library for your Home
This online library provides in-depth information about energy topics and technologies to learn more about the energy used in your home.
- Free Services
 - NC Weatherization Program
 - Energy Efficiency Videos
These videos will help you learn about energy efficiency and why it's good for us all. You'll also pick up a few no cost/low cost energy saving tips to help you save energy and money.
- NC Green Power
By purchasing NC GreenPower, one is making a contribution to the advancement of technologies that promote the generation of electric energy through environmentally friendly renewable and reusable resources, such as solar, wind, biomass and water.

Federal Environmental Protection Agency:

- ENERGY STAR
ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy helping us all save money and protect the environment through energy efficient products and practices.

The ENERGY STAR program rates new household products, and ensures they meet strict energy efficiency guidelines set by the EPA and US Department of Energy. ENERGY STAR also sets standards for new home construction, awarding the ENERGY STAR label to homes meeting their energy-efficient standard for new construction. For existing residences, EPA offers tools and resources to help plan and undertake projects to reduce energy bills and improve home comfort.

For business, EPA's ENERGY STAR partnership offers a proven energy management strategy that helps in measuring current energy performance, setting goals, tracking savings, and rewarding improvements.

EPA provides an innovative energy performance rating system which businesses have already used for more than 62,000 buildings across the country. EPA also recognizes top performing buildings with the ENERGY STAR certification.