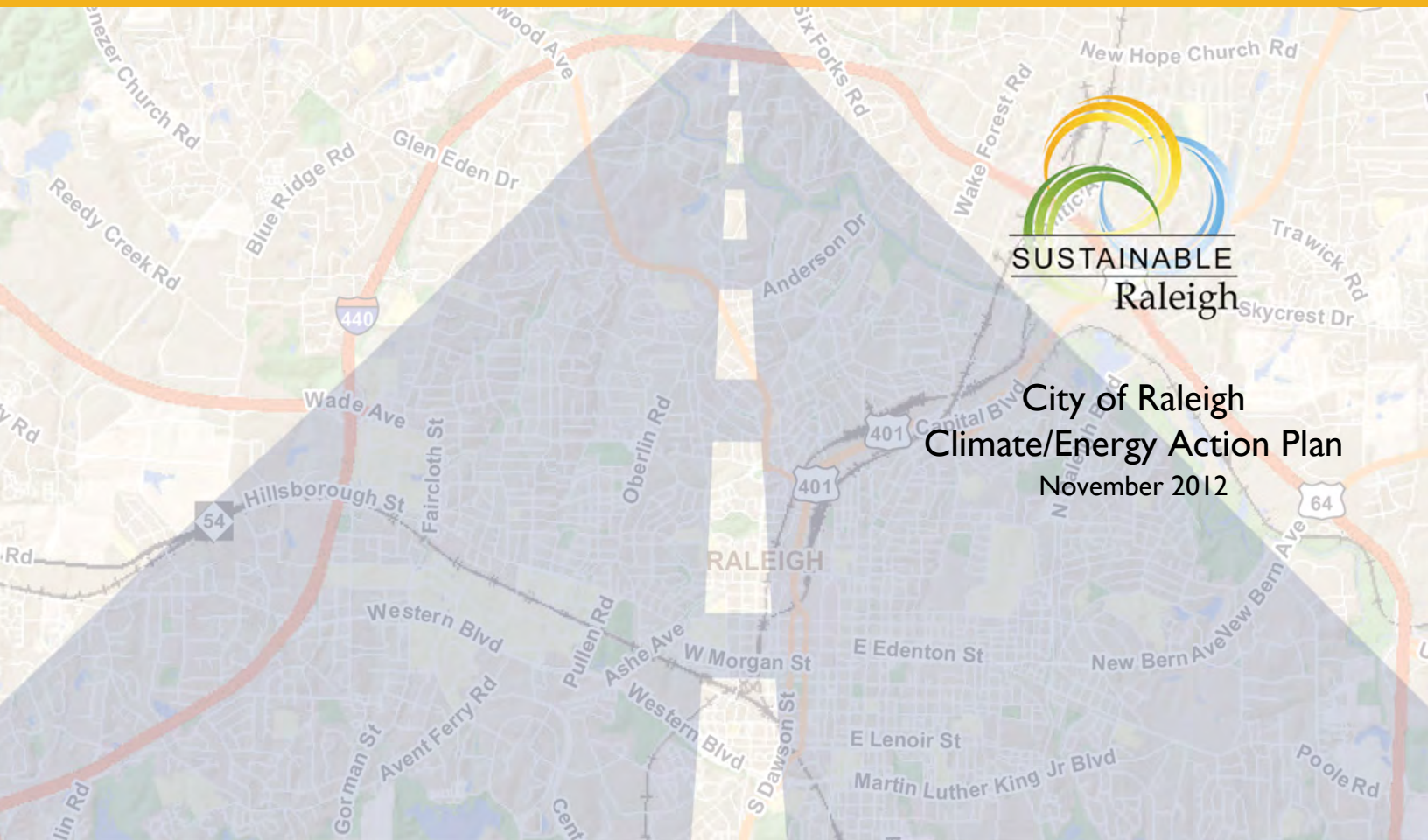




Technical Documentation – Volume One  
**Project Report**



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# **City of Raleigh's Climate / Energy Action Plan Technical Documentation – Volume One: Project Report**

Prepared for  
**City of Raleigh**  
**Office of Sustainability**  
Raleigh, North Carolina



October 2012

**CH2MHILL**  
Raleigh, NC

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# Abbreviations and Terms

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ARS	Audience Response System
AWWARF	American Water Works Association Research Foundation
BCE	Business Case Evaluation
CEAP	Climate / Energy Action Plan
CIP	Capital Improvement Projects
CR	Carbon Reduction Strategies
ESCO	Energy Services Company
EE	Energy Efficient Buildings Strategies
FLT	Fleet Strategies
FY	Fiscal Year
GPS	Global Positioning System
ICLEI	International Council for Local Environmental Initiatives
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
MCA	Multi-Criteria Analysis
O&M	Operations and Maintenance
PUD	Public Utilities Department
PV	Photovoltaic
REC	Renewable Energy Certificate
RTEMOO	Real Time Energy Management & Operations Optimization
SWS	Solid Waste Services
TCR	The Climate Registry
US OMB	United States Office of Management and Budget
WWTP	Wastewater Treatment Plant
W, kW, MW, kWh, MWh	Watt, Kilowatt, Megawatt, Kilowatt-hour, Megawatt-hour
CO <sub>2</sub>	Carbon Dioxide
CH <sub>4</sub>	Methane
NO <sub>2</sub>	Nitrous Oxide

## SECTION 1:

# Introduction

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The following Project Report presents the information and results from the various steps taken in the process of developing the City's Climate/Energy Action Plan (CEAP) during 2011 and 2012.

The following Sections are included as part of this document:

- **Section 2 – Climate/Energy Action Plan Project Process** describes the project process including chartering the Project Team and the Interdepartmental Teams, developing the project objectives, and defining the project mission statement, critical success factors and expected outcomes.
- **Section 3 – Existing Programs and Strategies for Operating Efficiency and Carbon Reduction** presents information generated by the Interdepartmental Teams about practices implemented since 2007 to increase operating efficiency and reduce carbon emissions as well as the documented carbon emissions reduction between 2007 and 2010.
- **Section 4 – Future Strategies, Best Management Practices & Policies for Operating Efficiency and Carbon Reduction** presents the strategies and practices developed by the Interdepartmental Teams and the consulting team that can be put in place in the future to continue to improve operating efficiency and reduce carbon emissions, as well as the reductions that can be expected from implementing the strategies.
- **Section 5 – Future Strategies Prioritization** describes the decision framework developed and utilized by the Prioritization Team for the review and prioritization of strategies as well as the prioritization process and results.
- **Section 6 – Financial Analysis** presents the development of the financial analysis framework. Specific business case evaluations were conducted for two of the highest scoring strategies. The complete Business Case Evaluations are included in Volume 2 of the CEAP Technical Documentation.

## SECTION 2:

# Climate/Energy Action Plan Project Process

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This Section describes the project process utilized to develop the City of Raleigh Operations Climate/Energy Action Plan: A Roadmap to Raleigh's Energy Future:

- Project Chartering
- Engaging the Interdepartmental Teams
- Decision framework that was utilized for potential future strategies prioritization
- Financial analysis of potential future strategies
- Obtaining City Manager's input

## 2.1 Project Chartering

Chartering is a process that is essential for projects with multiple outcomes and multiple stakeholder groups. It is a formal activity that essentially defines the "contract" by which all of the individual members of the project team agree to the specific values, outcomes, timeline, and change management techniques by which the project will be implemented. Goals, processes, measures of success, and personal/team accountabilities are established. Chartering requires each team member to become a fully committed participant by helping define the way the work will be done and by signing-on individually to the desired outcomes of the team.

### 2.1.1 Chartering Goals

The work of the CEAP Project Team began in a workshop setting on June 29, 2011 with a 4-hour Chartering Meeting of the Project Team Members. Twenty City of Raleigh Project Team Members were present and the meeting was facilitated by the consulting team. The goal of the Chartering Meeting was to:

- Build a shared awareness and clear understanding of what the City Team Members would accomplish during the project
- Provide the context to begin building an effective team with the City Team Members – some of whom did not know each other – beginning to work together to define their roles, values, and operating guidelines
- Define responsibilities and expectations for the active engagement of each Team Member
- Provide the context for measuring the success of the project
- Have all parties "sign on" to the direction of the project and the processes to be followed

### 2.1.2 Building the Project Team and Defining Roles and Responsibilities

A team is comprised of a group of individuals who have agreed to work together to achieve a common set of goals, to place the common goals above their functional or individual goals, and to work interdependently to achieve the common goals. To work interdependently, the Project Team Members recognized that they need each other to

perform their own role successfully and that the results of each members' individual work is needed for the team to achieve its common goals.

One of the most important elements of developing the Plan was bringing together the subject matter experts, or “thought leaders”, within the City staff who would frame, endorse and then implement the Plan. The Project Team Members were identified by the City of Raleigh and represented diverse City staff from the following Offices, Departments and Divisions:

- Budget and Management Services
- City Attorney's Office
- City Manager's Office
- Division of Facilities and Operations
- Finance
- Fire
- Information Technology
- Office of Sustainability
- Parks and Recreation
- Police
- Public Utilities
- Public Works – Fleet Management Operations, Transportation Operations, Construction
- Raleigh Convention Center
- Solid Waste Services

A list of all Project Team Members is included in Appendix 1. The diversity of the Team members ensured that the Plan would be applicable cross-departmentally and that key City enterprise-wide goals were identified and included in the discussions. In addition, each Project Team Member was also part of a smaller Interdepartmental Team as described later in this Section.

The Project Team Members discussed and agreed upon the values that were most important to them in order to work together successfully as a team:

- Active participation in the process to develop a Plan “from the bottom up”
- Open and honest communication
- Showing respect for others
- Personal responsibility and accountability with willingness to take the initiative
- Being positive, and open to and accepting of new ideas
- Listening and being heard
- Make efficient use of their time together
- Commitment to the team and the project process to “own” the work and to implement the strategies

Team roles were defined as follows for each Interdepartmental Team:

- Team Leader – serves as Project Manager for the Team; responsible for Team outcomes/deliverables and quality; reports regularly to their Department Directors and solicits input and feedback
- Team Facilitator – arranges meetings; assures invitees, facility, equipment and materials are accounted for; distributes meeting agendas and supporting materials
- Team Scribe – maintains records of key decisions and recommendations; prepares and distributes accurate meeting minutes in coordination with Team Leader
- Team Member - serves as decision-maker and/or decision facilitator; participates actively and attends all meetings; develops or collects required data and documents outside of meetings

In addition, all Project Team Members were to serve as ambassadors to their departments and were responsible for soliciting input and feedback from others in their departments.

The Project Team Members noted that there are different levels of decisions: decisions the team can make; decisions that need only limited involvement of Departments; and those decisions that must be made at the Department level.

### 2.1.3 Developing the Project Charter

The consulting team led the group through the review of a draft Project Charter with the following components:

- Mission of the Interdepartmental Team
- Executive Sponsors
- Project Team Members
- Deliverables and Schedule
- Critical Success Factors
- Expected Benefits

The draft charter was discussed by the Project Team Members and, with some minor revisions, was approved by all of the Interdepartmental Team Leaders during a meeting on July 6, 2011. By signing the Charter, the Project Team Members indicated that they agreed with the following statement:

*“We the following have read, understand, and fully endorse the City of Raleigh Climate/Energy Action Plan Project Team Charter dated July 6, 2011. I know my role and agree to personally contribute and add value to improve the quality of the effort.”*

The final Project Charter was signed by each Project Team Member. The final executed Project Charter and the Project Chartering Meeting Summary are included in Appendix 2.

## 2.2 Climate/Energy Action Plan Objective

The Project Charter Mission clearly states the objective of the CEAP:

*To serve as an internal guide for the City of Raleigh Operations in the financially responsible, legal and practical implementation of strategies so as to minimize carbon-related emissions, maximize the energy and operational efficiency of existing and new City-owned fleet, facilities and equipment with consideration for life-cycle costs, and provide renewable energy opportunities.*



During the Chartering Workshop, the Project Team Members identified the following as key factors that would define the project as a success:

- Use of a transparent process that is verifiable, defensible and repeatable to develop, review and prioritize the strategies
- Development of realistic and achievable strategies with outcomes that are measurable
- Setting realistic timeframes for implementing the strategies and measuring the results
- City staff agreement to implement the strategies

Also from the Chartering Workshop discussions, a common objective was evident – that the CEAP process was to be intensely inclusive and the Plan was to be developed, “owned” and endorsed by the Project Team Members. In other words, the Plan was not simply to be developed by the consulting team and/or City management and presented to the Project Team for approval. As part of this discussion, it was recognized and agreed to by the Project Team Members that they were in the best position to provide the Raleigh-specific information that would be needed throughout the CEAP development; information specific to the City was needed to form the basis for the most verifiable, defensible and repeatable analyses as well as the most realistic estimates of costs and impacts to City operations.

In order to meet these objectives and address the critical success factors, the project process utilized by the Project Team Members is shown in Appendix 3.

## **2.3 Interdepartmental Team Framework**

The City had previously defined six primary areas of focus for the CEAP. In order to efficiently address the focus areas, a smaller Interdepartmental Team was assigned to each:

- Fleet Team
- Buildings Team
- Carbon Team
- Renewables Team
- Finance Team
- Legal Team

Each Interdepartmental Team included members from various City departments to ensure that the diverse interests and concerns of the departments were voiced and recognized throughout the project. In addition, some Project Team Members were members of more than one of the Interdepartmental Teams which reflected and helped capture the interconnectedness of the focus areas.

### **2.3.1 Interdepartmental Teams Chartering**

The Interdepartmental Teams met separately throughout the project to work on their specific focus area. At the first meeting of each Interdepartmental Team, the Team was chartered in a manner similar to the Project Team Chartering. An individual Team Charter was created which utilizes the Project Charter as an umbrella but includes more specific critical success factors related to the specific work of each Interdepartmental Team. The Team Member roles and responsibilities were reviewed and affirmed, and members volunteered for each role in their Team.

### 2.3.2 Strategy Teams

The Interdepartmental Teams assigned to the first four focus areas (Fleet, Buildings, Carbon, and Renewables) are called the Strategy Teams. Their primary goals were to work with the consulting team to:

- Define the existing programs and strategies being implemented within the City to achieve operating efficiencies, energy efficiency and carbon emission reductions; this work allowed the consulting team to determine carbon emissions reductions achieved by City Operations between 2007 and 2010
- Identify future strategies, best management practices and policies needed to continue to achieve operating efficiencies, energy efficiency and carbon emission reductions
- Provide detailed information needed for analysis – the key information needed by the consulting team to preliminarily assess both the existing and future strategies included carbon emissions metrics, costs and operational impacts
- Prepare an inventory of the City's existing renewable energy projects and develop a strategy for reviewing potential new opportunities

The separate Strategy Teams met three times in workshop settings during the development of the Plan and their work is described in Sections 3 and 4 of this Project Report. The topics and deliverables of each of the workshops are presented in Exhibit 1. Between the workshops, the consulting team worked with Team Leaders and other Team Members to assimilate existing data and information, and to facilitate collection of new data from the Teams as needed for the strategy development and analyses.

**EXHIBIT 1**  
Strategy Team Workshop Topics and Deliverables

Strategy Team Workshop No.	Primary Workshop Topic	Deliverables	Date
1	Existing and Potential Future Projects, Programs and Strategies for Operation/Energy Efficiency and Carbon Emission Reduction	Team Charter Identification of existing projects, programs and strategies Initial identification of potential future projects, programs and strategies	Each Strategy Team Met Separately on the days of July 26 and 27, 2011
2	Finalize Future Strategies, Best Management Practices and Policies for Operation/Energy Efficiency and Carbon Emission Reduction and Validate Input Data	Finalize potential future projects, programs and strategies Operational implications Timelines for implementation Base financial data	Each Strategy Team Met Separately on the days of September 8 and 9, 2011
3	Review Strategy Prioritization Results with all Team Members		All Project Team Members met Together on December 5, 2011

### 2.3.3 Finance Team

The goal of the Finance Team was to work with the consulting team to provide base financial data, determine the financial implications of the strategies developed by the

Strategies Teams at a planning level, and to identify potentially viable financing techniques. The work of the Finance Team is detailed in Section 6 of this Project Report.

### **2.3.4 Legal Team**

The goal of the Legal Team was to identify and evaluate potential legal barriers to the strategies and programs identified by the other Interdepartmental Teams, and to recommend legislative or regulatory actions that could be taken to address the barriers. The potential CEAP strategies and programs that were developed throughout the project process were screened for potential legal and regulatory impacts as part of the strategies prioritization process described in Section 5 of this Project Report. The outcome of the prioritization process revealed that none of the potential strategies or programs would be prohibited by current Federal and/or North Carolina laws and regulations.

## **2.4 Decision Framework for Strategies Prioritization**

The Project Team Members had agreed during chartering that the CEAP must be developed using a transparent process that is verifiable, defensible and repeatable, and Members recognized that decisions that involve multiple stakeholders with different interests would be made. The Project Team elected to use a decision analysis approach which is a structured framework in which decision criteria are developed, weighted and then applied to prioritize potential future strategies to meet the City's stated goals. The decision framework process and the Prioritization Team's activities are described in Section 5 of this Project Report.

## **2.5 Financial Analysis**

The CEAP process included a financial analysis of potential future strategies in order to evaluate the financial implications, at a planning level, of the strategies developed by the Strategies Teams. The financial analysis is described in Section 6 of this Project Report.

## **2.6 Mid-Project Update for City Manager**

As the Strategy Teams and the consulting team were refining the potential strategies for further evaluation, it was appropriate to update and obtain input from the City Manager, Assistant City Managers, and other key Directors about the initial findings. The goal of the meeting was to facilitate their understanding of initial findings, gather their input on overall project direction, and discuss issues or concerns. The following City staff participated in the meeting held on September 26, 2011:

- Russell Allen, *City Manager*
- Julian Prosser, *Assistant City Manager*
- Dan Howe, *Assistant City Manager*
- Perry James, *Chief Financial Officer*
- Joyce Munro, *Budget and Management Services Director*
- Gale Roper, *Chief Information and Community Relations Officer*
- Paula Thomas, *Manager, Office of Sustainability*
- Cindy Homes, *CEAP Project Manager, Office of Sustainability*

The following information was presented by the consulting team:

- Carbon reductions achieved between 2007 and 2010 – this represents the significant work done by the City staff to reduce carbon emissions with relatively low capital cost investments; as a result, much of the “low hanging fruit” has been realized
- Expected carbon emissions without implementation of additional reduction strategies – with growth at 2.5% per year per the City Planning Department, the gains made will be eroded and will return to 2007 levels and then exceed those levels without additional reductions
- Future carbon emissions projections with implementation of additional reduction strategies developed by the Interdepartmental Teams
- Potential future strategies based on carbon reduction potential and estimated capital costs to implement

At the conclusion of the meeting, the consensus of the Managers and Directors was that the project direction was appropriate and would result in the CEAP as envisioned by the City.

## SECTION 3:

# Existing Programs and Strategies

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## 3.1 Introduction

The City of Raleigh has a solid foundation for its sustainability program and has already implemented a number of important projects that have increased operation and energy efficiency, and have reduced carbon emissions. One goal of the CEAP is to capture the projects, activities and strategies that have been put in place since 2007, the date of the baseline inventory. This section describes the work of the four Strategy Teams to identify the existing projects, programs and strategies, defined as those that had been implemented between 2007 and 2010. The Strategy Teams are:

- Fleet Team
- Buildings Team
- Carbon Team
- Renewables Team

The primary vehicle to obtain and consolidate this information was a combination of collaborative workshops and extensive work in between the workshops by both the Interdepartmental Team Members and the consulting team to confirm information and gather new information to fill data gaps. Each Strategy Team met separately in workshop setting two times throughout the course of the project, and once as the full Project Team to review the project results, as shown in Exhibit 1.

## 3.2 First Strategy Team Workshops

### 3.2.1 Goals

While conducted separately, the goals of the first workshop held with each Strategy Team were the same:

- Chartering and project process:
  - Become familiar with one another
  - Review the project goals established during the Project Chartering Workshop
  - Review the project process
  - Review the Project Team Charter
  - Validate Team Members, define roles and responsibilities, charter the Team Members, and sign the Team Charter
  - Agree on critical success factors
  - Agree on expectations of the Team, outcomes and deliverables to be produced
  - Agree on project schedule
- Document projects, activities and strategies implemented after 2007

- Capture Team's ideas about future projects, activities and strategies that could help further increase operation and energy efficiency, and reduce carbon emissions

Although most of the Strategy Team Members had attended the Chartering Workshop and were familiar with the chartering process and the final Project Team Charter, the chartering process was reviewed to ensure all Team Members understood the significance and were willing to sign the individual Team Charter.

One of key the CEAP objectives was that the Plan was to be developed, "owned" and endorsed by the Team Members, comprised of the City's subject matter experts. To make certain that this objective was met the Team Workshops were designed to encourage the free-flowing exchange of ideas among the Team Members and to capture all thoughts and ideas without any constraints. Facilitated exercises were used to ensure that these were highly productive discussions and that all voices were heard. Each Team Workshop was facilitated by the consulting team's local team leader, project manager, and a senior technical expert who provided insight about experiences and best practices associated with other programs.

### **3.2.2 Facilitated Exercises**

Following the Team chartering, the Team Members participated in the following facilitated exercises:

- Exercise 1: Document projects, programs and strategies that had been implemented between 2007 and 2010 – during this exercise the consulting team captured information on large easel pads and asked clarifying questions
- Exercise 2: Identify projects, programs and strategies that should be considered – during this exercise the consulting team captured information on large easel pads, asked clarifying questions, and provided input on strategies employed by other programs.

### **3.2.3 Data Needs and Action Items Assigned**

Data needs were then discussed and action items assigned to the Team, to complete prior to the second Workshop. Detailed information was needed by the consulting team for analysis of both the existing and potential new strategies in order to assess carbon emissions metrics, costs and operational impacts.

As part of the Project Team Chartering process, it was recognized by and agreed to by the Project Team Members were in the best position to provide Raleigh-specific key information listed above. The use of Raleigh-specific information would provide the basis for the most verifiable, defensible and repeatable analysis of strategies as well as the most realistic estimates of costs and impacts to City operations.

As the Team gathered the data needed, the consulting team members were involved with the Team Leads by telephone and email to clarify what was needed and to answer questions.

### 3.3 Existing Programs and Strategies

“Existing” projects, programs and strategies were defined as those that had been implemented between 2007 and 2010. The year 2007 was selected in order to capture those activities that were implemented after the 2007 baseline inventory was conducted. The year 2010 was selected because it would represent the most recent full calendar year of a available data and would provide several years of operating data for analysis.

#### 3.3.1 Fleet Team

The Fleet Team met on July 26, 2011. The scope of this Team’s work included:

- Public Works Department Fleet Management Operations – all vehicles under the management of the Department including a motor pool fleet that is used by various departments
- Public Works Department Transportation Operations – comprised of the City’s bus system services
- Solid Waste Services Operations – vehicles used for collection of solid waste and recyclable materials
- Parks and Recreation Department Operations – maintenance of the outdoor areas of City parks and ballfields including mowing and collection of solid waste
- Police Department and Fire Department vehicles

The scope did not include Public Utilities Department (PUD) fleet operations as PUD has a separate service area footprint (the City of Raleigh and the Towns of Garner, Rolesville, Wake Forest, Knightdale, Wendell, and Zebulon) and PUD fleet operations were being assessed under a separate organizational study for PUD.

The Fleet Team identified a total of 55 existing and future strategies as well as future best management practices and policies. The following action items were assigned at the end of the Workshop:

- The consulting team prepared a Strategy Matrix capturing the strategies; the matrix was transmitted electronically to the Team Leads
- The Team Leads were responsible for populating the blank cells in the matrix with the following information for each strategy, and returning the matrix to the consulting team:
  - Emission Metrics such as gallons of each type of fuel utilized by the City related to transportation, and miles traveled
  - Operational Impacts including staff behavioral changes that would be necessary and department budget impacts
  - Base Financial Information including capital costs, operation and maintenance costs, useful life, and revenue or savings generated
  - Timeframe for Implementation
  - Interdependencies with Other Projects
  - Responsible Department

### **3.3.2 Buildings Team**

The Buildings Team met on July 26, 2011. The scope of this Team's work included:

- Buildings under the management of the Buildings Superintendent
- Raleigh Convention Center
- Raleigh Memorial Auditorium (Progress Energy Center for the Performing Arts)
- Public Utilities Department Operations – PUD operations buildings/facilities in seven communities
- Solid Waste Services (SWS) Operations – SWS operations building/facilities
- Outdoor City lighting including traffic lights, street lights, parking structure lights, and lights at parks and ballfields

The Buildings Team identified a total of 62 existing and future strategies as well as future best management practices and policies. The following action items were assigned at the end of the Workshop:

- The consulting team prepared a Strategy Matrix capturing the strategies, divided into existing and future; the matrix was transmitted electronically to the Team Leads
- The Team Leads were responsible for populating the blank cells in the matrix with the following information for each strategy, and returning the matrix to the consulting team:
  - Emission Metrics such as kilowatt hours of power consumed, cubic feet of natural gas consumed
  - Operational Impacts including staff behavioral changes that would be necessary and department budget impacts
  - Base Financial Information including capital costs, operation and maintenance costs, useful life, and revenue or savings generated
  - Timeframe for Implementation
  - Interdependencies with Other Projects
  - Responsible Department

### **3.3.3 Carbon Team**

The Carbon Team met on July 27, 2011. The scope of this Team's work included:

- The Public Utilities Department Operations – water and wastewater treatment plants and pumping systems, reclaimed water system, water efficiency
- Solid Waste Services Operations – Wilder's Grove Landfill, yard waste composting
- Parks and Recreation Department Operations – tree planting, ornamental vegetation, and urban forest



The Carbon Team identified a total of 51 existing and future strategies as well as future best management practices and policies. The following action items were assigned at the end of the Workshop:

- The consulting team prepared a Strategy Matrix capturing the strategies, divided into existing and future; the matrix was transmitted electronically to the Team Leads
- The Team Leads were responsible for populating the blank cells in the matrix with the following information for each strategy, and returning the matrix to the consulting team:
  - Emission Metrics such as standard cubic feet of landfill gas recovered, tons of yard waste collected, average nitrogen discharged from the wastewater treatment plant, number of trees planted
  - Operational Impacts including staff behavioral changes that would be necessary and department budget impacts
  - Base Financial Information including capital costs, operation and maintenance costs, useful life, and revenue or savings generated
  - Timeframe for Implementation
  - Interdependencies with Other Projects
  - Responsible Department

### **3.3.4 Renewables Team**

The Renewables Team met on July 26, 2011, and again on August 17, 2011; two meetings were needed early in the process given the complex nature of the scope of this Team's work. The scope included:

- Prepare inventory of all City renewable energy projects to date
- Develop strategy and potential criteria that could be applied by the City when evaluating new renewable projects and opportunities
- Evaluate and develop tracking metrics needed
- Gain an understanding of the renewable energy market in NC and business models being applied
- Discuss Raleigh's vision for renewable energy
- Review potential forms of renewable energy and those most applicable to Raleigh (solar PV, solar thermal, hydro, geothermal, wind, biofuels)
- Discuss potential business models for project financing
- Review potential strategies

The focus of Workshops 1 and 2 are shown in Exhibit 2.

**EXHIBIT 2**  
 Renewables Team Workshop Topics and Deliverables

<b>Renewables Team Workshop No.</b>	<b>Primary Workshop Topic</b>	<b>Deliverables</b>	<b>Date</b>
1	State of the Renewable Energy Market and City's Vision for Renewable Energy	Team Goals, Business models, and Potential strategies	July 26, 2011
2	Criteria Development	Potential alternatives and criteria for project evaluation and prioritization	August 17, 2011

The Team identified a total of 19 existing and future strategies as well as future best management practices and policies. The following action items were assigned at the end of the Workshop:

- The consulting team prepared a Strategy Matrix capturing the strategies, divided into existing and future; the matrix was transmitted electronically to the Team leads
- The Team Leads were responsible for populating the blank cells in the matrix with the following information for each strategy, and returning the matrix to the consulting team:
  - Emission Metrics such as energy expected to be generated or offset
  - Operational Impacts including staff behavioral changes that would be necessary and department budget impacts

During Workshop 2, the potential criteria that could be applied by the City when evaluating new renewable projects and opportunities were identified:

- Maximum power capacity (kW) for the dollar investment
- Maximum energy production (kWh) for the dollar investment
- Minimum risk – what level of risk is acceptable to the City
- Diversity – a diverse portfolio is critical, potentially whether or not a project reduces carbon emissions
- Initial investment vs. life-cycle cost
- Best return on investment
- Source problems
- Market maturity
- Technical challenges (technology maturity)
- Environmental impact
- Decision framework criteria utilized for strategies scoring is applicable
- Opportunities for economic development (advancement of businesses involved in renewables; partnerships with local universities)

## 3.4 Summary of Existing Strategies

The existing strategies, by Team, are presented in Appendix 4.

## 3.5 Carbon Emissions Reductions by City Operations between 2007 and 2010

The information provided by the Strategy Teams for each of the existing programs and strategies was utilized by the consulting team to provide an estimate of the reduction in carbon emissions that had been achieved by City Operations as a result of implementing the programs and strategies. By comparing the amount of City Operations emissions that occurred in 2007 and in 2010, the City could demonstrate the carbon reductions that had been achieved within a few years. It is important to note that these reductions were all achieved from relatively low capital expenditures and have had few impacts on City or Department operations and budgets.

Per the July 12, 2010 City of Raleigh Greenhouse Gas Inventory: Municipal Operations report, total emissions from City Operations for FY 2007 were estimated to be 151,000 metric tons of CO<sub>2</sub> equivalent.

### 3.5.1 Development of City Operations Emissions for Year 2010

The consulting team utilized the information provided by the Strategy Teams to estimate the amount of carbon emissions from City Operations that had been reduced between the years 2007 and 2010. Calculations were performed according to The Climate Registry (TCR) and the International Council for Local Environmental Initiatives (ICLEI) *Local Government Operations Protocol Version 1.1, May 2010*. The TCR/ICLEI *Local Government Operations Protocol* was developed as a collaborative effort between the two organizations to give local governments a comprehensive guidance document for preparing greenhouse gas inventories outside of the traditional manufacturing/industrial sector. The TCR/ICLEI *Local Government Operations Protocol* utilizes U.S.-based emission factors.

The 2010 emissions include those from Scope 1 and Scope 2 sources as identified below:

#### Scope 1 – Direct Emissions

Direct emissions result from sources, processes, or facilities owned and/or controlled by the City. The City Operations include these source categories for direct emissions:

- Stationary Combustion Emissions – Emissions that are the result of combusting fossil-based fuels using equipment in a fixed location. Such pieces of equipment include boilers, heaters, and generators.
- Mobile Combustion Emissions – Emissions resulting from the combustion of fossil-based fuels in transportation sources both on- and off-road. These sources include the City's vehicles and heavy equipment.
- Process-Related – Process emissions result from physical or chemical processes, other than those resulting from fuel combustion. For the City, this includes emissions from the three wastewater treatment plants (Neuse River, Little Creek and Smith Creek), the Wilder's Grove Landfill and from yard waste composting

- Fugitive – Fugitives emissions result from unintentional leaks or releases of refrigerants from processes, storage devices, and/or cooling systems.

## Scope 2 – Indirect Emissions

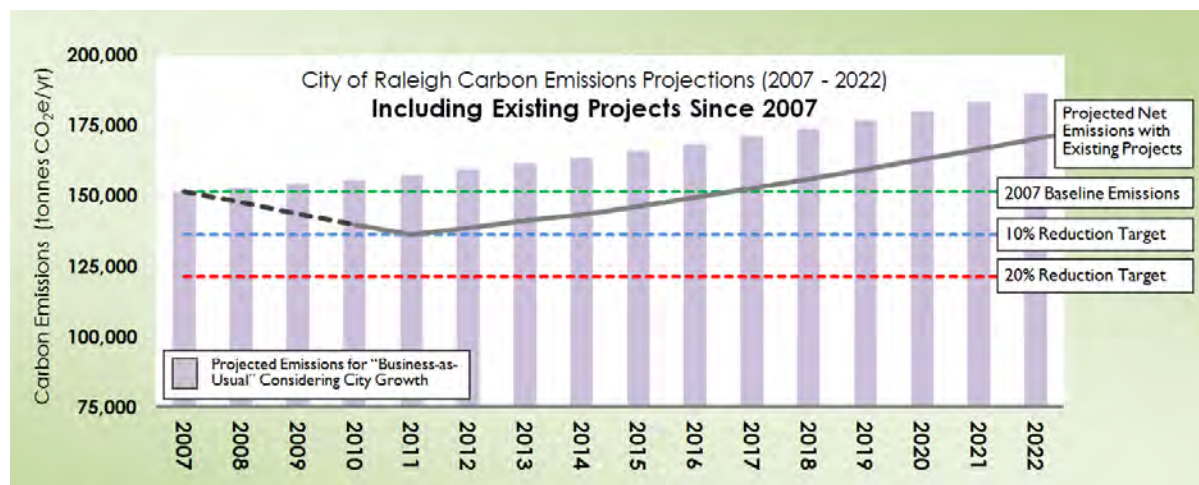
Indirect emissions result from activities owned and/or controlled by another entity, but are being completed on the City's behalf. For this category only emissions resulting from the use of purchased electricity, natural gas, steam, and/or hot/chilled water are included.

### 3.5.2 Summary of 2010 City Operations Carbon Emissions Reductions

Based on the information provided by the Strategy Teams about the implemented strategies, the consulting team estimated that Raleigh's City Operations reduced carbon emissions expressed as metric tons of CO<sub>2</sub> equivalent between 2007 and 2010 by approximately 10% as shown in Exhibit 3.

**EXHIBIT 3**

City of Raleigh Operations Carbon Emissions Reductions Between 2007 and 2010



## SECTION 4:

# Future Strategies, Best Management Practices and Policies

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Section 4 describes the work of the Strategy Teams to identify the future strategies, best management practices and policies that could be implemented to achieve additional operation and energy efficiencies and further reduce carbon emissions from City Operations.

The process followed was similar to that described in Section 3 of this Report, using the combination of collaborative workshops and extensive work in between the workshops by both the Interdepartmental Team Members and the consulting team to confirm information and gather new information to fill data gaps.

## 4.1 Second Strategy Team Workshops

### 4.1.1 Process and Goals

Between Workshops 1 and 2, the Strategy Team Leads and the consulting team worked to add information to the strategy spreadsheets; each modified version, whether by the City or the consulting team, was carefully managed to ensure no loss or duplication of information. Prior to the second workshop, each Strategy Team was provided with a near-final spreadsheet summarizing all of the information that had been provided by the Team Members and generated by the consulting team.

While conducted separately, the goals of the second workshop held with each Strategy Team were the same:

- Verify information that had been provided by the Team regarding the existing projects, activities and strategies to be included in the Plan
- Finalize identification of future strategies, best management practices and policies to be included in the Plan
- Complete the provision of key information about the future strategies needed to evaluate the strategies, including costs
- Identify key remaining data gaps and how the gaps will be filled
- Agree on assumptions to apply in the absence of data
- Agree on the future strategies that appear to have the highest carbon reduction potential and path forward to collect critical financial data for these particular strategies
- Review how outcomes would be used for strategies prioritization and inclusion in the Plan

### 4.1.2 Information Review

The near-final spreadsheet provided by the consulting team prior to the workshop summarized all of the information that had been provided by the Team and generated by

the consulting team for both the existing strategies and the potential future strategies, best management practices and policies. The spreadsheet included columns for:

- Emissions metrics
- Implementation Year
- Operational Impacts
- Responsible Department
- Interdependencies
- Cost including capital, O&M and any other cost information that could be provided such as potential revenue or savings
- Useful Life

Prior to the workshop, the consulting team requested that the Strategy Teams endeavor to provide all information that was still missing from the spreadsheets. The spreadsheets were then updated by the consulting team to incorporate any additional information. At the same time, in order to develop as complete information as possible, the consulting team provided industry standard values where they were applicable along with the assumptions that had been made in utilizing such standard values.

The key vehicle for verifying and finalizing the information was a line-by-line review of the spreadsheets to determine whether the assumptions made by the consulting team were valid and whether the information that was needed from the Teams could be provided within about two weeks. Information was needed by the consulting team well in advance of the Prioritization Team Workshop that was held on October 7, 2011 in order to provide the most information available to the Team that prioritized the potential future strategies.

### **4.1.3 Data Gathering Process**

During and following Workshop 2, the Project Team and the consulting team realized that the information needed to evaluate all of the strategies was not available or could not be generated by the Teams within the timeframe needed to complete the project. The number and variety of information needed was considerable even with the addition of industry standard information provided by the consulting team.

At this point in the project, the Project Team and the consulting team agreed that the analyses would move forward with the focus shifting to completing the most critical data needed for the evaluation of those strategies that would likely demonstrate the highest carbon emission reductions.

The data gaps were fully recognized and there was considerable discussion regarding the need for the City to develop and implement a standardized way to gather the types of information needed for future analyses. This is addressed in Volume 4 of the CEAP Technical Documentation – *“Data Collection Framework for City of Raleigh Operations”*.

The Strategy Teams provided last inputs to the consulting team at the end of September 2011.

#### **4.1.4 Third Renewables Team Workshop**

The third Renewables Team Workshop was held on December 22, 2011 and focused on developing possible tracking metrics to use to assess the viability of potential renewable energy projects. Three primary tracking metrics were identified:

- Power capacity (typically “nameplate” capacity measured in W, kW, MW)
- Energy production (actual energy output measured in kWh, MWh)
- NC REC production for potential registration with the NC Utilities Commission

During development of the CEAP, the City was conducting an in house inventory of all existing and potential City owned sites, projects and applications and their associated feasibility for renewable energy opportunities. Information about the City’s Renewable Projects Inventory is included in Appendix 5 of this Project Report.

## **4.2 Summary of Future Strategies, Best Management Practices & Policies**

The future strategies, best management practices, and policies, by Team, are presented in Appendix 4.

## **4.3 Potential Carbon Emissions Reductions from Implementation of Future Strategies, Best Management Practices and Policies**

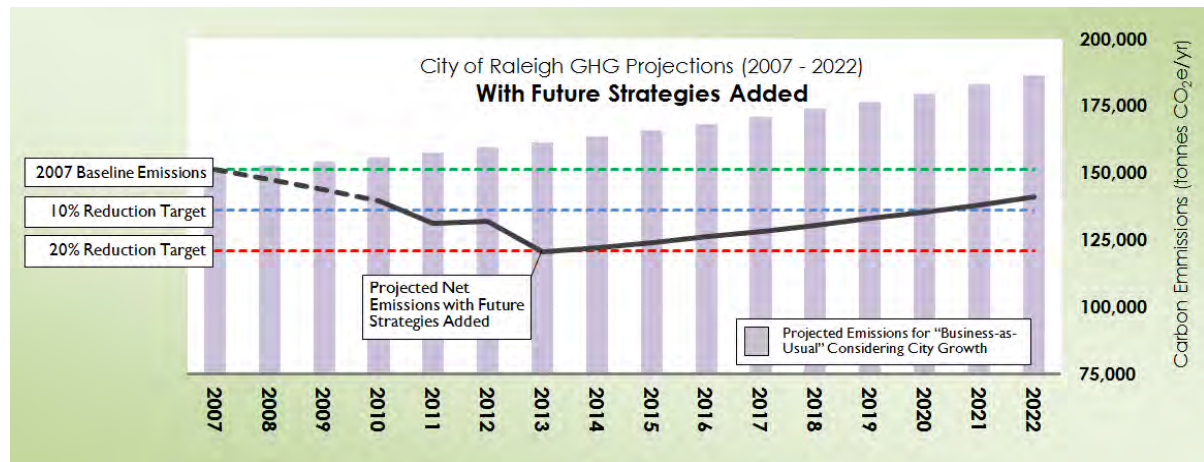
The information provided by the Strategy Teams and generated by the consulting team for the potential future strategies was utilized by the consulting team to provide an estimate of the reduction in carbon emissions that could potentially be achieved by City Operations as a result of implementing the future strategies, as shown in Exhibit 4. It must be noted that the reductions from the best management practices and policies generally could not be quantified because they are more conceptual than an implementable strategy that can be monitored and measured.

The consulting team utilized the information provided by the Strategy Teams to estimate carbon emissions from City Operations that could be reduced by the implementation of the potential future strategies. Calculations were performed according to the TCR/ICLEI *Local Government Operations Protocol Version 1.1, May 2010*.

The consulting team applied the following assumptions in the completion of the future emissions calculations:

- 2.5% growth per year per City Planning Department
- City Operations expected to increase emissions at same rate as City growth rate of 2.5% per year

**EXHIBIT 4**  
 City of Raleigh Operations Potential Future Carbon Emissions Reductions





## SECTION 5:

# Future Strategies Prioritization

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Like many cities throughout the country, Raleigh is faced with tight financial constraints, increased environmental regulatory compliance requirements, the need to devote increased resources to renewing and replacing aging existing infrastructure, and the desire to reduce carbon emissions from city operations. These drivers, along with increased stakeholder interest in making certain that funding resources are applied to projects that add the most value, supported the development of a strategies prioritization process that is explicit about the value that is contributed by a future strategy and documents the relative efficiency of potential strategies toward meeting the City's and CEAP's goals and objectives.

While the CEAP is not a capital planning document, the principles of prioritization, as detailed in the *Capital Planning Strategy Manual* (a capital planning guidance document developed for water and wastewater utilities that was released by the American Water Works Association Research Foundation (AWWARF, 2001)), are applicable. There are three primary levels of prioritization for capital projects:

- **Level 1 - Voting.** Voting often seems to be a form of consensus; however, voting, without good education and supporting information, often reflects the bias of the voters and may not reflect the highest benefit to the organization and its stakeholders.
- **Level 2 - Matrix.** This is appropriate for systems where there is a relatively short list of projects, and very few objectives that are fairly straightforward.
- **Level 3 - Decision Analysis.** For decisions that involve multiple stakeholders with different interests, a transparent process is required. A multi-criteria analysis (MCA) approach, where criteria are weighted, provides the foundation for comparing the relative contribution of a project toward meeting the stated goals.

The City elected to use the decision analysis approach to prioritization, in order to provide greater precision for weighting CEAP goals through weighted decision criteria and scoring the contribution of potential strategies to meeting the City's goals. This approach has been found preferable to traditional voting and matrix methods for prioritizing projects by an increasing number of local governments as it provides an explicit statement of the prioritization criteria and their relative importance. This approach is based upon the methods and tools developed for the *Capital Planning Strategy Manual* (AAWARF, 2001).

## 5.1 Strategy Prioritization Approach

The prioritization approach uses a 'decision analysis' method for scoring and prioritizing potential projects. As part of this method, a prioritization framework was developed that is specific to the CEAP and this framework served as the basis for which future strategies were screened. Key steps in the prioritization approach included:

- Developing a CEAP-specific prioritization framework
- Identification of decision criteria and their importance or weighting
- Selecting strategies for prioritization
- Scoring of selected strategies

- Use of a multi-criteria analysis prioritization model to support the development of the prioritized strategy list
- Review of prioritization results for verification of the prioritization framework.

In developing the prioritization framework, a series of interactive workshops were held to complete the above steps, as well as develop and verify the prioritization framework and decision-support prioritization model. Exhibit 5 shows the order of the workshops and the primary topics covered.

**EXHIBIT 5**  
 Prioritization Workshop Topics

Prioritization Workshop No.	Primary Workshop Topic	Date
1	Identify Prioritization Decision Criteria/ Weighting of Decision Criteria	July 22, 2011
2	Strategies Screening and Scoring	October 7, 2011
3	Review Results with City Interdepartmental Teams	December 5, 2011

### 5.1.1 Prioritization Team

In order to develop the scoring criteria for potential future strategies, a Prioritization Team was created. The Team was primarily comprised of the Co-Leaders of the Strategy Teams and the complete Finance Team.

The diversity of the Team members ensured that the decision criteria that were developed could be used for a broad range of projects, and that key City enterprise-wide goals were identified and included in the prioritization.

## 5.2 Identification & Weighting of Prioritization Decision Criteria

The Prioritization Team selected and developed five decision criteria for use in scoring potential strategies, during a facilitated discussion as part of Prioritization Workshop No. 1.

### 5.2.1 Criteria Definition

The decision criteria were selected based on the primary goals of the City and the CEAP, and the characteristics appropriate for measuring the effectiveness of each potential strategy toward meeting those goals. The selected criteria reflected the following attributes to ensure that the evaluation process yielded sound results:

- **Separate from cost.** The objective of the criteria is to evaluate the projects against the City's values and the CEAP goals. Utilizing cost in the initial evaluation matrix and combining it with other criteria does not allow for the analysis or comparison of project efficiencies.
- **Comprehensive.** Criteria selected cover all key goals.

- **Linked to values.** Criteria identified can be linked to the City's values and articulate what is important for the CEAP to accomplish.
- **Non-redundant.** Criteria identified do not address overlapping aspects of the projects. Redundant criteria would result in "double-counting" for that particular aspect in the scoring process.
- **Independent.** Accomplishment of one criterion would not be dictated by any other criterion.

Decision criteria used by other entities in similar prioritization efforts and knowledge of the City's and CEAP's goals and objectives provided a guide for the Prioritization Team to select and develop the following five decision criteria for use in scoring the projects:

- Carbon Reduction Potential
- Financially Responsible
- Operational Impacts
- Realistic / Implementable
- Coordinates with Other Projects

Definitions of each decision criteria are show in Exhibit 6. The selected criteria are consistent with the CEAP mission statement.

**EXHIBIT 6**  
Selected Decision Criteria and Definitions

Decision Criteria	Definition
Carbon Reduction Potential	Potential to reduce from human sources the atmospheric gases that contribute to the greenhouse effect by absorbing infrared radiation produced by solar warming of the Earth's surface including: carbon dioxide (CO <sub>2</sub> ); methane (CH <sub>4</sub> ); nitrous oxide (NO <sub>2</sub> )
Financially Responsible	Good use of public funds; considers capital and operating expenses; expressed by some form of a benefit-cost analysis, payback analysis, net present value, and/or initial capital outlay
Operational Impacts	<ul style="list-style-type: none"> <li>• Operational changes that lead to increased energy efficiency - Reduction of amount of energy required to provide products and services, most often achieved by adopting a more efficient technology or process</li> <li>• Operational changes that lead to increased operating efficiency - Generate goods and services from a fixed collection of inputs and/or costs</li> <li>• Stay within a range of a Department's operating budget</li> <li>• Staff behavioral changes may be required</li> </ul>
Realistic/ Implementable	<ul style="list-style-type: none"> <li>• Consistent with current operating patterns/paradigms; can be incorporated into the way City does business without major impacts</li> <li>• Reasonable amount of staff time and effort to implement</li> <li>• Mature technology and market</li> <li>• Legal; meets regulatory requirements</li> </ul>
Coordinates with Other Projects	<ul style="list-style-type: none"> <li>• Can be a component of current or future projects</li> <li>• Common responsible parties; common internal or external partners</li> </ul>

## 5.2.2 Criteria Weighting

Once the decision criteria were selected, the decision analysis process required an explicit, numerical weighting of each of the individual evaluation criterion, in order to allow the estimate of benefits to reflect the importance of the identified goals.

During Workshop No. 1, the Prioritization Team members were divided into three small groups and an initial scoring exercise was used to develop preliminary weights for the decision criteria. Each group was asked to assign 100 ‘value points’ to each of the five criteria with 100 representing the criteria assigned the greatest value. Exhibit 7 contains the decision criteria and weightings that were agreed to at the end of the verification process. It should be noted that one of the teams assigned 100 points to each of the criteria, indicating that all of the criteria were equally and most highly important.

### EXHIBIT 7

#### Summary of Decision Criteria Weightings

Criteria	Agreed Upon Final Weight	Team 1 Weightings	Team 2 Weightings	Team 3 Weightings
Financially Responsible	95	100	93	100
Realistic/Implementable	95	90	100	100
Operational Impacts	95	85	96	100
Carbon Reduction Potential	90	85	84	100
Coordinates with Other Projects	75	75	75	100

## 5.3 Strategies Screening

Mindful of the Prioritization Team’s time and to focus their additional efforts, the consulting team proposed a process that would reduce the number of strategies that would receive the full review of the Team. The consulting team proposed that the strategies for further evaluation be focused on those that would potentially provide the highest levels of carbon emission reductions if implemented, in other words, the first “screen” through which a strategy would need to pass to receive additional consideration was its contribution to the reduction of carbon emissions.

With the 2007 baseline emissions established at approximately 150,000 tonnes, the consulting team proposed that the minimum contribution of a strategy for further consideration be set at achieving 0.05% of the 2007 baseline or 75 tonnes.

Applying this “screen” the number of strategies for further evaluation was reduced to 32 strategies as shown in Exhibit 8 below.

**EXHIBIT 8**

**Top 32 Future Carbon Reduction Strategies**

(Strategies were Selected to Yield at Least 0.05% (75 tonnes) Reduction from 2007 Baseline Carbon Emissions)

<b>No.</b>	<b>Strategy ID</b>	<b>Strategy Name</b>
<b>Fleet Strategies</b>		
1	FLT-0-18	Transit Bus GPS
2	FLT-1-02	Vehicle GPS
3	FLT-1-06	Mower Alternative Fuel Usage
4	FLT-1-10	Increase City Fleet Alternative Fuel Vehicles
5	FLT-1-13	Fleet Propane Usage
6	FLT-1-25	Reduced Vehicle Speed Policy
7	FLT-1-27	Change Fuel for Solid Waste Services Trucks
8	FLT-1-28	Solid Waste Services Propane Usage
9	FLT-1-29	Consolidate Collection of Recyclables & Outdoor Solid Waste from City Parks
<b>Building Strategies</b>		
10	EE-1-11	City Building Climate Controls
11	EE-1-12	Elevator/Fan Light Controls and Lighting Conversion to LED
12	EE-1-21	LEED Policy Emphasis on Energy Efficiency
13	EE-1-32	Replace Lighting at Public Utilities Dept. Facilities
14	EE-1-33	Utilize LED Lighting for City Street Lighting
15	EE-1-35	City Building Interior Light Controls
16	EE-1-36	Utilize LED Lighting in City Parking Decks
17	EE-1-52	Energy-Efficient Vending Machines
18	EE-1-53	City Building Envelope Improvements
19	EE-1-63	Pre-Heat Water for City Pools by Solar Thermal
20	EE-1-72	Raleigh Convention Center Preventative Maintenance Plan Implementation
<b>Carbon Strategies</b>		
21	CR-0-12	Reduction in Solid Waste Services Collection Trips
22	CR-1-02	Increase Recycle Container Size
23	CR-1-04	Recover Methane by Composting Yard Waste
24	CR-1-07	Water Reuse
25	CR-1-08	Tree Planting Programs
26	CR-1-13	Utilize Alternative Chemicals in Wastewater Treatment Process

## EXHIBIT 8

### Top 32 Future Carbon Reduction Strategies

(Strategies were Selected to Yield at Least 0.05% (75 tonnes) Reduction from 2007 Baseline Carbon Emissions)

No.	Strategy ID	Strategy Name
27	CR-1-14	City Produce its own Biodiesel
28	CR-1-16	City Grow its own Biodiesel Fuel Stocks
29	CR-1-17	Anaerobic Biosolids Digestion at Neuse River WWTP
30	CR-1-28	Water Distribution System Real Time Energy Mgmt. Optimization (RTEM00)
31	CR-1-31	Organic Waste Management
32	CR-1-32	Continue Water Efficiency

It must be noted that the remaining strategies are viable and are part of the CEAP, however they either contributed below 75 tonnes or the carbon emissions reductions could not be quantified due to lack of data. The reductions from the best management practices and policies cannot be quantified since they are conceptual.

The consulting team then proposed a qualitative performance scale which was used to assess the contribution of a strategy toward meeting the identified, weighted goals (the decision criteria). For each decision criteria, several “levels” of performance are defined to comprise the performance scale and a range of numeric performance measure benefit scores is assigned to each level within the performance scale. For each decision criteria, the associated performance measure benefit scale range is always a 10-point scale which allows for a common measurement that provides a basis for comparing and making trade-offs among competing objectives.

### 5.3.1 Scoring the Strategies

Workshop No. 2 was conducted as a facilitated scoring session for the identified top 32 strategies. Before starting the scoring, the Team Members verified that there were no modifications needed to either the decision criteria or the performance scales to be applied during the screening exercise. The Prioritization Team progressed through the scoring by utilizing a personal handheld Audience Response System (ARS) device. Using their ARS, each team member entered their score, from 1 through 10 – using the qualitative performance scales provided above – for each of the 4 decision criteria established in Workshop No. 2, for each of the strategies. In addition, each team member completed a scoring sheet on which they recorded their entered score and also wrote any comments.

During the scoring session, Team Members suggested the addition of the two following strategies; the Team agreed to include the two strategies, bringing the total number of strategies scored to 34:

- CIP for Energy Efficiency City-wide
- Hydroelectric Facility at Falls Lake

## 5.4 Results of the Strategies Prioritization through the Decision Analysis Framework

The consulting team applied its multi-criteria analysis prioritization model to support the development of the prioritized strategy list. Utilizing the decision criteria, criteria weights, and performance scale scorings by each Team member, the prioritization model produced the total benefit ranking, based on the cumulative criteria score, for the 34 strategies as shown in Exhibit 9. These results are arranged in the order of highest to lowest priority strategies.

The prioritization model calculated a cumulative criteria score for each candidate strategy, determined from the combination of the performance scale scores and the decision criteria weighting. The cumulative criteria scores are presented on a '100' point scale, a score of '100' points represents the most complete benefit that a candidate strategy could provide to meet the CEAP goals that represented by the decision criteria.

### EXHIBIT 9

Prioritized 34 Future Carbon Reduction Strategies

No.	Strategy ID	Strategy Name
1	EE-1-11	City Building Climate Controls
2	FLT-1-29	Consolidate Collection of Recyclables & Outdoor Solid Waste from City Parks
3	EE-1-53	City Building Envelope Improvements
4	EE-1-72	Raleigh Convention Center Preventative Maintenance Plan Implementation
5	EE-1-35	City Building Interior Light Controls
6	EE-1-63	Pre-Heat Water for City Pools by Solar Thermal
7	CR-1-02	Increase Recycle Container Size
8	FLT-1-10	Increase City Fleet Alternative Fuel Vehicles
9	EE-1-36	Utilize LED Lighting in City Parking Decks
10	CR-1-32	Continue Water Efficiency
11	CR-1-28	Water Distribution System Real Time Energy Mgmt. Optimization (RTEM00)
12	EE-1-33	Utilize LED Lighting for City Street Lighting
13	EE-1-32	Replace Lighting at Public Utilities Dept. Facilities
14	CR-1-13	Utilize Alternative Chemicals in Wastewater Treatment Process
15	EE-1-21	LEED Policy Emphasis on Energy Efficiency
16	EE-1-52	Energy-Efficient Vending Machines
17	CR-1-08	Tree Planting Programs
18	EE-1-12	Elevator/Fan Light Controls and Lighting Conversion to LED

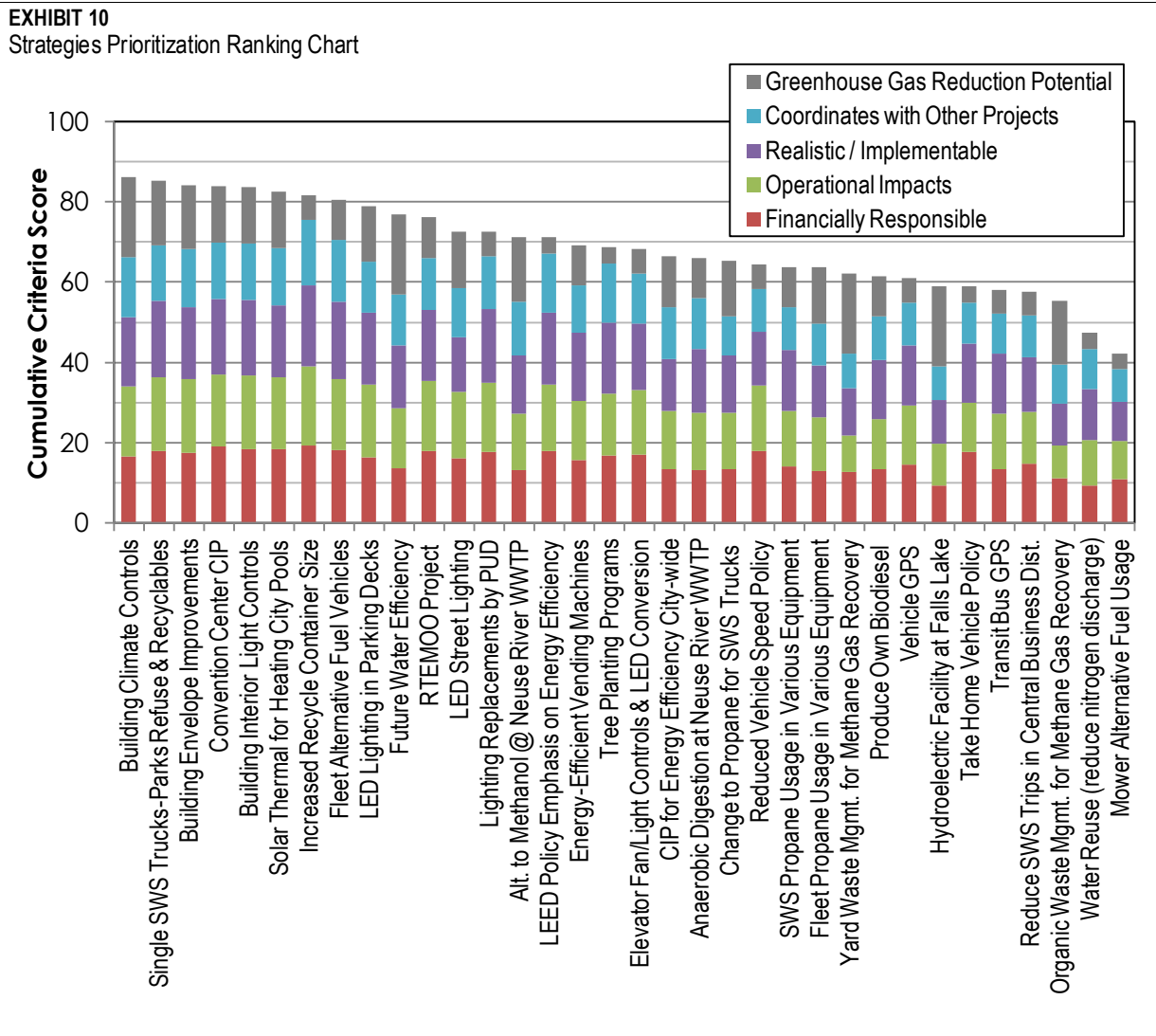
**EXHIBIT 9**

Prioritized 34 Future Carbon Reduction Strategies

<b>No.</b>	<b>Strategy ID</b>	<b>Strategy Name</b>
19	Added during project scoring	CIP for Energy Efficiency City-wide
20	CR-1-17	Anaerobic Biosolids Digestion at Neuse River WWTP
21	FLT-1-27	Change Fuel for Solid Waste Services Trucks
22	FLT-1-25	Reduced Vehicle Speed Policy
23	FLT-1-28	Solid Waste Services Propane Usage
24	FLT-1-13	Fleet Propane Usage
25	CR-1-04	Yard Waste Management
26	CR-1-14	Produce Own Biodiesel
27	FLT-1-02	Vehicle GPS
28	Added during project scoring	Hydroelectric Facility at Falls Lake
29	FLT-0-18	Transit Bus GPS
30	CR-0-12	Reduction in Solid Waste Services Collection Trips
31	CR-1-31	Organic Waste Management
32	CR-1-07	Water Reuse
33	FLT-1-06	Mower Alternative Fuel Usage
34	CR-1-16	Grow Biodiesel Fuel Stocks



Exhibit 10 shows the ranking of the 34 strategies by cumulative criteria score. The cumulative criteria score (y-axis) represents the total benefit or contribution of each strategy to meeting the weighted decision criteria. Different colors within each stacked bar reflect the contribution of each of the decision criteria to each strategy's cumulative criteria score.



It is critical to note that additional judgment must be applied in determining the strategies to implement, through further review that considers factors that might not be considered in the prioritization modeling. Also, given the precision in the scoring and weighting processes, it is often helpful to think of the results as dividing the potential strategies into priority "tiers", since it is often useful to think of the relative merit of very closely scored projects as essentially equivalent.

## SECTION 6

# Financial Analysis

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The goals of the Finance Team were to:

- Work with the consulting team to develop base financial data for strategies financial evaluation
- Develop financial metrics to be applied to evaluate the financial implications of the strategies developed by the Strategies Teams at a planning level
- Identify potentially viable financing techniques

The Finance Team was engaged in three collaborative workshops and also in extensive work in between the workshops with the consulting team to gather and confirm financial information needed for the assessment of the strategies. The Finance Team Workshops are described in Exhibit 11 below; the Team Members also met with the full Project Team to review the project results.

**EXHIBIT 11**  
Finance Team Workshop Topics and Deliverables

<b>Finance Team Workshop No.</b>	<b>Primary Workshop Topic</b>	<b>Deliverables</b>	<b>Date</b>
1	Existing City Financial Analysis Framework and Processes to be Applied for CEAP Development	Team Charter City Financial Metrics, Financing Techniques, Financial Analysis Platform Typical Data Gaps	July 22, 2011
2	Develop Methodology for Financial Evaluations given Gaps in Financial Information Provided by Strategy Teams	Method and Input for Prioritization Team to use to evaluate strategies for contribution to the Financially Responsible and Realistic/Implementable decision criterion as related to City's financial operations Method of proceeding with financial evaluations; financial metrics	October 4, 2011
3	Review Strategy Prioritization Results with all Project Team Members		All Project Team Members met Together on December 5, 2011
4	Business Case Evaluation Overview and Review of Two Cases for CEAP	Understanding of business case evaluation process; results of business case evaluations developed for two potential future strategies Consistent evaluation analysis framework that can be applied by City for budgeting, CIP and other finance-related decisions	April 30, 2012; also attended by Other Project Team Members

## 6.1 First Finance Team Workshop

The goals of the first Finance Team Workshop were:

- Chartering and project process:
  - Become familiar with one another
  - Review the project goals established during the Project Chartering Workshop
  - Review the project process
  - Review the Project Team Charter
  - Validate Team Members, define roles and responsibilities, charter the Team Members, and sign the Team Charter
  - Agree on critical success factors
  - Agree on expectations of the Team, outcomes and deliverables to be produced
  - Agree on project schedule
- Discuss financial evaluation metrics and analysis methods that would be applied to development of the CEAP
- Discuss potential business models for project financing
- Capture Team's ideas about future projects, activities and strategies that could help further increase operation and energy efficiency, and reduce carbon emissions

Although most of the Finance Team Members had attended the Chartering Workshop and were familiar with the chartering process and the final Project Team Charter, the chartering process was reviewed to ensure all Team Members understood the significance and were willing to sign the individual Team Charter.

### 6.1.1 Facilitated Exercise

Following the Team chartering, the Team Members actively participated in a facilitated exercise designed to encourage the free-flowing exchange of ideas among the Team Members and to capture all thoughts and ideas without any constraints. The goal of the exercise was to capture the:

- Kind of data need to be provided by the other Interdepartmental Teams – especially by the Strategy Teams – for the Finance Team to do its work
- Level of data detail is expected to be provided by the other Teams or developed by this Team in order to make planning level decisions
- Assumptions that are typically seen that can lead to errors in financial analyses
- Past and current perspectives on investment returns and the view for the future

### 6.1.2 Other Information

Discussions at the workshop also highlighted these important findings:

- The City does not use common metrics and Departments evaluate costs differently from each other

- As such, the Financial Strategy Team would need to agree on the financial metrics that would be applied for CEAP development
- The use of Raleigh-specific information would provide the basis for the most verifiable, defensible and repeatable analysis of strategies as well as the most realistic estimates of costs and impacts to City operations

## 6.2 Second Finance Team Workshop

The goals of the second Finance Team Workshop were to:

- Develop a method for the Prioritization Team to use to evaluate strategies for contribution to the Financially Responsible decision criterion
- Provide input for Prioritization Team to use to evaluate strategies for contribution to the Realistic/Implementable decision criterion as related to City's financial operations
- Develop a process that could be used to fill the gaps in the financial information that was provided by the Strategy Teams, in order to conduct the financial evaluations

### 6.2.1 Information for Prioritization Team

One of the five decision criteria for use in scoring potential strategies was "Financially Responsible", defined as the "good use of public funds; considers capital and operating expenses; expressed by some form of a benefit-cost analysis, payback analysis, net present value, and/or initial capital outlay."

The Finance Team developed additional information to refine the definition of the criterion in enough detail to be applied by the Prioritization Team during the strategy scoring process. The Finance Team validated qualitative, planning level financial descriptors to be utilized for prioritization as shown in Exhibit 12:

**EXHIBIT 12**  
Qualitative Planning Level Financial Descriptors for Strategy Prioritization

<b>Estimate of Capital Cost (Initial Cost)</b>	
Low	\$0 to approximately \$200,000
Medium	\$200,000 to approximately \$2 million
High	Greater than \$2 million
<b>Potential Impact on Long-Term O&amp;M Costs Cost of Ownership</b>	
Increase	Increases O&M cost
Decrease	Decreases O&M cost
Neutral	No impact on O&M cost
<b>Potential Payback Period</b>	
Short-term	1 to 5 years
Mid-term	5 to 15 years
Long-term	Greater than 15 years

Similarly, the Finance Team was responsible for providing input to the “Realistic/Implementable” decision criterion as related to the City’s financial operations as:

- Can be incorporated into the way the City does business from a procurement standpoint
- Ability exists to not have to procure the lowest first-cost equipment
- Ability exists to use a 3<sup>rd</sup> party such as a public-private partnership or an energy service company (ESCO)
- The needed technology possesses a comfortable level of market maturity (i.e., it is proven on the market as successful and is widely available and utilized )

## 6.2.2 Financial Metrics

As described above, it was necessary for the Finance Team to develop the overall financial metrics that would be applied to the CEAP development, since the City does not use common metrics and Departments evaluate costs differently. Exhibit 13 shows the financial metrics that were discussed at the second Team Workshop and approved for use in the CEAP by the Finance Team.

**EXHIBIT 13**  
Financial Metrics

Partial Cost of Ownership Components		
Capital Cost (first cost)		
Total O&M		
Total Savings		
Full Cost of Ownership Components		Notes/Selected Values
Return on Investment		City does not use a standard value
Payback Period		City does not use a standard value; Team elected to use simple payback
Life Cycle Costs (Net Present Worth)	Nominal Discount rate	4.5% (US OMB)
	Escalation	1.8% (US OMB)
	Salvage Values	Include
	Evaluation Period	30 years
	Renewal Schedule	5-years at 2/3's of capital cost
	Replacement Schedule	Infrastructure specific
	Cost of Capital	Reserve fund Issuance cost 2-4%
	Revenue Generation	
Benefit/Cost		Energy cost savings and O&M cost savings

## 6.3 Financial Evaluation Process Revised

Following the second Strategy Teams Workshops, the Project Team and the consulting team recognized that “filling the gaps” in the financial information necessary to evaluate the full costs of ownership for the top potential strategies was not realistic within the timeframe to complete the project. The number and variety of information gaps were so large that, while the consulting team was able to provide industry standard values where needed, it was agreed that an analysis based almost entirely on industry standards would weaken one of the key CEAP objectives – a Plan developed by the Team Members.

At this point in the project, an alternative method to evaluate project financials was needed. The discussions that followed captured several important things:

- One CEAP objective was to provide a process for the City to begin to think holistically carbon emission reductions, energy and related financials; this objective was being met through exposure of the Project Team Members to these concepts throughout their work to develop the CEAP
- Reaffirmed that the use of information that was primarily Raleigh-specific would provide the basis for the most verifiable, defensible and repeatable analysis of strategies as well as the most realistic estimates of costs and impacts to City operations
- Additional attempts to obtain information from the Project Teams were not warranted and a revised method to complete the financial portion of the CEAP was needed
- There is a great need for the City to develop and implement a standardized way to gather the types of information needed for future financial analyses. This is addressed in Volume 4 of the CEAP Technical Documentation – *“Data Collection Framework for City of Raleigh Operations”*.

After several strategy sessions, the following process was agreed upon by the City and the consulting team:

- Evaluate key characteristics of total cost of ownership
- Conduct business case evaluations (BCE) on two strategies to demonstrate an evaluation methodology that could be applied by the City when detailed cost information becomes available

The key characteristics of total cost of ownership were evaluated for the top strategies resulting from the Prioritization Team’s work and are shown above in Exhibit 12.

## 6.4 Business Case Evaluations

As described above, the Team supported the application of the BCE concept to the CEAP financial evaluation process as an alternative approach. The BCE approach provides a transparent framework for making financially justifiable decisions that can be correlated to both energy and carbon reduction, and also provides tools to evaluate the tradeoffs between capital replacement projects versus longer life-cycle replacement projects.

Two of the highest scoring strategies were selected as examples to demonstrate the BCE process. The process follows a standard format that can be applied by the City staff to

evaluate any of the CEAP actions. The process can also be applied for capital improvement projects (CIP) prioritization. The potential strategies evaluated were:

- Utilize the Solid Waste Services Department trucks and personnel to collect recyclables in addition to outdoor solid waste from the City's parks
- Strategy for Conversion to LED Lighting in City Parking Decks

The complete Business Case Evaluations are included in Appendix 2 of the CEAP.

## **6.5 Raleigh Public Utilities Department Real Time Energy Management & Operations Optimization (RTEM00) Project**

Under a separate contract between the consulting team and the City of Raleigh PUD, a feasibility study was conducted to investigate the suitability for the City to use a water distribution and optimization software solution that could potentially reduce operating costs by:

- Shifting electrical load to maximize use of the lowest cost kWh tariff periods
- Preparing proactively for load shedding to minimize peak kW demand charges
- Selecting efficient operations of pumps and pump combinations to yield optimal energy improvements
- Selecting the lowest cost source of water
- Selecting the lowest cost transport path for water distribution based on system demands

The feasibility study focused on understanding the complexities, operational requirements and inherent constraints within the distribution systems operations and determining the likely benefits that energy management and operations optimization could deliver.

Findings included:

- The electric tariff rates in use by the City provide an incentive to shift load from expensive (e.g., peak) to cheaper (e.g., off-peak) priced electricity periods
- The software demonstrated that by effective dynamic operation of the water storage capacity within the distribution system, cost reduction opportunities were available
- The software demonstrated that by selecting the most appropriate pump combinations to run at any time, possible energy efficiency improvements in the range of 6 to 8 percent might be achieved without asset changes
- A nominal 6 percent reduction in energy use would realize a reduction of 2,550 MWh or 1,290 tonnes of CO<sub>2</sub> per year
- The 2010 annual electricity cost for the studied sites was \$3.1 million; a cost reduction in the range of 10 percent per year might be realized through load shifting

## **6.6 Comprehensive Fleet Transformation Strategy**

One of the top CEAP strategies is Strategy FLT-1-10: Increase City Fleet Alternative Fuel Vehicles. Under this strategy, the City's fleet would continue to be replaced with alternative fuels and/or hybrid vehicles when it is deemed that the optimal life cycle of the existing

vehicle has been reached. To begin to implement this strategy, a first step must be taken to gather additional information needed up front.

Working to lower emissions and operating costs, a comprehensive fleet management program will examine the full lifecycle of vehicles to determine when it is best to retire, repair, or replace vehicles in favor of cleaner, more efficient options. This strategy will provide a decision support system to measure the existing performance and operating cost of individual vehicles to determine at which point in time, either now or in the future, it would be best to replace the vehicle, maintaining the optimal lifecycle of the existing asset while minimizing overall emissions. The strategy involves understanding many things including the average life, emission factors, cost of a vehicle over its lifecycle, and time replacement relative to the maintenance and repair cost versus that of new technology. Using both statistical modeling and decision analysis, individual vehicles in a fleet can be evaluated as part of the entire fleet, in order to minimize the actuarial present value of all future costs associated with the fleet, and thus the long-term consumption of scarce resources.

Details are provided in Volume 3 of the CEAP Technical Documentation – *“Comprehensive Fleet Transformation Strategy – Initial Step”*.



## **APPENDIX 1:**

### **Project Team Members**

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## City of Raleigh Operations Climate/Energy Action Plan Project Teams

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### Fleet Team

City Team Members	Title/Dept	CH2M HILL Team Members
<b>Travis Brown</b>	Fleet Superintendent/PW	Kathryn Benson
<b>Mike Kennon</b>	Transportation Operations Manager/PW	Jamiyo Mack
Michele Mallette	Staff Analyst/PUD	Francine Durso
Kermit Chapman	Utility Support Superintendent/PUD	
Wayne Schindler	Parks and Recreation	
Dana Knuckles	Police	
Vaughn Lowman	Police	
Darryl Collins	Solid Waste Services	
Bobby Broadway	Solid Waste Services Analyst	
Lynn Graham	Sustainability Programs Manager/Office of Sustainability	
Paula Thomas	Manager/Office of Sustainability	
Cindy Holmes	Project Manager/Office of Sustainability	
Steve Burr	Energy Fellow/Office of Sustainability	

### Buildings Team

City Team Members	Title/Dept	CH2M HILL Team Members
<b>Billy Jackson</b>	Buildings Superintendent	Jennifer Bell
<b>Suzanne Walker</b>	Energy Manager	Ken Hayse
Michele Mallette	Staff Analyst/PUD	Francine Durso
Kermit Chapman	Utility Support Superintendent/PUD	
Richard Kelly	Construction Manager/PW	
Mickey Barbour	Convention Center	
Mike Kennon	Transportation Operations Manager/PW	
Paula Thomas		
Cindy Holmes		
Steve Burr		

### Carbon Team

City Team Members	Title/Dept	CH2M HILL Team Members
<b>TJ Lynch</b>	Assistant Director/PUD	Kathryn Benson
<b>Fred Battle</b>	Solid Waste Director	Jamiyo Mack
Michele Mallette	Staff Analyst/PUD	Francine Durso
Bobby Broadway	Solid Waste Services Analyst	
Linda Leighton	Solid Waste Educator	
Sally Thigpen	Urban Forester/Parks and Recreation	
Paula Thomas	Manager/Office of Sustainability	
Cindy Holmes	Project Manager/Office of Sustainability	
Steve Burr	Energy Fellow/Office of Sustainability	

## Renewables Team

City Team Members	Title/Dept	CH2M HILL Team Members
<b>Julian Prosser</b>	Assistant City Manager	Jennifer Bell
<b>Robert Hinson</b>	Renewable Energy Coordinator/ Office of Sustainability	JD Solomon
Kenny Waldroup	Assistant Director/PUD	Francine Durso
Billy Jackson	Buildings Superintendent	
Suzanne Walker	Energy Manager	
Richard Kelly	Construction Manager/PW	
Mickey Barbour	Convention Center	
Stewart Grantham	Intern/Office of Sustainability	
Paula Thomas	Manager/Office of Sustainability	
Cindy Holmes	Project Manager/Office of Sustainability	
Steve Burr	Energy Fellow/Office of Sustainability	

## Finance Team

City Team Members	Title/Dept	CH2M HILL Team Members
<b>Louis Buonpane</b>	City Manager's Office	Adam Sharpe
<b>Stephen Bentley</b>	Capital Budget Manager	JD Solomon
Tyrone Williamson	Finance	Francine Durso
Allyson Wharton	Finance	
Fred Blackwood	Finance	
Jonathan Minter	IT Director	
Paula Thomas	Manager/Office of Sustainability	
Cindy Holmes	Project Manager/Office of Sustainability	
Steve Burr	Energy Fellow/Office of Sustainability	

## Legal Team

City Team Members	Title/Dept	CH2M HILL Team Members
<b>Dan McLawhorn</b>	City Attorney's Office	JD Solomon
<b>Kenny Waldroup</b>	Assistant Public Utilities Director	Jennifer Bell
Paula Thomas	Manager/Office of Sustainability	
Cindy Holmes	Project Manager/Office of Sustainability	
Steve Burr	Energy Fellow/Office of Sustainability	

### Notes:

**Bold indicates Team Leader**

**APPENDIX 2:**  
**Team Charter & Chartering Workshop Summary**



## City of Raleigh Operations Climate/Energy Action Plan Project Team Charter

## Mission

The Climate/Energy Action Plan Project Team will provide the leadership, resources and management to guide internal City Operations in the financially responsible, legal and practical implementation of strategies so as to minimize carbon-related emissions, maximize the energy and operational efficiency of existing and new City-owned fleet, facilities, and equipment with consideration for life-cycle costs, and provide renewable energy opportunities.

### Critical Success Factors

Interdepartmental City Staff participate fully in the process and reach agreement

Set realistic carbon emission reduction and energy efficiency targets and time-frames

Provide cost effective solutions that consider life-cycle costs and departmental budgets

Cross-departmental responsibilities will be defined and accepted by responsible parties

### City Council adoption of GHG emission reduction targets

### Expected Benefits

Improved internal stakeholder confidence and satisfaction

Interdepartmental cooperation toward common goals

Cost effective strategies that include life-cycle costs to meet reduction targets

Action Plan that provides measurable actions linked to targets

Sufficient evidence to demonstrate  
reduction targets to management and  
City Council

## Executive Sponsors

Russell Allen, City Manager  
Julian Prosser, Assistant City Manager  
Paula Thomas, Office of Sustainability, Sustainability Manager

## Deliverables and Schedule

Charter Team	June 29, 2011
Team Workshops No. 1	Weeks July 18 and 25, 2011
Team Workshops No. 2	Weeks Sept. 5 and 12, 2011
Team Workshops No. 3	Late October, 2011
City Council Adopts GHG Emission Reduction Targets	November, 2011
Draft Strategies and Action Plan	December 1, 2011
Final Strategies and Action Plan	December 30, 2011

## Members

*We the following have read, understand, and fully endorse the City of Raleigh Operations Climate/Energy Action Plan Project Team Charter dated July 6, 2011. I know my role and agree to personally contribute and add value to improve the quality of the effort.*

Name	Signature
Cindy Halmes	Cindy Holmes
Dana Knuckles	Dana Knuckles
T.J. Lynch	T.J. Lynch
Kermit Chapman	Kermit Chapman
MIKE KENNON	Mike Kennon
Michael Barbour	Michael Barbour
Robert Hinson	Robert Hinson
STEWART GRANTHAM	Stewart Grantam
STEVE BURR	Steve Burr
Michele Mallette	Michele Mallette
Suzanne Walker	Suzanne Walker
William R. Jett	William R. Jett
Travis W. Brown	Travis W. Brown
Bobby Broadway	Bobby Broadway
JULIAN B. PROSSER, JR.	Julian B. Prosser, Jr.
Paula S. Thomas	Paula S. Thomas
Allyson Wharton	Allyson Wharton
Fred Blewwood	Fred Blewwood
Thyrone Williams	Thyrone Williams
Louis M. Buonpane	Louis M. Buonpane
Leroy W. Drapp	Leroy W. Drapp
Federick H. Battle	Federick H. Battle
WYUVE H. SCHINDLER	Wyuve H. Schindler
DARRYL COLLINS	Darryl Collins
Richard Kew	Richard Kew
W. Leighton	W. Leighton
Sally Thigpen	Sally Thigpen

# City of Raleigh Operations Climate/Energy Action Plan

## Project Chartering Meeting – Summary

**ATTENDEES:**

<b>City of Raleigh:</b>	<b>Suzanne Walker</b>	<b>CH2M HILL:</b>
<b>TJ Lynch</b>	<b>Richard Kelly</b>	<b>JD Solomon</b>
<b>Fred Battle</b>	<b>Mickey Barbour</b>	<b>Francine Durso</b>
<b>Michele Mallette</b>	<b>Julian Prosser</b>	<b>Jamiyo Mack</b>
<b>Travis Brown</b>	<b>Robert Hinson</b>	<b>Wendy Nero</b>
<b>Mike Kennon</b>	<b>Stephen Bentley</b>	<b>Kathryn Benson</b>
<b>Kermit Chapman</b>	<b>Dan McLawhorn</b>	<b>Jennifer Bell</b>
<b>Vaughn Lowman</b>	<b>Paula Thomas</b>	<b>Adam Sharpe</b>
<b>Darryl Collins</b>	<b>Cindy Holmes</b>	
<b>Bobby Broadaway</b>	<b>Steve Burr</b>	
<b>Lynn Graham</b>		

**CHARTERING  
MEETING DATE and  
LOCATION:**

June 29, 2011 from 9 AM until 1 PM at City of Raleigh New Transit Facility

The Project Chartering Meeting for the City of Raleigh Operations Climate/Energy Action Plan was held on June 29, 2011. The goal of the Chartering Meeting was to build a shared awareness and clear understanding of what the City Team Members will accomplish during the project and what roles they will be expected to play as well as to provide the context for measuring whether the project will be deemed successful and potential blockers to success.

### 1. Agenda for the Chartering Session

- Safety Moment
- Introductions
- Project Goals, Scope and Work Organization
- Chartering Overview
- Exercise – Critical Success Factors; One Big Thing
- Exercise – Values; Enablers and Disablers (in small team session)
- Individual Team Sessions
- Communicating the Project
- Chartering
- Wrap Up



## 2. Project Background

This project is the next step toward accomplishing the three Climate/Energy protection policies adopted by City Council in 2007-200; the policies are:

- Establish a goal of reducing fossil fuel consumption by the City of Raleigh vehicle fleet by 20%
- Energy efficiency in buildings goal of LEED Silver certification for all new government building construction greater than 10,000 square feet
- Endorsing the U.S. Mayors Climate Protection Agreement for Greenhouse Gas emissions reduction

## 3. Project Goals

The goal of this project is to guide the City of Raleigh Operations toward sustainable practices that support and further those policies through:

- Collaborative workshops to develop Climate/Energy Action Plan for the City of Raleigh Operations
- An action plan endorsed and implemented by City staff based on Interdepartmental Team's direct participation in development
- Establishing realistic and achievable greenhouse gas emissions reduction targets based on carbon reduction best practices and strategies
  - *Group clarified that setting of target(s) to be by consensus of entire group*
- Raleigh City Council adoption of greenhouse gas emissions reduction targets by November 2011

## 4. City Teams, Member Roles and Expectations

Six Teams were previously established:

- Fleet
- Buildings
- Carbon
- Renewables
- Finance
- Legal

The following roles, expectations and active engagement of City Team Members were discussed:

### Team Leader

- **Serves as a Project Manager in delivery of the Team Charter**
- **Responsible for Team outcomes/deliverables; quality and timeliness**
- Assures effective meeting management; ensures team adheres to values and meeting conduct; reports regularly to Executive Sponsor; facilitates conflict resolution; exhibit model behavior (be the leader the team wants to follow)

**Team Facilitator**

- Arranges meetings; Assures invitees, facility, materials, and equipment are accounted for; prepares and distributes meeting agendas; distributes supporting material at a minimum of 1-week in advance of meeting

**Team Scribe**

- Maintains record of key decisions and recommendations; prepares and distributes accurate and concise meeting minutes/ notes, in coordination with Team Leader and Facilitator

**Team Member**

- **Serves as decision-maker and/or decision facilitator for your department**
- **Participates actively in and attends all team meetings**
- Develops or collects required data and documents outside of meetings; communicates data or document review concerns to the team; communicates team activities within the wider organization

It was noted that there are different levels of decisions: decisions the team can make; decisions that need only limited involvement of departments; and those decisions that must be decided at the department level. It will also be important to understand what the triggers are within the department for decision levels, such as a capital threshold, staffing needs, etc; and to determine the engagement process for those larger decisions.

**5. Critical Success Factors**

Team Members were asked to write down up to three things that this project must be or possess in order to be a success.

<b>Item</b>	<b>Number of Times Listed</b>
A. Commitment to the team, the process, to 'own' the work, and to implement the strategies	8
B. Open team communication	8
C. Realistic strategies and timeframes	8
D. Finance/budget impacts (understand costs )	7
E. Buy-in from above, below, and staff-wide	6
F. Verifiable and defensible process	6
G. Reasonable staff time	5
H. Measurable outcomes	4
I. Sustainable strategies	4



## 6. “One Thing”

Team Members were then asked to write down the one thing that this project must be or possess in order to be a success.

Item	Number of Times Listed
A. City-wide buy-in	6
B. Realistic	4
C. Affordable	2
D. Visionary	2
E. Prioritization for city leaders	1
F. Communications	1
G. Active engagement	1
H. Support of team members	1
I. Synergy	1
J. Understanding interdependencies	1

## 7. Values

Attendees were separated into two groups: one group comprised of the Carbon Reduction and Fleet Transformation Team Members and one group comprised of the Energy Efficient Buildings, Renewable Energy, Finance, and Legal/Regulatory Team Members. Teams developed lists of values that are meaningful to them as follows:

Values	
A. Timeliness of data and meetings	L. Creativity
B. Active participation	M. Group consensus
C. Open and honest	N. Buy-in – listen and be heard
D. Respect for others	O. Compromise
E. Understanding we are blazing a trail; no bad questions or ideas	P. Broader endorsement
F. Turn off phones	Q. Personal responsibility and accountability/personal willingness to participate and take the initiative/compromise
G. Efficiency	R. Open to and acceptance of new ideas
H. Be prepared in advance	S. Positive, out-of-the-box thinking
I. Champions that communicate and educate	T. Understanding (think of lessons learned from Comprehensive Plan)
J. Buy-in for the financial impacts (Council and Department Heads)	U. Candor
K. Build business case	

## 8. Enablers and Disablers

Within the separate groups, Teams developed lists of the things that are available that will enable them to accomplish the project goals (Enablers), and things that are potential blockers to achieving the project goals (Disablers). Each group reported out to the full group as follows:

Enablers	Disablers
A. Council, City Managers and Department Heads	A. Shift in culture
B. Environmental Advisory Board; Water Utility Transformation Alternatives Task Force; Citizen Advisory Councils	B. A large City Project – potential issues with confidence and trust
C. Support of community groups	C. Impacts to staff
D. Media	D. Cost
E. Crossing Departmental lines	E. Crossing Departmental lines
F. Immediate and measurable direct benefits	F. Lack of funding
G. Experience	G. Infrastructure (lack of E85, propane)
H. Linking benefits/ translating goals to action and language	H. Media
	I. Different systems throughout City
	J. Different Departments
	K. Resources
	L. Diverse drivers and skill sets
	M. Benefits more in the distance (time-wise) – economic/ environmental
	N. First time experience

## 9. Team Charter

The following was discussed at the Chartering Meeting and approved by the Team Leaders during a meeting on July 6, 2011. At the Chartering Meeting, all attendees expressed their willingness to sign the Charter.

### City of Raleigh Operations Climate/Energy Action Plan Team Charter

#### **Mission**

The Climate/Energy Action Plan Project Team will provide the leadership, resources and management to guide internal City Operations in the financially responsible, legal and practical implementation of strategies so as to minimize carbon-related emissions, maximize the energy and operational efficiency of existing and new City-owned fleet, facilities, and equipment with consideration for life-cycle costs, and provide renewable energy opportunities.

#### **Executive Sponsors**

Russell Allen, City Manager  
Julian Prosser, Assistant City Manager  
Paula Thomas, Office of Sustainability, Sustainability Manager

#### **Deliverables and Schedule**

- |  |                            |
|--|----------------------------|
| • Charter Team                                       | June 29, 2011              |
| • Team Workshops No. 1                               | Weeks July 18 and 25, 2011 |
| • Team Workshops No. 2                               | Weeks Sept. 5 and 12, 2011 |
| • Team Workshops No. 3                               | Late October, 2011         |
| • City Council Adopts GHG Emission Reduction Targets | November, 2011             |
| • Draft Strategies and Action Plan                   | December 1, 2011           |
| • Final Strategies and Action Plan                   | December 30, 2011          |

#### **Critical Success Factors**

- Interdepartmental City Staff participate fully in the process and reach agreement
- Set realistic carbon emission reduction and energy efficiency targets and timeframes
- Provide cost effective solutions that consider life-cycle costs and departmental budgets
- Cross-departmental responsibilities will be defined and accepted by responsible parties
- City Council adoption of GHG emission reduction targets

#### **Expected Benefits**

- Improved internal stakeholder confidence and satisfaction
- Interdepartmental cooperation toward common goals
- Cost effective strategies that include life-cycle costs to meet reduction targets
- Action Plan that provides measurable actions linked to targets
- Sufficient evidence to demonstrate reduction targets to management and City Council

**Chartering Meeting Date:** June 29, 2011

#### **Member's Statement (each member will sign charter):**

We the following have read, understand, and fully endorse the City of Raleigh Operations Climate/Energy Action Plan Project Team Charter dated July 6, 2011. I know my role and agree to personally contribute and add value to improve the quality of the effort.

## 10. Project Ambassadors

Team Members are Ambassadors for the Project. Three key “take-ways” or talking points from today are:

- We are in agreement on where we are going and we are focused on internal operations
- We have identified some concerns and potential trouble spots
- I have a good understanding of what is expected of me as a Team Member and as an ambassador to my Department

## 11. Parking Lot

Throughout the day, items were placed in a Parking Lot to be considered as the project progresses as follows:

- A. How will reduction targets be expressed
  - i. By “X” date will have achieved “X” reduction (set one date with one target); or
  - ii. By “X” year (e.g. 2 years, 4 years, etc) will achieve “X” percent reduction; so incrementally within “X” years (e.g. 10 or 20 years) will have achieved “X” percent reduction
- B. Legal Team – to determine if the legal structure supports a strategy
- C. Are we including water efficiencies/water usage/behavioral changes as part of strategies?
- D. New construction versus construction process
  - i. Project covers City-owned assets that City has control over such as operations of facilities and associated emissions
  - ii. Project does not cover emissions by contractors during construction or from the materials they use
- E. Financial – include total cost of both owning and operating
- F. Is there simple contract language change that could provide GHG savings to City
- G. Communications – is a Communications Team needed
- H. What is the role of the EAB
- I. Consider piloting energy and water efficiency upgrades at City Housing Authority homes
- J. Should members be added to large team from City Community Services, City Housing Authority, City Planning (for Code Enforcement, ADA)
- K. Not part of this project but a future step will be community-wide GHG reductions including residential, commercial, industrial, etc.

## 12. Summary

At the conclusion of the Chartering Meeting, the consensus of attendees was that they were willing to sign the Team Charter, that the meeting had helped set the framework for developing the Action Plan, that most of the goals, success factors, and enablers/disablers expressed early in the meeting were touched on at some level during the course of the meeting, that the goals of the Chartering Meeting had generally been met, and that they were ready to begin work within the individual Work Teams.

## 13. Plus-Delta

At the end of the day, each Team Member was asked to state one thing that they liked about the session (a plus), and one thing that would help CH2M HILL to improve the process used at the meeting (a delta):

Plus (number times stated)	Delta
A. Kept schedule/good pace/maintained focus (5)	A. Cold room
B. Energy of group	B. Need separate room for the small team break-out session
C. Openness of group	C. See no need for the small team break-outs
D. Mix of expertise/interaction and perspectives (2)	D. More time
E. Rules / control of group/overall meeting conduct (3)	E. Paula talked too much (this was Paula's own comment)
F. Charter itself with timeframe and expectations	
G. Food	
H. Index card exercise	
I. Good attendance and participation	

## **APPENDIX 3:**

### **Project Process Overview**

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# Project Process Overview

## Workshop No. 1

Charter Team; Identify  
Strategies &  
Data Needs

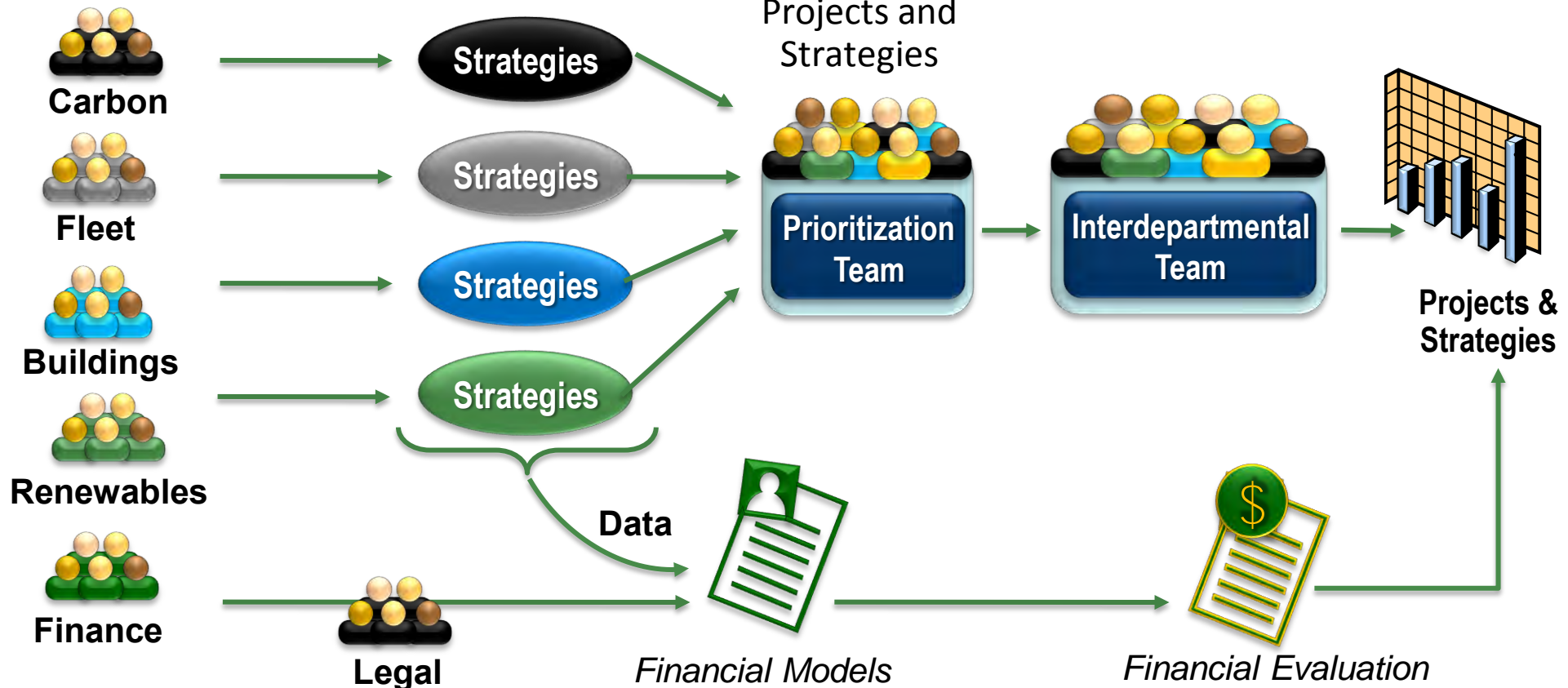
## Workshop No. 2

Finalize Strategies  
and Data

## Workshop No. 3

Review Ranking of  
Projects and Strategies

### WORK TEAMS



**APPENDIX 4:**  
**Strategies – Existing, Future, & Best Practices**

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## CITY OF RALEIGH OPERATIONS - TOP FUTURE CEAP STRATEGIES

### Top Future Strategies - Buildings Team

EE-1-11	Building Climate Controls (Technology Interface)	Load-shedding/demand-response algorithms using building automation infrastructure and Periscope (energy management software). Smart Buildings; building-wide thermostats with motion sensors and smart schedulers
EE-1-12	Elevator Fan/Light Controls & LED Conversion	Elevator controllers to reduce energy usage when not in use; convert lighting to LED
EE-1-21	LEED Policy Emphasis on Energy Efficiency	Policy for LEED to concentrate points for energy efficiency
EE-1-32	Replace Lighting in PUD Facilities	Lighting replacement in PUD operating facilities (Induction lighting, CFL, motion-detection)
EE-1-33	Utilize LED Lighting for City Street Lighting	Replace all street lights with LEDs
EE-1-35	Building Interior Light Controls	Control based on ambient light level and motion detection
EE-1-36	Utilize LED Lighting in Parking Decks	Install LED lights in all City parking decks
EE-1-52	Energy-Efficient Vending Machines	Procure energy-efficient vending machines; Update contract terms for vending machines to require Energy Star rating
EE-1-53	Building Envelope Improvements	Building weather-proofing, glazing improvements, etc.
EE-1-63	Pre-heat Water for City Pools by Solar Thermal	Preheat pool water at aquatic centers by solar
EE-1-72	Raleigh Convention Center Preventative Maintenance Plan Implementation	Implement CIP preventative maintenance plan for Convention Center
Added During Project Scoring	CIP for Energy Efficiency City-wide	Develop CIP preventative maintenance plans City-wide

CITY OF RALEIGH OPERATIONS - TOP FUTURE CEAP STRATEGIES		
Top Future Strategies - Fleet Team		
FLT-1-02	Vehicle GPS	Measure and report idle-time, miles driven, speed, etc; with policy to stay below established parameters
FLT-1-06	Mower Alternative Fuel Usage	Use of natural gas/propane in large capacity mowers
FLT-1-10	Increase Fleet Alternative Fuel Vehicles	Continue to replace fleet with alternative fuel and hybrid vehicles
FLT-1-13	Fleet Propane Usage	Use of propane in various equipment within Fleet
FLT-0-18	Transit Bus GPS	Measure and report idle-time, miles driven, speed, etc; with policy to stay below established parameters (buses are already equipped with GPS)
FLT-1-25	Reduced Vehicle Speed Policy	Set max speed allowed in City-owned vehicles to reduce fuel usage and increase safety
FLT-1-27	Change Fuel for SWS Trucks	Replace full diesel with propane hydraulic hybrid trucks
FLT-1-28	SWS Propane Usage	Use of propane in various equipment within SWS
FLT-1-29	Consolidate Collection of Recyclables & Outdoor Solid Waste from City Parks	Pick up recyclables and waste from Parks in same trip
Top Future Strategies - Carbon Team		
CR-1-02	Increase Recycle Container Size	Reduce number of trucks and trips; increase recyclables
CR-1-04	Yard Waste Management	Recover methane gas from yard waste composting
CR-1-07	Water Reuse	Reduce effluent nitrogen discharged = reduce GHG production in receiving stream

## CITY OF RALEIGH OPERATIONS - TOP FUTURE CEAP STRATEGIES

### Top Future Strategies - Carbon Team

CR-1-08	Tree Planting Programs	Carbon sequestration through several tree planting programs (NeighborWoods, Sustainable Trees); plant up to 3,600 trees per year
CR-0-12	Reduction in SWS Collection Trips	Reduce number of trips to collect residential and commercial refuse/recycling; less frequent collection schedule
CR-1-13	Utilize Alternative Chemicals in Wastewater Treatment Process	Use alternative, green carbon source such as glycerin or MicroC or MicroCg for the denitrification process instead of methanol
CR-1-14	Produce Own Biodiesel	Use biodiesel produced from crops grown at Neuse River WWTP
CR-1-16	Grow Biodiesel Feed Stocks	Grow biodiesel feed stocks on Parks & Recreation properties
CR-1-17	Anaerobic Digestion at Neuse River WWTP	Anaerobic digestion of biosolids at Neuse River WWTP
CR-1-28	RTEMOO Project	Water distribution system pumping optimization project for Public Utilities Dept.
CR-1-31	Organic Waste Management	Collect organic waste separately, compost and recover methane gas
CR-1-32	Continue Water Efficiency	Continued water efficiency programs and efforts
Added During Project Scoring	Hydroelectric Facility at Falls Lake	Generate hydroelectric power at Falls Lake Dam

## CITY OF RALEIGH OPERATIONS - BEST MANAGEMENT PRACTICES AND POLICIES FOR CLIMATE/ENERGY ACTION PLAN

Best Management Practices and Policies - Buildings Team		
EE-BP-01	Energy Management	Utilize the high-level strategies presented in the Sustainable Energy Plan developed by Facilities as a basis for implementation strategies that can be used by other departments
EE-BP-02	Cross-Departmental Design Reviews	Ensure that the Facilities group along with other city departments (i.e. Planning, Engineering, etc.) are reviewing and modifying aspects of new construction design prior to construction to ensure that best management practices are considered and included from the start of a project
EE-BP-03	Control Automation	Ensure that when automated controls of any type (i.e. lighting, climate controls) are installed in buildings, that Facilities can track usage and provide this data to the various departments to encourage better energy management
EE-BP-04	Lighting Standards	Develop City-wide standards for indoor and outdoor lighting
EE-BP-05	Lighting Evaluations	Evaluate lighting at all WTPs and WWTPs (motion sensors controls, LEDs, CFDs) at control rooms, auxiliary buildings, and for external lighting
		Continue evaluating where fluorescent lights can be replaced with CFDs or LEDs
EE-BP-06	Preventative Maintenance	Use existing preventative maintenance (PM) plans to assist other departments (i.e. Fire, PUD) with development of their own PM Plans
EE-BP-07	Facilities Audits	Conduct audits on City buildings using internal City staff
EE-BP-08	Real-Time Energy Data	Ensure that Facilities/Buildings is able to use real-time energy data (from EDI) to determine total peak and off-peak usage
EE-BP-09	High Efficiency Equipment	Require that replacement equipment has a high efficiency rating

## CITY OF RALEIGH OPERATIONS - BEST MANAGEMENT PRACTICES AND POLICIES FOR CLIMATE/ENERGY ACTION PLAN

Best Management Practices and Policies - Buildings Team		
EE-BP-10	Building Roofing	Develop standards/policy for evaluating roofs for new buildings and for roof replacements to ensure that green roofs and possible solar applications are considered
Best Management Practices and Policies - Fleet Team		
FLT-BP-01	Right-Size the Fleet	Select the right vehicle for the right job, i.e. the vehicle that best fit its mission
		Every 6 months, send departments a report on vehicle usage; departments can use this information to consider switching to more efficient vehicles
		Evaluate who is using what type of vehicles; i.e. have crews use Escape Hybrids because they travel many miles instead of supervisors who may travel few miles
		Determine whether to replace a vehicle with the same type or to find a more fuel efficient/green vehicle that is the best fit for the use. This will allow for better budgeting and allow City to take advantage of technology changes
		When considering the replacement of large capacity vehicles, take into account the towing, loading, and hauling capacity required, i.e. if a smaller vehicle is chosen it will negatively affect the ability to use the vehicle to respond to natural disasters
		Establish a two-meeting process (inter-departmental and with Fleet) for replacement of vehicles and equipment to ensure best type is purchased
FLT-BP-02	Sustainability Fund	Establish a "Sustainability Fund" in Fiscal Budget; Fund would allow Departments to augment their budgets to purchase "green" alternatives (i.e. plug-in stations, hybrid vehicles, etc.) over the "business as usual" replacement vehicle
FLT-BP-03	Sell Used Vehicle Oil	Sell used vehicle oil and generate revenue

## CITY OF RALEIGH OPERATIONS - BEST MANAGEMENT PRACTICES AND POLICIES FOR CLIMATE/ENERGY ACTION PLAN

Best Management Practices and Policies - Fleet Team		
FLT-BP-04	Enhanced Preventative Maintenance for SWS Vehicles	Sample oil during preventative maintenance at every 3,000 miles and change oil only if needed at that time instead of changing oil whether needed or not; this will reduce oil changes and save money
FLT-BP-05	Use of Synthetic Fluids	Consider use of synthetic based fluids
FLT-BP-06	Vehicle Fleet Services Awareness Training	Help other departments better understand what Vehicle Fleet Services does and the data that is required for evaluating vehicle purchases
FLT-BP-07	Vehicle Change Out Awareness Training	Raise awareness that budget cuts cause delays in vehicle replacement
FLT-BP-08	Vehicle Change Out Awareness Training	Raise awareness that maintenance of older, retained equipment can cost more in the long run than replacing with newer and more efficient equipment; use this information to provide justification for replacement (make the business case)
FLT-BP-09	Evaluation of Alternative Fuel Mix	Evaluate breadth and depth of fuel mix - too much diversification will require many types of alternative fuel systems to be constructed to keep vehicles and equipment fueled and operational
FLT-BP-10	Central Warehousing	Consider more central warehousing for storing/stocking supplies (similar to Facilities and PUD); allows supplies to be delivered instead of employees traveling to pick them up, reducing mileage/fuel usage in City vehicles
FLT-BP-11	Teleworking, Video-Conferencing, Electronic Data Exchange	Evaluate teleworking, compressed work schedule, alternative hours, etc.
		Evaluate the use of video conferencing for mandatory employee workshops, training, information sessions (i.e. HR Mtg, Healthcare, operational training)
		Evaluate the use of electronic data exchange instead of delivering paperwork to various City departments
		Evaluate using pictures and electronic media transfer to obtain 3 estimates for wrecked vehicles instead of driving to 3 different sites for cost estimates

## CITY OF RALEIGH OPERATIONS - BEST MANAGEMENT PRACTICES AND POLICIES FOR CLIMATE/ENERGY ACTION PLAN

Best Management Practices and Policies - Fleet Team		
FLT-BP-12	Cross Training for Reduction of Service Call Mileage	Evaluate cross-training PUD and PWD staff in order to better utilize staff and Fleet resources for call-outs/service calls
FLT-BP-13	Use of Hydrogen or Fuel Cell Vehicles	Evaluate use as technology improves
Best Management Practices and Policies - Carbon Team		
CR-BP-01	Real Estate Purchasing Policy	Develop a real estate purchasing policy that takes into consideration the potential for locating solar and also employee co-location opportunities
CR-BP-02	Carbon Footprint Policy	Develop construction policy for CIP projects that includes carbon footprint as part of the evaluation criteria
CR-BP-03	High Efficiency Equipment	Require that replacement equipment has a high efficiency rating (i.e. replacement of aging aeration blowers at Neuse River WWTP with high efficiency blowers)
CR-BP-04	Budget Practice	Provide fuel "consumption" budget for vehicles instead of "dollars" budget due to fluctuating fuel prices
CR-BP-05	Neuse River WWTP Blower Operation Awareness	Consider developing a "cost speedometer" at Neuse River WWTP via the SCADA system so operators can see cost impact of ramping blowers up or down (i.e. see energy costs impacts when tweaking system)
CR-BP-06	AMR	Use fixed AMR system for entire service area to read water meters - reduces vehicle idling, fuel usage, and number of employees
CR-BP-07	Neuse River WWTP Filter Denite. Chemicals	At Neuse River WWTP test use of sugar water instead of methanol for denitrification filters
CR-BP-08	Neuse River WWTP Pump VFDs	At Neuse River WWTP replace screw pumps with vertical turbines with VFDs for solids handling and influent flow
CR-BP-09	Aeration Efficiency at Neuse River WWTP	Implement a formal inspection, cleaning and replacement program for aeration basin diffusers at Neuse River WWTP

## CITY OF RALEIGH OPERATIONS - BEST MANAGEMENT PRACTICES AND POLICIES FOR CLIMATE/ENERGY ACTION PLAN

Best Management Practices and Policies - Carbon Team		
CR-BP-09	Neuse River WWTP Screenings Compaction	At Neuse River WWTP compact influent screenings to reduce solids volume and number of trips required for disposal
CR-BP-10	Neuse River WWTP Operations Audit	Evaluate wastewater treatment operations for energy efficiency opportunities (i.e. operational improvements, pump replacements, lighting upgrades, etc.)
CR-BP-11	Neuse River WWTP Biosolids for Fertilizer	Evaluate use of Class A dried biosolids from anaerobic digestion (if/when implemented) as fertilizer for use by City or citizens
		Parks and Recreation to partner with PUD to use Neuse River WWTP biosolids instead of potting soil
CR-BP-12	PUD Strategic Plan	PUD is developing a Strategic Plan for fleet usage and routing; this takes into consideration the location at which employees should report for maximum efficiency
CR-BP-13	WW Pump Station Elimination	Eliminate WW PS and use gravity flow where possible; always consider new opportunities for WW gravity flow instead of new pump stations
CR-BP-14	System to Track Position of Valves in Water System	Institute a system for tracking the position of major valves in the water distribution system to prevent pumping against closed valves or pumping in a loop
CR-BP-15	WTPs Filter Optimization	Optimize filter backwash at water treatment plants
CR-BP-16	Distribution Pressure	Evaluate pressure of system need to provide water to customers and consider reducing by 5 psi to reduce pumping throughout various water system zones
CR-BP-17	Toilet Conversion	Convert all old toilets in City buildings from 5-gallon flush to lower flush model
CR-BP-18	Water Efficiency	Develop plan to better manage water use in all City buildings
CR-BP-19	Convention Center Water Efficiency	Consider collecting and using the stream of water running under the under building



## CITY OF RALEIGH OPERATIONS - BEST MANAGEMENT PRACTICES AND POLICIES FOR CLIMATE/ENERGY ACTION PLAN

Best Management Practices and Policies - Carbon Team		
CR-BP-20	Recovery of Rain Water at Convention Center	Consider expanding rainwater collection at the Convention Center (now recovering ~ 10,000 gallons of water from the roof top) and using it for irrigation; consider practice at other City buildings
CR-BP-21	Recycling	Require mandatory recycling by all city employees; would increase volume of recyclables and has revenue earning potential of \$30/ton
		Require mandatory residential recycling of all recyclables; would increase volume of recyclables and has revenue earning potential of \$30/ton. Note that Parks and Recreation has obtained a grant for placing recycle containers for use by employees and a pilot is underway.
		Implement recycling "education" campaign to increase total recyclables
CR-BP-22	Tree Removal and Sale	When City removes trees, sell as firewood and /or send to mills for revenue
CR-BP-23	Smart Grid Concepts	Adopt Smart Grid concepts for energy management; consider modifying the operation of generators and other practices
Best Management Practices and Policies - Renewable Energy		
RE-BP-01	Sustainability Fund	Use revenue from renewables projects to create a "Sustainability Fund"
RE-BP-02	External Financing	Consider standard/policy to seek external financing opportunities for renewable energy options (i.e. buildings, elevators, etc.)
RE-BP-03	Purchase Renewable Energy Credits	Consider purchase of Renewable Energy Credits (RECs)

## CITY OF RALEIGH OPERATIONS - BEST MANAGEMENT PRACTICES AND POLICIES FOR CLIMATE/ENERGY ACTION PLAN

Best Management Practices and Policies - Renewable Energy		
RE-BP-04	Renewable Projects Long Term Ownership and Maintenance	Consider standard/policy that when entering into renewable projects with initial 3rd party ownership, ensure that City budgets include appropriate funds to acquire and/or maintain the project when it is turned over to City (timing depends on agreement with 3rd party)
Best Management Practices and Policies - Other		
OT-BP-01	Sustainable Procurement Policy	Finalize draft Policy and ensure it is applied throughout City departments when adopted
Best Management Practices and Policies - Other		
OT-BP-02	New Capital Budget Process	Ensure integration of Sustainable Procurement Policy into City's new capital budget development process and involvement of Office of Sustainability in developing the process
OT-BP-03	Interface with Emergency Preparedness	Integrate practices with Emergency Preparedness for standards/policy on energy preparedness and dependence on fossil fuels
OT-BP-04	Reduce Mileage Related to Wellness Program Exams	Export Wellness Program exams and information workshops/sessions out to remote locations; will eliminate mileage traveled by staff to one site for the exams and information

## CITY OF RALEIGH OPERATIONS - EXISTING STRATEGIES FOR CLIMATE/ENERGY ACTION PLAN

### Existing Strategies - Buildings Team

EE-0-11	Energy Management Software (Periscope) and Climate Control System (multiple locations)	Installations in Police Training Center, Sanderford Rd, Optimist Pool & CC, Six Forks Police Admin Facility, Greystone, Millbrook Exchange Pool & CC, St. Monica Teen Center, Municipal Complex, Jaycee CC, Frank E. Evans Admin Office, Pullen Arts, Pullen Pool, Barwell Rd Emergency Communications, Lake Lynn, Laurel Hills, Chavis, Worthdale, Biltmore Hills, Green Rd, Lions Park, Walnut Creek Ballfields, Cabarrus St Downtown District Station, One Exchange Plaza, 310 W. Martin St, Ralph Campbell, Sertoma Arts, Brentwood Neighborhood Center, Roberts, Tarboro Rd, Glen Eden, Millbrook Exchange Tennis, Peach Rd, Halifax, Hill St, Five Points Center for Active Adults, Dunn Rd, Chavis Park Carousel, Mordecai Historic Park Interpretive Center
EE-0-20	2008 LEED Buildings (Silver)	Convention Center
		Neuse River WWTP Building
EE-0-21	2009 LEED Buildings (Silver)	Walnut Creek Wetland Center - Includes exterior LED lighting and climate control system with lighting occupancy sensors. The Walnut Creek Wetland Center was designed by Frank Harmon Architects and incorporates many elements of environmentally friendly design.
		Brentwood Remote Operations - Solar LED exterior lighting, LED exterior lighting, rooftop solar PV system
EE-0-22	2010 LEED Building (Silver)	D.E. Benton WTP Building
EE-0-23	2011 LEED Buildings (Silver)	Marsh Creek Community Center - energy efficient lighting, solar thermal water heating, climate control system
		Anna Louise Wilkerson Nature Center - energy efficient lighting, small sell all solar PV system, climate control system, EVSE charging station
		Pullen Park Amusement - LED lighting, geothermal for carousel building, climate control system
EE-0-24	2011 LEED Building (Platinum)	Transit Operations Facility

# CITY OF RALEIGH OPERATIONS - EXISTING STRATEGIES FOR CLIMATE/ENERGY ACTION PLAN

## Existing Strategies - Buildings Team

EE-0-25	2012 LEED Building (Platinum)	Wilders Grove Remote Operations Facility
EE-0-26	2012 LEED Building (Silver)	Buffaloe Road Aquatics Center
EE-0-27	2013 LEED Buildings (Silver)	NE Remote Operations - Climate control system, exterior LED lighting
		Fire Station 29
		Whitaker Mill Senior Center
		Millbrook Senior Center
EE-0-28	2014 LEED Buildings (Silver)	Barwell Community Center
EE-0-29	2014 LEED Building (Gold)	Public Safety Center
EE-0-31	RTN Lighting Replacement	Changed 2kW spots to 1kW spots
EE-0-32	Interior Lighting Replacement (multiple locations)	Buildings - Fire Stations 2-12, 14-16, 18, 19; Biltmore Hills Park, Carolina Pines, Brentwood CC, Worthdale, Sgt. Courtney T. Johnson, Durant Nature Park Admin Building, Eastgate Park, Garriss Building, Glen Eden, Roberts Park, Lions Park, Chavis Park, Sertoma Arts, Tarboro Rd, Pullen Arts, Laurel Hills, Lake Lynn, Green Rd, Jaycee Park, Kiwanis Park, Lake Johnson, Method CC/Pioneer Building, Millbrook, Millbrook Tennis Center, Optimist Park, Powell Dr, One Exchange Plaza, 310 W. Martin St
EE-0-33	LED Traffic Lights	Replaced ALL traffic lighting with LED lights

## CITY OF RALEIGH OPERATIONS - EXISTING STRATEGIES FOR CLIMATE/ENERGY ACTION PLAN

### Existing Strategies - Buildings Team

EE-0-34	Lighting Replacement in Memorial Auditorium	Replaced 85-90% of lights in Memorial Auditorium with LEDs/CFLs
EE-0-35	LED Lighting Replacement in Convention Center Deck	Replaced Parking Deck Lights with LEDs
EE-0-36	LED Parking Structure Lighting	Facilities has installed LED lights on the 1st floor of the parking deck (at 222 W. Hargett St.); 141 fixtures replaced
EE-0-37	LED Exterior Park/Area Lights (multiple locations)	Exchange Plaza, Carolina Pines, Jamaica Dr Greenway Tunnel, Brentwood Road Operations Center wallpacks, Sgt. Courtney Johnson, Chavis Park, Eastgate, Optimist, Walnut Creek Wetland Center, Reedy Creek Pedestrian Bridge, Sertoma Arts, Cabarrus Street Downtown Police District, City Plaza light towers, Lake Boone Trail Bridge Underpass, Municipal Complex campus, Lions Park, Worthdale Park, Ridge Rd Pool, Pullen Aquatics, Pullen Amusement, Longview Pool, Roberts, Method
EE-0-38	LED Exterior & Interior Lighting Replacement (misc depts)	EXTERIOR: Public Works - Hillsborough Street, State Street - Community Development, Benton Water Plant - Public Utilities; INTERIOR: Mayor's Office and Elevator Lighting Downtown
EE-0-39	Exterior Lighting Replacement at Parks (excludes LED)	Parks and Recreation has installed exterior lights with control panels at ball fields; the lights are on automated controls which allows lights to turn on and off based on the presence of citizens: Optimist Senior Ballfield, Jaycee Little League Field
EE-0-41	Roofing Upgrades	Rooftops with white, opaque, and/or reflective materials to reduce R-factor at Biltmore Hills, Tarboro, Optimist, Chavis, Pullen Pool, Glen Eden, Green Road, Method, Pullen Community, and One Exchange Plaza
EE-0-42	Green Roofs	Developed green roofs at Hill Street Neighborhood Center, Five Points Center for Active Adults, Fire Station 9
EE-0-43	Building Glass Replacement	Installed new glazing to reduce heat radiation at Roberts, Sgt. Courtney Johnson, Worthdale, Optimist, Green Road, Lions, Method, Pullen Community, Chavis, Jaycee, and Carolina Pines

## CITY OF RALEIGH OPERATIONS - EXISTING STRATEGIES FOR CLIMATE/ENERGY ACTION PLAN

### Existing Strategies - Buildings Team

EE-0-51	Equipment Replacement	Boiler Replacement at Biltmore Hills, Method Road, Lions boiler and HVAC, Mechanical upgrades at Chavis community to include variable refrigerant system and upgrade of gym heaters, Pullen Arts HVAC and boiler replacement, Carolina Pines and Jaycee mechanical upgrade to higher SEER, Sgt. Courtney T. Johson HVAC and mechanical upgrade, One Exchange Plaza chiller replacement.
EE-0-52	Computer Upgrades	Emergency Communications replaced their 19" CRT Monitors with 24" LEDs. Also replaced power supply units with 28% more efficient ones.
EE-0-61	Solar Energy at Bus Stops	Transportation has installed solar panels at bus stops; energy produced is used to power lights, reader boards, etc.)
EE-0-62	Solar LED Lighting	Campbell U. Parking, City Plaza (temporary solar), Marsh Creek Remote Operations, Strickland Road Park
EE-0-63	Solar Thermal	Fire Station #1, 6, 15, 16, 17 & Municipal Building
EE-0-64	Solar PV at Wilder's Grove	50-kW solar voltaic array at the administration building and a 25-kW array at a vehicle wash building

### Existing Strategies - Fleet Team

FLT-0-01	Fleet Transformation - Alternative Fuels	Fleet alternative fueling program began in 2000. Fleet increased the variety of biofuels (i.e. B5, B20, E85, and CNG) beginning in 2007 to meet the EAB goal of reducing the amount of fossil-fuel consumed by 20%
FLT-0-02	Flex Fuel Vehicles	Changed pickups and sedans to unleaded/flex fuel vehicles
FLT-0-03	Police Car Change Out	Changed undercover cars from Crown Victoria to Hybrids and increased fuel efficiency of vehicles
FLT-0-04	SUV-Pickup Change Out	Changed full-size SUVs & Pickups to compact SUVs

## CITY OF RALEIGH OPERATIONS - EXISTING STRATEGIES FOR CLIMATE/ENERGY ACTION PLAN

### Existing Strategies - Fleet Team

FLT-0-05	No Idling Policy	Initiated a "No Idling" policy
FLT-0-06	Large to Small Capacity Conversion	Shifted focus to reduce large vehicle capacity, where it was not needed, to smaller capacity vehicle (i.e. F150 vs. sedan or Escape)
FLT-0-07	Police Dept GPS Usage	Police department is using GPS technology for all 911 service calls; System helps ensure the closest officer responds to a call
FLT-0-08	SWS Route Optimization	Solid Waste Services (SWS) implemented route optimization standards to reduce the number of trips (miles traveled) for solid waste pick-up and disposal
FLT-0-09	Extended Maintenance	Extended maintenance frequency - i.e. mow every 3 weeks instead of 2 weeks at parks and road right-of-ways
FLT-0-10	Naturalization of Parks & Recreation Areas	Parks and Recreation has/is naturalizing areas in Parks (i.e. turf reduction to meadow conversion) to reduce the need for mowing
FLT-0-11	SWS GPS Usage	SWS installed GPS devices in trucks that record a driver's behavior; has helped reduce instances of speeding, frequent stopping, sudden braking, etc.
FLT-0-12	Fire Dept. Alternative Fuel Vehicles	The Fire Dept is using more efficient and alternative fuel vehicles for supervisor's cars
FLT-0-13	Fire Dept. Increased B5 Usage	The Fire Dept is using more B5 in vehicles and equipment
FLT-0-14	SWS Cleaner Fuel Usage	SWS purchased new equipment that uses cleaner fuel and emits less emissions
FLT-0-15	Motor Pool Implementation	Implemented a motor pool at municipal center; City staff can choose a car from those available to drive to other City centers instead of being assigned an individual vehicle
FLT-0-16	Citizens Report	Police Dept. began allowing citizens to reports situations for police response by internet (reduces number of trips officers take to visit citizen's homes)

CITY OF RALEIGH OPERATIONS - EXISTING STRATEGIES FOR CLIMATE/ENERGY ACTION PLAN		
Existing Strategies - Fleet Team		
FLT-0-17	Mower Alternative Fuel	In 2009 pilot project for mowers within Parks & Recreation was initiated to determine the effects of alternative fuel use on exhaust emissions using GESI (report is not available yet)
FLT-0-19	SWS Idling Monitors	Solid Waste Services - uses controller to monitor vehicle idling monitored - shuts down motor after 3-5 minutes
Existing Strategies - Carbon Team		
CR-0-01	Landfill Gas Recovery	Wilder's Grove Landfill - Landfill Gas Recovery
CR-0-04	Streetscapes with Trees	Public works streetscapes planted 5,000 trees Fayetteville Rd
CR-0-05	SWS Split Body Trucks	Reduced trips to central business district by using split body trucks to collect solid waste and recycling at same time
CR-0-06	Pump Station Visitation Reduction	Reduced number of pump stations visits through improved reliability of telemetrics; saves gas and also holiday/OT pay
CR-0-07	Water Efficiency	Water efficiency has reduced potable water pumping costs
CR-0-08	Reclaimed Water	Using Reclaimed water; at Walnut Creek WW pump station are using reclaimed water instead of potable for the wet scrubber
CR-0-09	Reclaimed Water at Neuse River WWTP	Reuse water used in toilets at Neuse River WWTP
CR-0-11	Native Seeds	Parks and Recreation is growing local sources of seeds for park properties, including trees and landscape plants
CR-0-13	Parks & Recreation Greenhouse	Built energy efficient Parks and Recreation greenhouse - seeing reduction in cooling/heating



CITY OF RALEIGH OPERATIONS - OTHER FUTURE STRATEGIES FOR CLIMATE/ENERGY ACTION PLAN		
Other Future Strategies - Buildings Team		
EE-1-20	Silver LEED Policy	Future Impact of existing LEED Policy that new construction should be LEED Silver
EE-1-22	Gold LEED Policy	Raise LEED "level" on new construction (option for retrofits) from silver to gold
EE-1-31	Natural Lighting	Skylights in Warehouse Spaces
		Solar Tubes in Office Areas
EE-1-34	Park Area Lighting Upgrade	Continue retrofitting with new energy efficient lighting at numerous facilities that still need lighting upgrades
	Ballpark Light Controls	Lighting upgrade at 40 ballfields
EE-1-42	Reflective Surfaces	Paint schemes at warehouses - more reflective; reflective rooftop surface
EE-1-43	Green Roofs	Proposed (Non-LEED) locations include Hill Street Park Neighborhood Center
EE-1-51	HVAC Upgrades	Replace HVAC at Memorial Center, ~13 Fire Stations for higher SEER/ performance, 6 Community Centers for higher SEER and control automation
EE-1-61	Solar Lighting for Signals	Solar option for daytime lighting (i.e. school crossings, bus stops, crosswalks, flashers)
EE-1-62	Solar LED Lighting for Remote Areas	Add area lights (equivalent to 289W Metal Halide) where no power infrastructure is available for normal LED lighting
EE-1-71	PMP for Fire Facilities	Implementation of Preventative Maintenance (PM) Plans for Fire Facilities and implementation of HVAC replacement and life cycle upgrades at numerous Fire Stations - See EDF report.
EE-1-73	WWTP Effluent Heat Recovery	Recover heat from wastewater plant effluent for heating and cooling buildings

## CITY OF RALEIGH OPERATIONS - OTHER FUTURE STRATEGIES FOR CLIMATE/ENERGY ACTION PLAN

### Other Future Strategies - Fleet Team

FLT-1-03	Route Optimization	Evaluate route optimization in city departments (i.e. PUD for AMR, Police & Fire call-outs, etc.)
FLT-1-04	Auxiliary Battery Power for Police Vehicles	Consider installing battery operated equipment on police vehicles to run flashing lights, etc. so that if the engine does not need to be running, the vehicle can be turned off
	Solar to Charge Auxiliary Batteries	Evaluate the use of solar panels to charge batteries for auxiliary power source
FLT-1-05	Remote Operations Centers for Parks and Rec	Evaluate the development of remote operation centers for Parks & Recreation (currently under consideration for location in Mt. Herman area and south of downtown)
FLT-1-07	Police Work Order System	Evaluate the development of a Police Work Order system to reduce travel times to service areas and back to stations
FLT-1-08	Co-Location of Employees	Consider co-locating City departmental staff to reduce the distance employees must travel to get to their work and/or service locations
FLT-1-09	Co-Location of Fueling Operations	For the new remote facility planned in the NE quadrant of city, evaluate equipping the facility with all-types of fuels - specifically bio-fuels - for fueling city vehicles. Will reduce miles traveled to only the one or two sites available now to refuel with alternative fuels.
FLT-1-12	Compressed Natural Gas Vehicles	Evaluate the use of natural gas; issue is City doesn't have infrastructure to accommodate more CNG vehicles; consider the limits on fuel capacity (125 mi/tank) and fueling time (a SWS truck would have to refuel in parking lot overnight)
FLT-1-14	Use SWS Trucks for "Double-Duty"	Evaluate using SWS trucks for collecting AMR data for Public Utilities Dept.
FLT-1-21	Large to Small Capacity Vehicle Change Out	Evaluate changing the way vehicles are used and/or the current capacity of large equipment (use 1 larger vehicle for 2 smaller; i.e. leaf-collection machines)
FLT-1-22	Remote Operations Centers	Consider developing and building additional remote Operations Centers (2 in study and design); also consider including fueling stations for alternative fuels at the sites (Similar to Strategy EE-1-09)
FLT-1-26	Periodic Driver Training	Provide City staff with "Driver Behavior" education classes to reduce costly and unsafe driving practice (i.e. driving 55, no sudden braking, proper inflation of tires, etc.)
FLT-1-30	Vehicle Efficiency	Continuation of current vehicle change out policy and purchase of newer vehicles with cleaner emissions
FLT-1-31	Propane Use in Various Fleet Vehicles	Evaluate use of propane/propane addition in sedans and compact pick up trucks; will require the development of propane fueling stations

CITY OF RALEIGH OPERATIONS - OTHER FUTURE STRATEGIES FOR CLIMATE/ENERGY ACTION PLAN		
Other Future Strategies - Fleet Team		
FLT-1-32	Recover City-Generated Gas for Use in Vehicles	Use recovered landfill gas or or digester gas (if/when constructed) to power compressed natural gas buses or other vehicles/equipment
FLT-1-33	Alternative Energy Source for Comfort Heating	Provide alternative energy source for comfort (cab) heating in large diesel trucks by using Gensets
Other Future Strategies - Carbon Team		
CR-1-01	Privatize Water and Wastewater Services	Consider privatization of city's water and wastewater services
CR-1-05	Export Yard Waste and Discontinue Use of Yard Waste Landfill	Export yard waste stream to 3rd party; <i>note that either this strategy OR Strategy CR-1-04 can be used but not not both since they accomplish the same purpose</i>
CR-1-11	Reuse System Expansion	Expand reuse system to Wake Med to use reclaimed water for non-contact water
		Expand reuse system to Wilder's Grove Facility to use reclaimed water for non-contact water
		At Crabtree Creek WW pump station use reclaimed water for air scrubber
CR-1-24	Pump Station Visitation Reduction	Continue to reduce pump station visits
CR-1-27	Reclaimed water pickup	Initiate policy to use reclaimed water for watering landscapes by city personnel and contractors (in water trucks totes, etc.)
CR-1-29	Landfill Gas Recovery Expansion	Additional LFG Recovery from Wilder's Grove
Other Future Strategies - IT Department		
IT-1-01	Desktop Virtualization	Continue investigation of utilizing desktop virtualization to centralize computing resources in the data center and having "dumb terminal"-style devices on the desktop. Energy savings as terminals use about 1/3 the power of a full PC.
IT-1-02	Data center consolidation	Continue investigation of reducing the number of servers in the city's data centers by further utilizing server virtualization and consolidation strategies

CITY OF RALEIGH OPERATIONS - OTHER FUTURE STRATEGIES FOR CLIMATE/ENERGY ACTION PLAN		
Non-Feasible Future Strategies as Determined by Teams		
CR-1-20	Biosolids Solar Drying at Neuse River WWTP	Evaluate use of solar for drying biosolids and residuals; will decrease volume to be hauled; <i>team determined this is a Scope 3 item and therefore not part of this analysis</i>
CR-1-21	Equalization at Neuse River WWTP	Use existing 32 million gallon equalization basin at Neuse River WWTP to store WW and then pump and treat during off-peak hours; <i>not feasible due to US Army COE issues with regulation of downstream flows</i>
CR-1-23	Increase WW Pump Station Wet Well Capacities	Increase WW PS wet well capacity to reduce pumping; <i>team determined not feasible as can create large operational problems</i>

**APPENDIX 5:**  
**Renewable Energy Project Inventory**

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CITY OF RALEIGH OPERATIONS CLIMATE/ENERGY ACTION PLAN - RENEWABLE ENERGY INVENTORY

CEAP No.	Project Name	Contact	Priority	Street Address	City	Zip	Comments	Grid	Source	Type	Status	Status Comments	Energy / yr	System Size
<b>Renewable Energy Facilities - Proposed Strategies</b>													<b>28516 MWh</b>	<b>9904 kW</b>
	Neuse River Wastewater Treatment Plant (AD)	R. Massengill		8500 Battle Bridge Road	Raleigh	NC 27610	anarobic digestion, phase 2 5-10 years	Y	Biogas	WWTP	Proposed		13140.0 MWh	2000.0 kW
	Neuse River Wastewater Treatment Plant Discharge	R. Massengill, T. Woody		8500 Battle Bridge Road	Raleigh	NC 27610	needs evaluation; low head hydro	Y	Hydro		Proposed		350.4 MWh	100.0 kW
	Falls Lake Dam	Kenneth Waldroup	High	13304 Creedmoor Road	Wake Forest	NC	Needs funding evaluation/research	Y	Hydro		Proposed	consulting contracts in place for stud	7008.0 MWh	2000.0 kW
	EM Johnson Water Treatment Plant	R. Massengill	High	10301 Falls of Neuse Road	Raleigh	NC		N	Solar	LED	Proposed		13.8 MWh	10.0 kW
	Raleigh Convention Center Amphitheater	E. Stempien	Medium	502 Salisbury St.	Raleigh	NC 27601	small, needs funding source	N	Solar	LED	Proposed	LED under review	13.8 MWh	10.0 kW
	Public Utilities North Raleigh Operations Center (WF)	R. Massengill	Medium	10700 Star Road	Wake Forest	NC 27587	needs evaluation	N	Solar	LED	Proposed		13.8 MWh	10.0 kW
	Public Utilities Northeast Operations Center (Wendell)	R. Massengill	Medium	1715 Wendell Blvd	Wendell	NC 27591	needs evaluation	N	Solar	LED	Proposed		13.8 MWh	10.0 kW
	Public Utilities South Operations Center (Garner)	R. Massengill	Medium	5380 Raynor Road	Garner	NC 27529	needs evaluation	N	Solar	LED	Proposed		13.8 MWh	10.0 kW
	Public Utilities Lake Woodard Operations Facility	R. Massengill		3304 Lake Woodard Drive	Raleigh	NC 27604	needs evaluation	N	Solar	LED	Proposed		13.8 MWh	10.0 kW
	Raleigh Plaza	Dan Howe, B. Jackson		400 block Fayetteville St	Raleigh	NC 27601		N	Solar	LED	Proposed		13.8 MWh	10.0 kW
	Neuse River Wastewater Treatment Plant Area Lighting (LED Conversion)	T. Woody	Medium	8500 Battle Bridge Road	Raleigh	NC 27610	Packaged with other City LED initiative	N	Solar	LED	Proposed		13.8 MWh	10.0 kW
EE-1-62	Walnut Creek Softball Complex	B. Jackson		1201 Sunnybrook Road	Raleigh	NC 27610		N	Solar	LED	Proposed		13.8 MWh	10.0 kW
	Wilder's Grove Landfill	B. Jackson, F. Battle		4120 New Bern Avenue	Raleigh	NC 27602	not optimum topo for solar pv	Y	Solar	PV-GM	Proposed		345.4 MWh	250.0 kW
	Raleigh Convention Center Amphitheater	E. Stempien	Medium	502 Salisbury St.	Raleigh	NC 27601	small, needs funding source	Y	Solar	PV-GM	Proposed		345.4 MWh	250.0 kW
	Dix Property	J. Prosser, G. Pollard	Medium				partnership with NCSU?	Y	Solar	PV-GM	Proposed		345.4 MWh	250.0 kW
	Neuse River Wastewater Treatment Plant Mial Plantation Site (field 500)	R. Massengill, T. Woody	Low	Mial plantation / old baucom			already have one array	Y	Solar	PV-GM	Proposed		345.4 MWh	250.0 kW
	Wrenn Road	T. Woody	Medium	8828 Wrenn Rd	Garner	NC 27529	Need to determine specific area	Y	Solar	PV-GM	Proposed		345.4 MWh	250.0 kW
	Transit Operations Facility	Gill Johnson, G. Pollard	High	4104 Poole Rd.	Raleigh	NC 27610	Been evaluated, PEC appetite?	Y	Solar	PV-RT	Proposed	Preliminarily designed	69.1 MWh	50.0 kW
	City of Raleigh Municipal Building	B. Jackson		222 West Hargett Street	Raleigh	NC 27602		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Wilder's Grove Solid Waste Services Center Transfer Station	B. Jackson, F. Battle	High	4120 New Bern Avenue	Raleigh	NC 27602	side of building possible thin film solar	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Wilder's Grove Solid Waste Services Center Future Covered Parking	B. Jackson, F. Battle	Medium	4120 New Bern Avenue	Raleigh	NC 27602		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Time Warner Pavilion	E. Stempien		3801 Rock Quarry Rd	Raleigh	NC 27610	in design stage	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Neuse River Wastewater Treatment Plant Pump Station Equipment Shelte	R. Massengill, T. Woody	Medium	8500 Battle Bridge Road	Raleigh	NC 27610	Needs Evaluation for grid tie; Flex Solar?	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	310 West Martin Street	B. Jackson	High	310 West Martin Street	Raleigh	NC 27601	good visibility, has control system	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Barwell Road Community Center	B. Jackson	Medium	3935 Barwell Road	Raleigh	NC 27610	possible secondary evaluation process for P&R Centers	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	218 West Cabarrus Street	B. Jackson	Medium	218 West Cabarrus Street	Raleigh	NC 27601		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Green Road Community Center	B. Jackson	Medium	4101 Green Road	Raleigh	NC 27604		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Lake Lynn Community Center	B. Jackson	Medium	7921 Ray Rd	Raleigh	NC 27613		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Laurel Hills Community Center	B. Jackson	Medium	3808 Edwards Mill Road	Raleigh	NC 27612		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Lions Park Community Center	B. Jackson	High	516 Dennis Ave	Raleigh	NC 27604		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Method Road Community Center	B. Jackson	Medium	514 Method Road	Raleigh	NC 27607		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Millbrook Exchange Community Center	B. Jackson	High	1905 Spring Forest Road	Raleigh	NC 27615	high traffic, relatively small	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Peach Road Community Center	B. Jackson	Medium	911 Ileagnes Road	Raleigh	NC 27601		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Police Training Center	B. Jackson		4205 Spring Forest Road	Raleigh			Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Pullen Arts	B. Jackson		105 Pullen Road	Raleigh		shade	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Pullen Community Center	B. Jackson	High	408 Ashe Avenue	Raleigh	NC 27606	good visibility, has control system	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Roberts Park	B. Jackson		1300 E. Martin Street	Raleigh	NC 27610	shade	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Chavis Community Center	B. Jackson	High	505 Martin Luther King Jr. Blvd.	Raleigh	NC 27601	good visibility, near PEC	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Heavy Equipment Shop (Fire Operations Center?)	B. Jackson	Medium	4120 New Bern Avenue	Raleigh	NC 27602	big metal roof, no control system	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Marsh Creek Community Center	B. Jackson	High	3050 N New Hope Road	Raleigh	NC 27604	new, has control system	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Walnut Creek Wetlands Center	B. Jackson	High	950 Peterson Street	Raleigh	NC 27610	New e environmental education opportunity	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Pullen Aquatics Facility	B. Jackson	Medium	410 Ashe Avenue	Raleigh	NC 27606		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Millbrook Aquatics Facility	B. Jackson	Medium	1905 Spring Forest Road	Raleigh	NC 27615		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Buffaloe Road Aquatics Facility	B. Jackson		5812 Buffaloe Road	Raleigh	NC 27616		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	North West Remote Operations Center	B. Jackson		Mt Hermin Road				Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Northeast Operations Center (Greshams Lake)	B. Jackson		3222-3228 Spottswood Street, 7704 Burwell Street, 7708 Burwell Street			3 sections, multi-departmental campus	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Public Utilities North Raleigh Operations Center (WF)	R. Massengill	Medium	10700 Star Road	Wake Forest	NC 27587	needs evaluation	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Public Utilities Northeast Operations Center (Wendell)	R. Massengill	Medium	1715 Wendell Blvd	Wendell	NC 27591	needs evaluation	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Public Utilities South Operations Center (Garner)	R. Massengill	Medium	5380 Raynor Road	Garner	NC 27529	needs evaluation	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Public Utilities Lake Woodard Operations Facility	R. Massengill		3304 Lake Woodard Drive	Raleigh	NC 27604	needs evaluation	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Neuse River Wastewater Treatment Plant Farm Equipment Garage	R. Massengill, T. Woody	Medium	8500 Battle Bridge Road	Raleigh	NC 27610	Needs Evaluation for grid tie; Flex Solar?	Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Raleigh Convention Center Parking Deck	M. Barbour	Medium	501 Salisbury St.	Raleigh	NC 27601		Y	Solar	PV-RT	Proposed		69.1 MWh	50.0 kW
	Raleigh Convention Center Rooftop	R. Hinson	High	500 Salisbury St.	Raleigh	NC 27601		N	Solar	Thermal	Proposed		101.7 MWh	73.6 kW
EE-1-63	Pullen Aquatics Facility	B. Jackson	Medium	410 Ashe Avenue	Raleigh	NC 27606	need a thermal evaluation	N	Solar	Thermal	Proposed		320.5 MWh	232.0 kW
EE-1-63	Millbrook Aquatics Facility	B. Jackson	Medium	1905 Spring Forest Road	Raleigh	NC 27615	need a thermal evaluation	N	Solar	Thermal	Proposed		1404.3 MWh	1016.5 kW
EE-1-63	Buffaloe Road Aquatics Facility	B. Jackson		5812 Buffaloe Road	Raleigh	NC 27616		N	Solar	Thermal	Proposed		1922.8 MWh	1391.8 kW
	Raw Water Reservoir Floatophataics (EM Johnson)	R. Massengill	Medium	10301 Falls of Neuse Road	Raleigh	NC	Needs Evaluation for Floatovoltaics or bird ball potential	N	Solar	Other	Proposed			
	Neuse River Wastewater Treatment Plant Sludge Dryer	R. Massengill		8500 Battle Bridge Road	Raleigh	NC 27610	Solar sludge dryer, phase 2 CIP	N	Solar	Other	Proposed			
	Wilder's Grove Landfill	B. Jackson, F. Battle		4120 New Bern Avenue	Raleigh	NC 27602		Y	Wind		Proposed			
	Raleigh Convention Center Rooftop	R. Hinson	High	500 Salisbury St.	Raleigh	NC 27601		Y	Wind		Proposed			
	Wrenn Road	T. Woody	Medium	8828 Wrenn Rd	Garner	NC 27529	Need to determine specific area	Y	Wind		Proposed			

CITY OF RALEIGH OPERATIONS CLIMATE/ENERGY ACTION PLAN - RENEWABLE ENERGY INVENTORY

CEAP No.	Project Name	Contact	Priority	Street Address	City	Zip	Comments	Grid	Source	Type	Status	Status Comments	Energy / yr	System Size
Renewable Energy Facilities - Existing Strategies													38484 MWh	7493 kW
	Wilder's Grove Landfill	B. Jackson, F. Battle		4120 New Bern Avenue	Raleigh	NC 27602		N	Biogas	Landfill	Existing	Completed	35040.0 MWh	5000.0 kW
	Transit Operations Facility	Gill Johnson, G. Pollard		4104 Poole Rd.	Raleigh	NC 27610	150 geo wells	N	Geothermal		Existing	Completed		
EE-0-62	Campbell University Parking	B. Jackson		West Morgan / South Dawson			open gravel lot with LED solar lighting	N	Solar	LED	Existing	Completed	13.8 MWh	10.0 kW
EE-0-62	Marsh Creek Operations Center	B. Jackson		4225 Daly Road	Raleigh	NC 27604		N	Solar	LED	Existing	Completed	13.8 MWh	10.0 kW
	Brentwood Road Operations Center - Parks and Recreation	B. Jackson		3315 Vison Court	Raleigh	NC 27604		N	Solar	PV-RT	Existing	Completed	40.9 MWh	29.6 kW
	EM Johnson Water Treatment Plant	R. Massengill	High	10301 Falls of Neuse Road	Raleigh	NC	Probable Expansion	Y	Solar	PV-RT	Existing	Completed	345.4 MWh	250.0 kW
	Wilkerson Park	S. Bentley		2401 Wade Ave	Raleigh	NC 27607	Sell to NC Green Power	Y	Solar	PV-RT	Existing	Completed	3.5 MWh	2.5 kW
EE-0-61	Bus Stop 1	M. Kennon		4104 Poole Rd.	Raleigh	NC 27610	energy put back into transit center	N	Solar	PV-RT	Existing	Completed	8.7 MWh	6.3 kW
EE-0-61	Bus Stop 2	M. Kennon						N	Solar	PV-RT	Existing	Completed	8.7 MWh	6.3 kW
EE-0-61	Bus Stop 3	M. Kennon						N	Solar	PV-RT	Existing	Completed	8.7 MWh	6.3 kW
EE-0-63	City of Raleigh Municipal Building	B. Jackson		222 West Hargett Street	Raleigh	NC 27602		N	Solar	Thermal	Existing	Completed	101.7 MWh	73.6 kW
EE-0-63	Fire Station 1	B. Jackson		220 South Dawson Street				N	Solar	Thermal	Existing	Completed	61.0 MWh	44.2 kW
EE-0-63	Fire Station 6	B. Jackson		2601 Fairview Road				N	Solar	Thermal	Existing	Completed	61.0 MWh	44.2 kW
EE-0-63	Fire Station 16	B. Jackson		5225 Lead Mine Road				N	Solar	Thermal	Existing	Completed	61.0 MWh	44.2 kW
EE-0-63	Fire Station 17	B. Jackson		4601 Pleasant Valley Road				N	Solar	Thermal	Existing	Completed	61.0 MWh	44.2 kW
EE-0-63	Fire Station 15	B. Jackson		1815 Spring Forest Road				N	Solar	Thermal	Existing	Completed	61.0 MWh	44.2 kW
	Wilder's Grove Solid Waste Services Center Main Building	B. Jackson, F. Battle	High	4120 New Bern Avenue	Raleigh	NC 27602	60 geothermal wells	N	Geothermal		In Progress			
	Wilder's Grove Solid Waste Services Center Wash Bay Roof	B. Jackson, F. Battle	High	4120 New Bern Avenue	Raleigh	NC 27602		N	Geothermal		In Progress			
	Neuse River Wastewater Treatment Plant	R. Massengill, G. Pollard	High	8500 Battle Bridge Road	Raleigh	NC 27610		Y	Solar	PV-GM	In Progress	Owner financing in progress	1795.9 MWh	1300.0 kW
	Raleigh Convention Center Rooftop	R. Hinson	High	500 Salisbury St.	Raleigh	NC 27601	Pending Investor Commitment	Y	Solar	PV-RT	In Progress		690.7 MWh	500.0 kW
	Raleigh Convention Center Charging Station	M. Barbour, N. Daniels	High	503 Salisbury St.	Raleigh	NC 27601		N	Solar	PV-RT	In Progress		4.1 MWh	3.0 kW
EE-0-64	Wilder's Grove Solid Waste Services Center Main Building	B. Jackson, F. Battle	High	4120 New Bern Avenue	Raleigh	NC 27602		N	Solar	PV-RT	In Progress		69.1 MWh	50.0 kW
EE-0-64	Wilder's Grove Solid Waste Services Center Wash Bay Roof	B. Jackson, F. Battle	High	4120 New Bern Avenue	Raleigh	NC 27602		N	Solar	PV-RT	In Progress		34.5 MWh	25.0 kW
	Wilder's Grove Solid Waste Services Center Main Building	B. Jackson, F. Battle	High	4120 New Bern Avenue	Raleigh	NC 27602		N	Solar	Thermal	In Progress		0.0 MWh	0.0 kW
Alternative Energy Facilities - Not Renewable Energy														
	Wilder's Grove Solid Waste Services Center Wash Bay Roof	B. Jackson, F. Battle	High	4120 New Bern Avenue	Raleigh	NC 27602	resuse of water for toilets		Reuse	Toilets	In Progress			
	Raleigh Convention Center	M. Barbour		500 Salisbury St.	Raleigh	NC 27601	use of treated contaminated water for resue in cooling tower		Reuse	Cooling	Proposed			
	Wilkerson Park	S. Bentley		2401 Wade Ave	Raleigh	NC 27607			EV Station		Existing	Completed		
	Wilmington Station Deck	M. Kennon		115 S Wilmington St	Raleigh	NC			EV Station		Existing	Completed		
	Performing Arts Center Deck	M. Kennon		128 W South St	Raleigh	NC			EV Station		Existing	Completed		
	City Center Deck	M. Kennon		429 S Wilmington Street					EV Station		Existing	Completed		
	Nash Square	B. Jackson		200 McDowell Street	Raleigh	NC 27601			EV Station		Existing	Completed		
	Raleigh Convention Center Charging Station	M. Barbour, N. Daniels	High	503 Salisbury St.	Raleigh	NC 27601	In design phase with PEC		EV Station		Proposed			
	Wilder's Grove Solid Waste Services Center Main Building	B. Jackson, F. Battle	High	4120 New Bern Avenue	Raleigh	NC 27602			EV Station		Proposed			
	Neuse River Wastewater Treatment Plant Farm Equipment Garage	R. Massengill, T. Woody	Medium	8500 Battle Bridge Road	Raleigh	NC 27610	Needs Evaluation for grid tie; Flex Solar?		EV Station		Proposed			
	Raleigh Convention Center Parking Deck	M. Barbour	Medium	501 Salisbury St.	Raleigh	NC 27601			EV Station		Proposed			

= Power equivalent





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