CHARLESTON GREEN PLAN INVENTORY & METRICS

2002 & 2006 City of Charleston Emissions Inventories
2009 Charleston Green Plan Reduction Metrics, Methodology & Analyses

Charleston Green Committee | City of Charleston

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I.

Charleston Green Plan
Greenhouse Gas Inventory
Data and Methodology
2002 and 2006

These notes were compiled for two purposes:

1. *To record data, methodology and assumptions for use in future years when assessing similar data to determine progress and*
2. *To allow readers the chance to offer suggestions for improving the data for future years.*

This data and these trends were the foundation for developing the City of Charleston's plan to address climate protection and sustainability. Visit www.charlestongreen.us to view the Charleston Green Plan and more information about the Charleston Green Committee.

In developing a climate protection and sustainability plan, one of the first tasks for the Green Committee was to understand more about greenhouse gases currently released within the City of Charleston. Armed with this information, the Green Committee's next task was to develop greenhouse gas reduction goals for 2030, 2050, and beyond.

To understand more about current emissions, the Committee relied on two inventories prepared by City staff, one for 2002 and one for 2006. These inventories show that the amount of greenhouse gases released in Charleston is increasing, though at a slower rate than Charleston's population growth. The City of Charleston is committed to updating this inventory by 2010 and to work toward an annual inventory to understand where successes and future challenges lie.

The Charleston Green Plan's overall emissions reduction goal relative to the 2002 inventory baseline is to achieve or exceed both a 30% reduction by 2030 and an 83% by 2050. Several quantifiable strategies have been identified to help reach this goal and are outlined in this document.

1. Citywide Data (within the City of Charleston)

a. Overall Emissions Projection and Reduction Goal

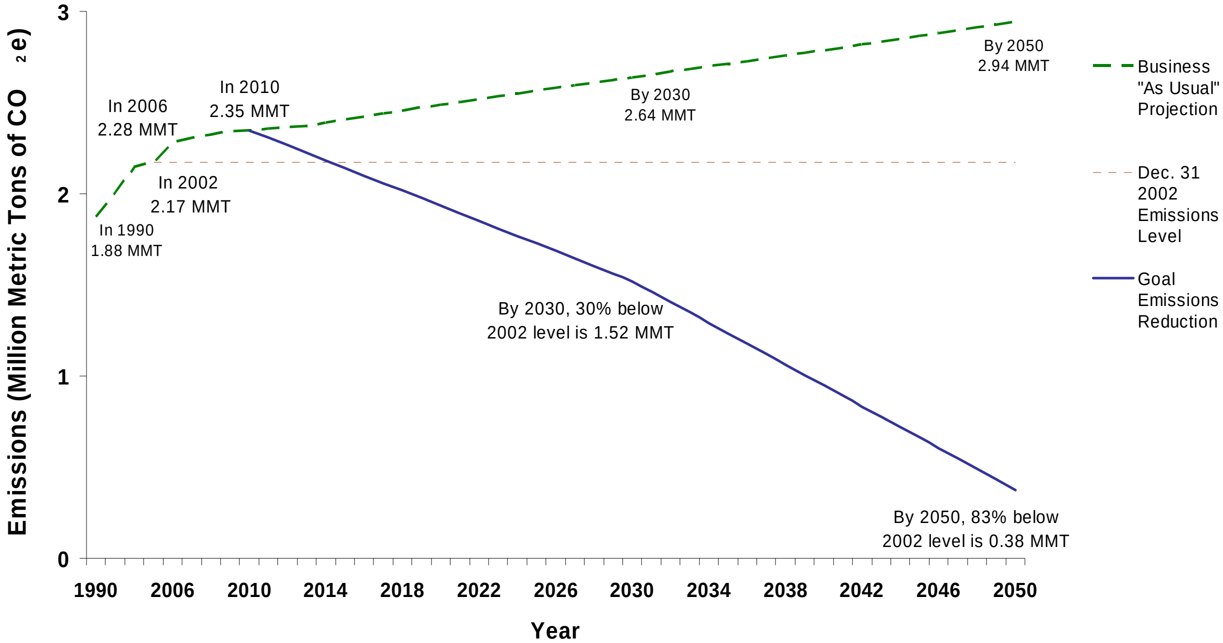


Figure 1

Note: The above graph illustrates data collected for 2002 and 2006 inventories. Data shown prior to 2002 is estimated based on historical predictions and 2000 and 1990 Census Data. Data shown after 2006 is extrapolated based on "business as usual" measures and anticipated population growth.

Current Emissions (Citywide)

- **Buildings** includes energy use in residential, commercial, government, and industrial buildings, including water treatment and delivery.
- **Transportation** includes emissions from cars, motorcycles, and trucks, but not boats, ships, or rail, whose contributions could not easily be estimated.
- **Waste** includes landfill and incinerator emissions from residential, commercial, and government waste picked up by City haulers.
- **Other** includes direct emissions from industries that are not fully captured by the above categories.

Citywide greenhouse gas emissions increased 5% between 2002 and 2006 while the City's population grew 13.4%.

In addition to showing an increase in citywide greenhouse gases, the inventories also showed which activities produce these emissions.

Buildings and related energy use release the most greenhouse gases - 58% of the citywide total. Transportation runs a close second, contributing 40% of citywide greenhouse gases.

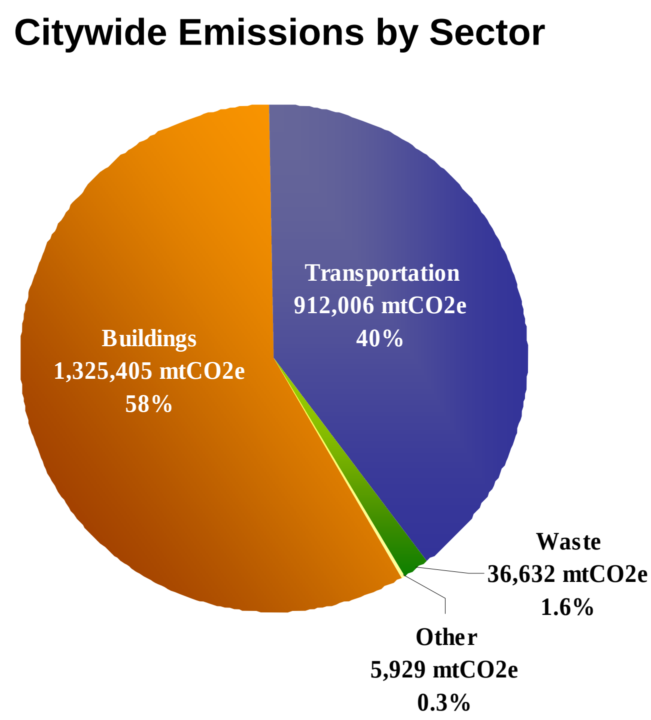


Figure 2

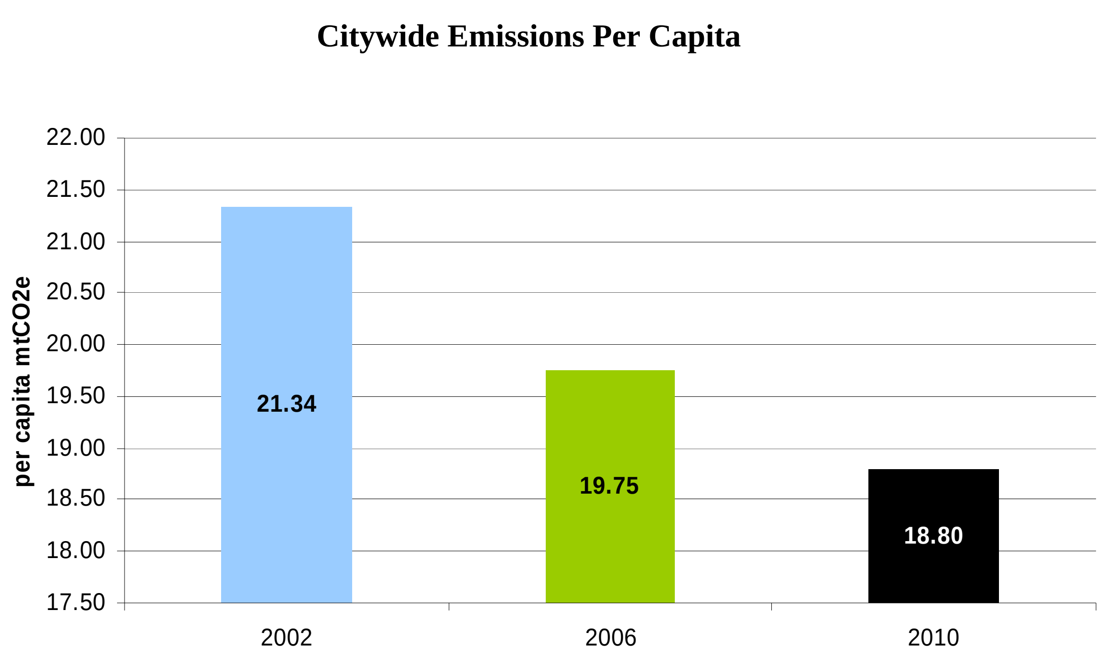


Figure 3

Source: City of Charleston Planning, Preservation, and Sustainability Dept. and CACP Software

Citywide Emissions by Sector

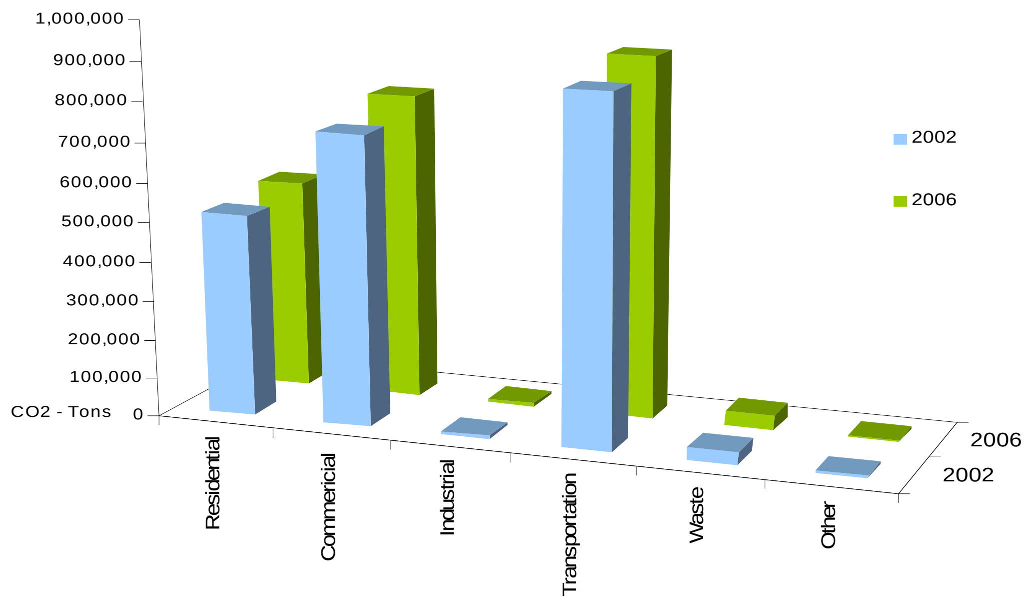


Figure 4

Sources: South Carolina Electric and Gas, Berkeley Electric, City of Charleston Department of Planning, Preservation and Economic Innovation, SC DHEC, Bee's Ferry Landfill, Montenay Charleston Resource Recovery, and CACP Software

Citywide Emissions by Sector 2006

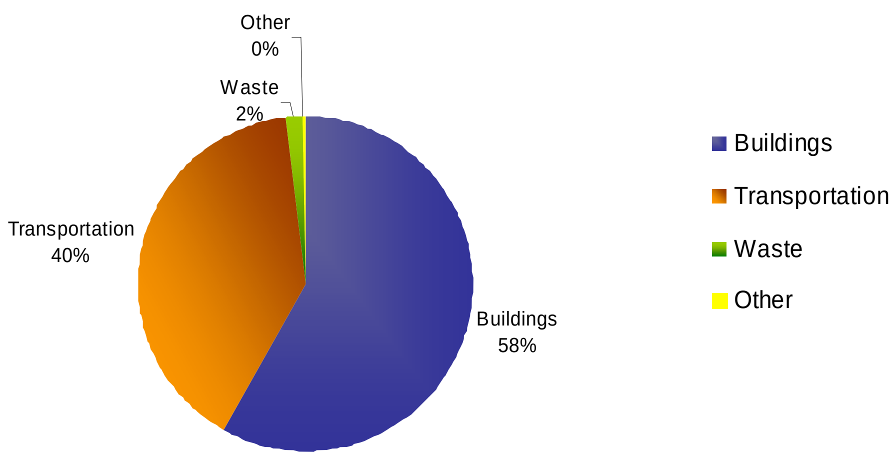


Figure 5

Sources: South Carolina Electric and Gas, Berkeley Electric, City of Charleston Department of Planning, Preservation and Economic Innovation, SC DHEC, Bee's Ferry Landfill, Montenay Charleston Resource Recovery, Inc. and CACP Software

b. Residential, Commercial, and Industrial Energy Use

These three categories of data were gathered from South Carolina Energy and Gas (SCE&G). SCE&G put together the spreadsheet below (Table 1). Commercial/industrial was entered as commercial. All data is from revenue districts found within the City of Charleston.

Table 1

REVENUE DISTRICT	RATE PLAN #	Act. Ty. CD.	Account Type	2002 Year	2002 KWH	2002 THERMS	2006 Year	2006 KWH	2006 THERMS
481	002	C	COMMERCIAL / INDUSTRIAL	2002	2308	0.00000	2006	537	0.00000
481	003	C	COMMERCIAL / INDUSTRIAL	2002	10009590	0.00000	2006	7863326	0.00000
482	003	C	COMMERCIAL / INDUSTRIAL	2002	531	0.00000	2006	637	0.00000
481	008	C	COMMERCIAL / INDUSTRIAL	2002	841088	0.00000	2006	458828	0.00000
481	009	C	COMMERCIAL / INDUSTRIAL	2002	210943153	0.00000	2006	213415389	0.00000
482	009	C	COMMERCIAL / INDUSTRIAL	2002	541966	0.00000	2006	1579617	0.00000
481	010	C	COMMERCIAL / INDUSTRIAL	2002	665586	0.00000	2006	644600	0.00000
482	010	C	COMMERCIAL / INDUSTRIAL	2002	173	0.00000	2006	8518	0.00000
481	012	C	COMMERCIAL / INDUSTRIAL	2002	15882808	0.00000	2006	16113573	0.00000
482	012	C	COMMERCIAL / INDUSTRIAL	2002	0	0	2006	10253	0.00000
481	016	C	COMMERCIAL / INDUSTRIAL	2002	96720	0.00000	2006	91262	0.00000
481	017	C	COMMERCIAL / INDUSTRIAL	2002	7835389	0.00000	2006	9630288	0.00000
481	018	C	COMMERCIAL / INDUSTRIAL	2002	173140	0.00000	2006	1191023	0.00000
481	020	C	COMMERCIAL / INDUSTRIAL	2002	326346090	0.00000	2006	280411180	0.00000
482	020	C	COMMERCIAL / INDUSTRIAL	2002	960600	0.00000	2006	0	0
481	021	C	COMMERCIAL / INDUSTRIAL	2002	2452910	0.00000	2006	4812983	0.00000
481	022	C	COMMERCIAL / INDUSTRIAL	2002	20733781	0.00000	2006	18897784	0.00000
481	023	C	COMMERCIAL / INDUSTRIAL	2002	205800	0.00000	2006	0	0
481	024	C	COMMERCIAL / INDUSTRIAL	2002	301297062	0.00000	2006	372504386	0.00000
481	025	C	COMMERCIAL / INDUSTRIAL	2002	5958587	0.00000	2006	5904443	0.00000
482	025	C	COMMERCIAL / INDUSTRIAL	2002	25584	0.00000	2006	38597	0.00000
481	026	C	COMMERCIAL / INDUSTRIAL	2002	1161277	0.00000	2006	1073800	0.00000
482	026	C	COMMERCIAL / INDUSTRIAL	2002	36681	0.00000	2006	36264	0.00000
481	029	C	COMMERCIAL / INDUSTRIAL	2002	1155289	0.00000	2006	1125345	0.00000
482	029	C	COMMERCIAL / INDUSTRIAL	2002	19656	0.00000	2006	19656	0.00000
481	031	C	COMMERCIAL / INDUSTRIAL	2002	0	5737410.33700	2006	0	1273445.52000

482	031	C	COMMERCIAL/INDUSTRIAL	2002	0	92693.27600	2006	0	5222.19500
481	032	C	COMMERCIAL/INDUSTRIAL	2002	0	10929.27800	2006	0	0
481	033	C	COMMERCIAL/INDUSTRIAL	2002	0	0	2006	0	4578510.07700
481	035	C	COMMERCIAL/INDUSTRIAL	2002	0	0.00000	2006	0	0.00000
481	036	C	COMMERCIAL/INDUSTRIAL	2002	0	0.00000	2006	0	0
481	049	C	COMMERCIAL/INDUSTRIAL	2002	0	10860.00000	2006	0	10860.00000
481	062	C	COMMERCIAL/INDUSTRIAL	2002	337424	0.00000	2006	19647	0.00000
481	064	C	COMMERCIAL/INDUSTRIAL	2002	2054	0.00000	2006	0	0
481	067	C	COMMERCIAL/INDUSTRIAL	2002	340634	0.00000	2006	215854	0.00000
481	077	C	COMMERCIAL/INDUSTRIAL	2002	1400	0.00000	2006	0	0
481	079	C	COMMERCIAL/INDUSTRIAL	2002	0	0.00000	2006	0	0.00000
481	09D	C	COMMERCIAL/INDUSTRIAL	2002	12071783	0.00000	2006	11899094	0.00000
482	09D	C	COMMERCIAL/INDUSTRIAL	2002	67360	0.00000	2006	1501350	0.00000
481	20T	C	COMMERCIAL/INDUSTRIAL	2002	7028400	0.00000	2006	887840	0.00000
481	21A	C	COMMERCIAL/INDUSTRIAL	2002	0	0	2006	46442060	0.00000
481	261	C	COMMERCIAL/INDUSTRIAL	2002	0	0	2006	0	0.00000
481	32S	C	COMMERCIAL/INDUSTRIAL	2002	0	0	2006	0	3933.01000
481	32V	C	COMMERCIAL/INDUSTRIAL	2002	0	0	2006	0	433.73500
481	36S	C	COMMERCIAL/INDUSTRIAL	2002	0	0	2006	0	4680.00000
481	650	C	COMMERCIAL/INDUSTRIAL	2002	0	0	2006	0	0.00000
481	69A	C	COMMERCIAL/INDUSTRIAL	2002	1920	0.00000	2006	3809	0.00000
			Total		927196744	5851892.89100		996801943	5877084.53700
481	009	I	INDUSTRIAL	2002	13280	0.00000	2006	168964	0.00000
481	020	I	INDUSTRIAL	2002	1504120	0.00000	2006	1147800	0.00000
481	023	I	INDUSTRIAL	2002	4691830	0.00000	2006	4842335	0.00000
481	024	I	INDUSTRIAL	2002	3982035	0.00000	2006	4269782	0.00000
481	031	I	INDUSTRIAL	2002	0	0	2006	0	427.75600
481	035	I	INDUSTRIAL	2002	0	0.00000	2006	0	0.00000
481	061	I	INDUSTRIAL	2002	0	0.00000	2006	0	0.00000
482	09D	I	INDUSTRIAL	2002	971460	0.00000	2006	0	0
481	260	I	INDUSTRIAL	2002	0	0.00000	2006	0	0.00000
481	261	I	INDUSTRIAL	2002	0	0.00000	2006	0	0.00000
481	452	I	INDUSTRIAL	2002	0	0.00000	2006	0	0
481	550	I	INDUSTRIAL	2002	0	0.00000	2006	0	0

481	650	I	INDUSTRIAL	2002	0	0.00000	2006	0	0.00000
481	655	I	INDUSTRIAL	2002	0	0.00000	2006	0	0.00000
			Total		11162725	0.00000		10428881	427.75600
481	001	R	RESIDENTIAL	2002	26709058	0.00000	2006	26294214	0.00000
481	002	R	RESIDENTIAL	2002	2508138	0.00000	2006	1960546	0.00000
482	002	R	RESIDENTIAL	2002	14588	0.00000	2006	1250	0.00000
481	005	R	RESIDENTIAL	2002	115361	0.00000	2006	132906	0.00000
481	006	R	RESIDENTIAL	2002	36892102	0.00000	2006	41929232	0.00000
481	008	R	RESIDENTIAL	2002	508230058	0.00000	2006	532064633	0.00000
482	008	R	RESIDENTIAL	2002	1974633	0.00000	2006	3535016	0.00000
481	009	R	RESIDENTIAL	2002	372737	0.00000	2006	175392	0.00000
481	010	R	RESIDENTIAL	2002	25	0.00000	2006	0	0
481	018	R	RESIDENTIAL	2002	1553	0.00000	2006	101714	0.00000
481	022	R	RESIDENTIAL	2002	935	0.00000	2006	0	0
481	025	R	RESIDENTIAL	2002	28720	0.00000	2006	26364	0.00000
481	026	R	RESIDENTIAL	2002	446046	0.00000	2006	447974	0.00000
482	026	R	RESIDENTIAL	2002	756	0.00000	2006	754	0.00000
481	031	R	RESIDENTIAL	2002	0	9822.35000	2006	0	2868.38400
481	032	R	RESIDENTIAL	2002	0	10028483.60600	2006	0	0
482	032	R	RESIDENTIAL	2002	0	4162.21500	2006	0	0
481	036	R	RESIDENTIAL	2002	0	0.00000	2006	0	0
481	062	R	RESIDENTIAL	2002	11174	0.00000	2006	540	0.00000
481	064	R	RESIDENTIAL	2002	1500185	0.00000	2006	1702081	0.00000
481	067	R	RESIDENTIAL	2002	25407	0.00000	2006	32688	0.00000
481	32B	R	RESIDENTIAL	2002	0	1819.10200	2006	0	27.04400
481	32S	R	RESIDENTIAL	2002	0	0	2006	0	3936977.87000
482	32S	R	RESIDENTIAL	2002	0	0	2006	0	1570.01900
481	32V	R	RESIDENTIAL	2002	0	0	2006	0	5473736.99500
482	32V	R	RESIDENTIAL	2002	0	0	2006	0	425.47100
481	36S	R	RESIDENTIAL	2002	0	0	2006	0	180.00000
481	69A	R	RESIDENTIAL	2002	444	0.00000	2006	444	0.00000
481	69B	R	RESIDENTIAL	2002	11277	0.00000	2006	9987	0.00000
			Total	**2002**	**578843197**	**10044287.27300**	**2006**	**608415735**	**9415785.78300**

Berkeley Electric also provides a small amount of electricity to Charleston residents.

2002 Data:

Community Energy Usage: 20,000,000 kWh

2006 Data:

Community Energy Usage: 32,975,000 kWh

*Berkeley Electric data was collected in the inventory. However, this data was not used in the metrics because their numbers are unreliable estimations, and a very small percentage of Charleston's energy use. This omitted data leaves out a negligible amount of uncalculated potential CO2 reductions on some metrics.

Citywide Buildings Emissions in Tons of CO2e

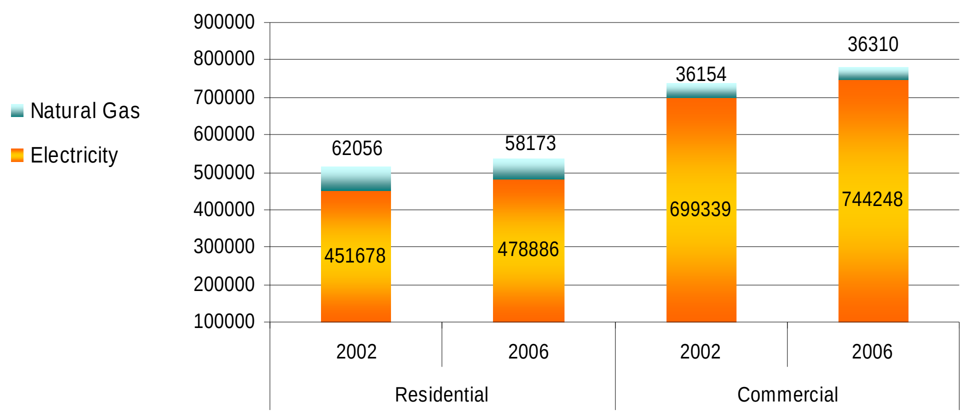


Figure 6

Sources: South Carolina Electric and Gas, Berkeley Electric Cooperative, and CACP Software

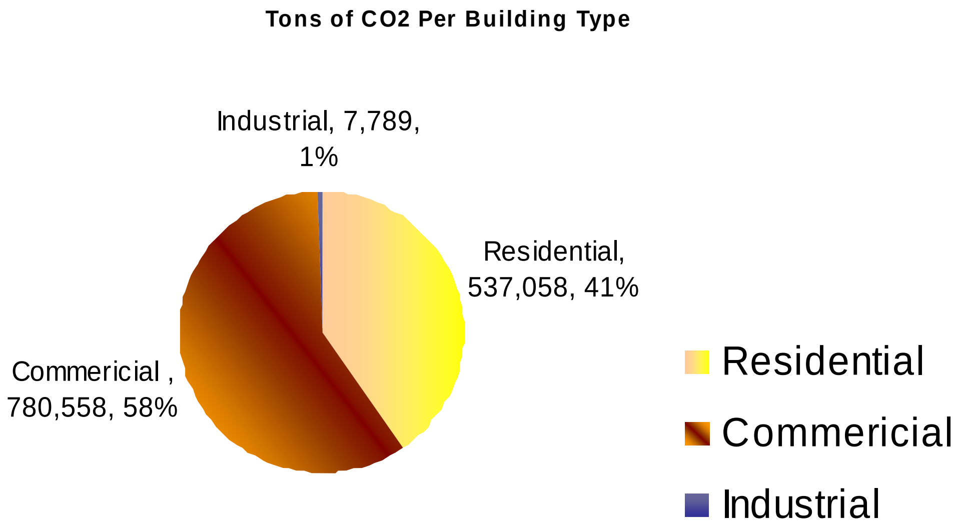


Figure 7
Sources: South Carolina Electric and Gas, Berkeley Electric Cooperative, and CACP Software

c. Transportation

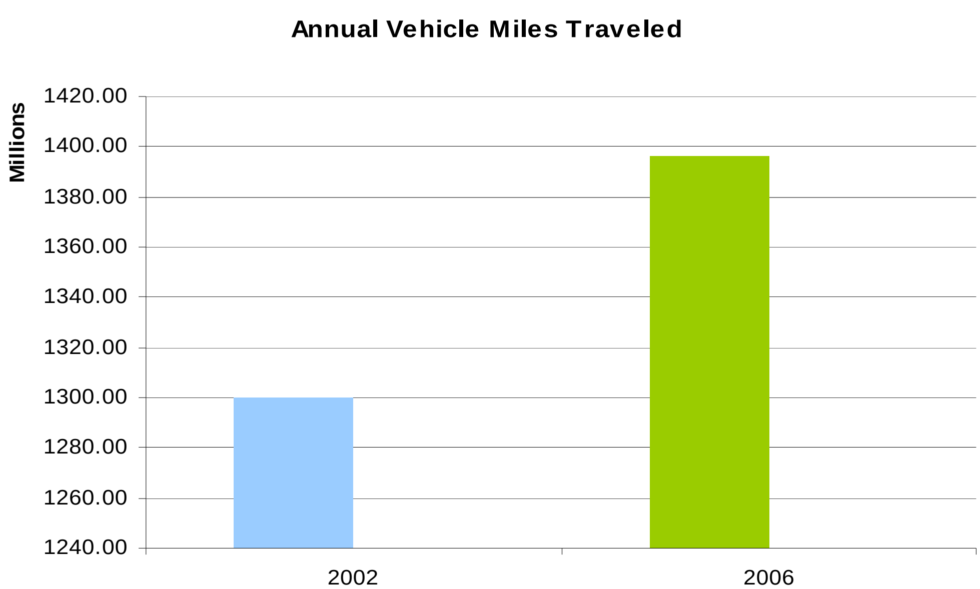


Figure 8
Source: BCD-COG and City of Charleston Planning, Preservation, and Sustainability Dept.

In order to enter transportation data, we had to obtain the City's annual Vehicle Miles Traveled (VMT). Unfortunately, this data is only compiled at the county level (by the BCD Council of Governments). We first tried to get around this by looking at the Average Annual Daily Traffic (AADT) counts for roads within the City of Charleston (from South Carolina Department of Transportation) because the CACP program has a calculator which coverts AADT to VMT. This ended up not working out because the SCDOT only keeps tracks of the high volume roads so our numbers, when multiplied for all the miles of roads in the City, were way too high. We finally decided to use the VMT number from BCDCOG and divided it by the percentage of roads that are within the City limits. Philip Overcash from the City of Charleston's Department of Planning, Preservation and Economic Innovation used Geographic Information Systems (GIS) to determine the percentage of roads in Charleston and Berkley County that are within the City limits. However, he noted that this number "may not be a true representation of VMT for Charleston. The reason being: most miles traveled are in or near the urban area and while we can separate out percent of City streets from the total, we cannot separate out how many VMT were assigned to the ones actually in our jurisdiction." Thus these numbers may be conservative estimates. He pointed this out to BCDCOG and they said in the future they can build jurisdiction into the road centerline data in their modeling software and be able to get a very accurate number. Please see Figure 4 for the Annual VMT for 2002 and 2006.

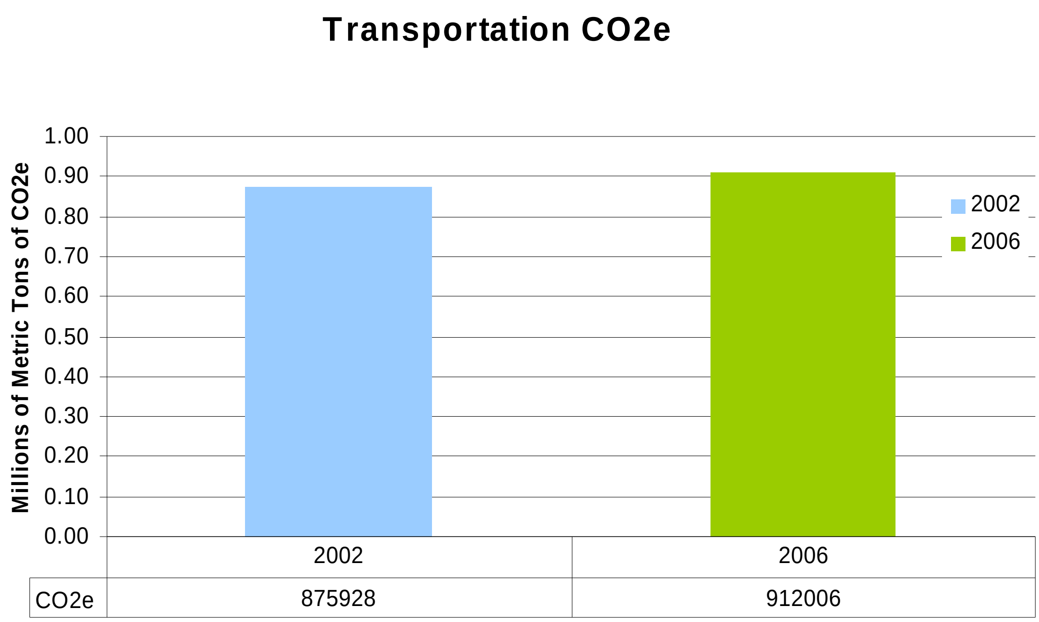


Figure 9

Source: BCD-COG, City of Charleston Planning, Preservation, and Sustainability Dept., and CACP software

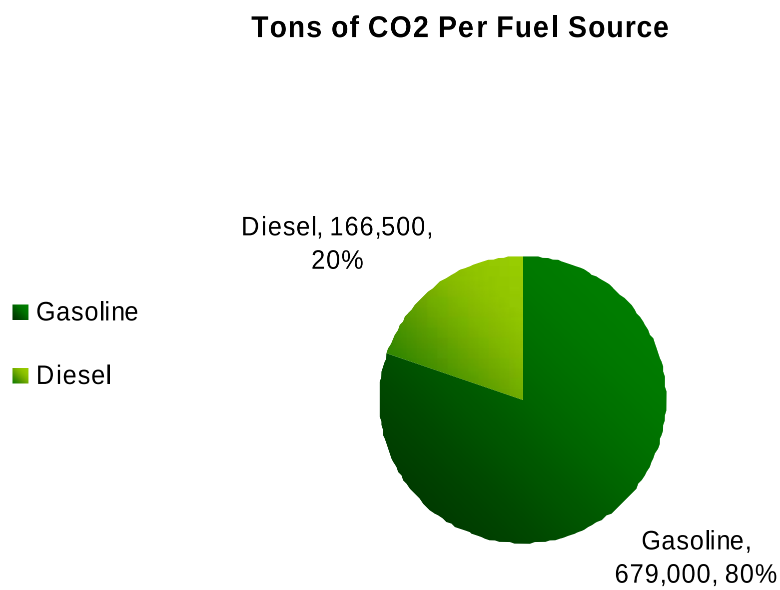


Figure 10

Source: BCD-COG, and CACP Software

d. Waste

Waste data was collected from two sources, Bees Ferry Landfill (Table 2 and 3) and the Incinerator (Figure 7). Each source gave us the amount of garbage in tons from the City of Charleston. Bees Ferry Landfill also had all of the City's garbage categorized which proved to be very helpful because the CACP program requires you input the makeup of the waste by a percentage. The CACP program uses the categories paper, food waste, plant debris, wood/textile and other. The landfill uses somewhat different categories; however, Bees Ferry assisted us in matching up their categories to the program's categories. You can see in Table 2, 2.1, 3 and 3.1 how this was done. Since the incinerator does not keep track of what kind of waste it takes, we used the same percentages from the landfill when inputting this data. Figure 7 depicts the incinerator data. You will see that 2002 was unusually high volume year. The representative we spoke with could not explain this so we decided to average 2001 and 2003 and use that number instead of the actual number for 2002.

Table 2

2002 Bees Ferry Landfill Data			
Landfill Category	CACP Software Category	Tons	% of Total
Yard Waste	Plant Debris	5,205.35	12.96%
Tree Debris	Plant Debris	863.15	2.15%
MSW	Wood/Textile (75%)	1,118.28	2.78%
	Paper (25%)	372.76	0.93%
C&D	Wood/Textile	7,574.08	18.86%
Concrete	Other	2,574.35	6.41%

Pallets	Wood/Textile	3.17	0.01%
Metal	Other	857.36	2.13%
Soil (cover)	Other	94.35	0.23%
Soil (Buried)	Other	3,255.42	8.10%
Code One –Animals	Other	2.00	0.00%
Tires	Other	18.71	0.05%
Compost	Other	8.71	0.02%
Garbage	Food Waste	8,326.64	20.73%
	Plant Debris (50%)	354.24	0.88%
Mixed (C&D w/ vegetation)	Wood/Textile (50%)	354.23	0.88%
Tires (no charge)	Other	6.82	0.02%
Yard Waste – Bags	Plant Debris	4.01	0.01%
Xmas Trees	Plant Debris	21.91	0.05%
TV	Other	5.26	0.01%
Free Tire Residential	Other	1.78	0.00%
Yard Waste- C&D	Plant Debris	8,294.55	20.65%
Tree Debris- C&D	Plant Debris	130.32	0.32%
C&D to MSW	Wood/Textile	718.75	1.79%
	TOTAL	40,166.20	100.00%

Table 2.1

Totals by Categories		
Category	Tons	%
Paper Product Subtotal	372.76	0.93%
Food Waste Subtotal	8,326.64	20.73%
Plant Debris Subtotal	14,873.53	37.03%
Wood/Textile Subtotal	9,768.51	24.32%
Other Subtotal	6,824.76	16.99%
TOTAL	40,166.20	100.00%

Table 3

2006 Bees Ferry Landfill Data			
Landfill Category	CACP Software Category	Tons	% of Total
Yard Waste	Plant Debris	6,299.38	13.95%
MSW	Wood/Textile (75%)	1,399.31	3.10%
	Paper (25%)	466.44	1.03%
C&D	Wood/Textile	7,333.85	16.24%
Concrete	Other	769.31	1.70%
Metal	Other	11.39	0.03%
Soil (cover)	Other	1,356.76	3.00%
Soil (Buried)	Other	3,395.96	7.52%
Code One -Animals	Other	2.00	0.00%
Garbage	Food Waste	9,428.47	20.88%
	Plant Debris (50%)	395.12	0.88%
Mixed (C&D w/ vegetation)	Wood/Textile (50%)	395.12	0.88%
Tires (no charge)	Other	7.57	0.02%
Yard Waste- C&D	Plant Debris	11,505.45	25.48%
Tree Debris- C&D	Plant Debris	328.32	0.73%
C&D to MSW	Wood/Textile	2,059.95	4.56%
	TOTAL	45,154.38	100.00%

Table 3.1

Totals by Categories

Category	Tons	%
Paper Product Subtotal	466.44	1.03%
Food Waste Subtotal	9,428.47	20.88%
Plant Debris Subtotal	18,528.27	41.03%
Wood/Textile Subtotal	11,188.22	24.78%
Other Subtotal	5,542.99	12.28%
TOTAL	45,154.38	100.00%

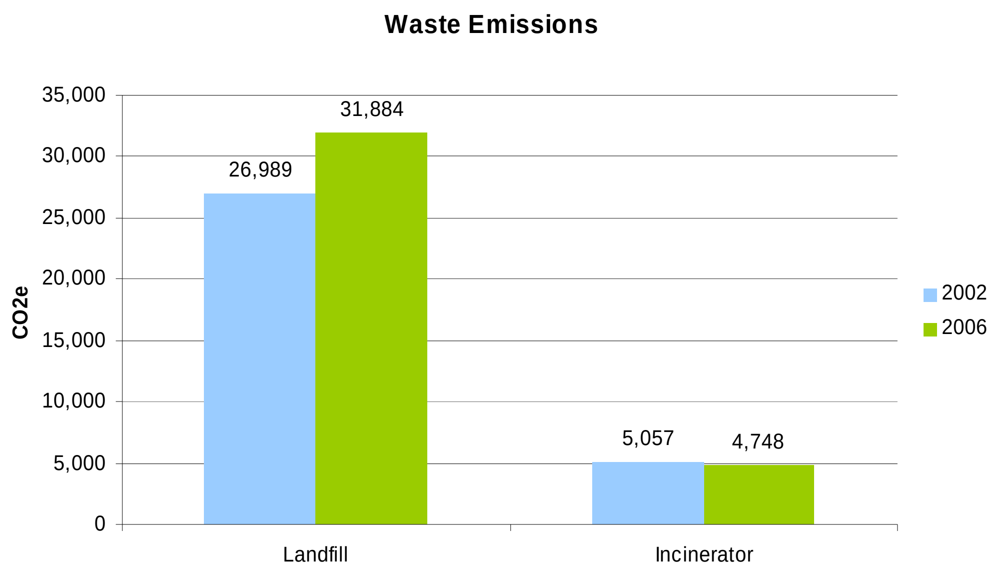


Figure 11
Sources: City of Charleston Department of Planning, Preservation and Economic Innovation, Bee's Ferry Landfill, Montenay Charleston Resource Recovery, Inc., and CACP Software

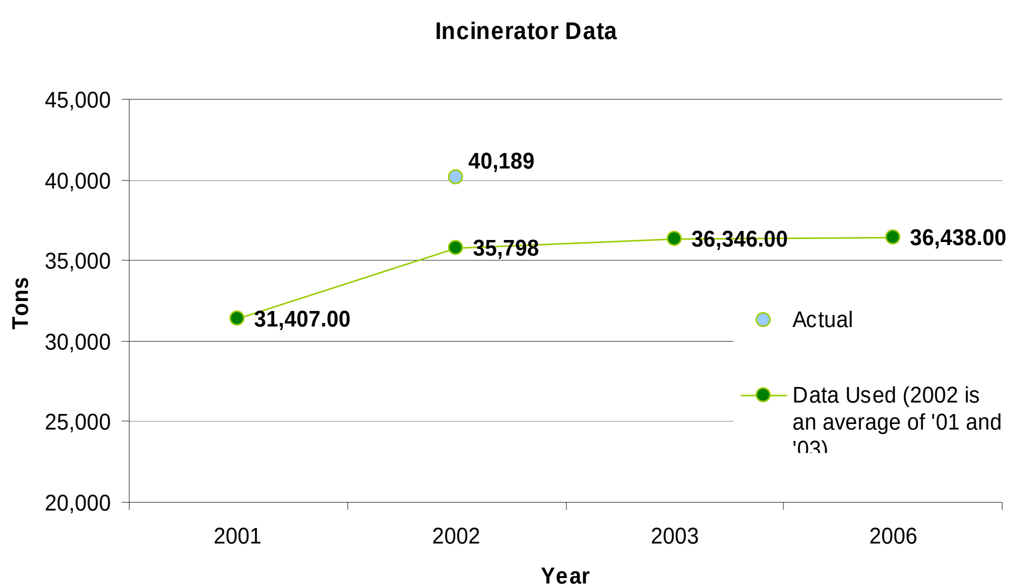


Figure 12
Sources: City of Charleston Department of Planning, Preservation and Economic Innovation, Montenay Charleston Resource Recovery, Inc. and CACP Software

e. Other

This category is primarily used for direct emission sources. After speaking with South Carolina Department of Health and Environment (DHEC), we decide to include certain industries that directly emitted greenhouse gasses. DHEC put together the following spreadsheet for 2001 (Table 4) and 2005 (Table 5). They did not have very accurate data for 2002 and 2006 so we went with these years instead. It is also important to note that these are estimates. The EPA does not require industries to report Carbon Dioxide or Methane emissions so DHEC uses a model to estimate these emissions based on other pollutants.

Table 4

DHEC Industrial Direct Emissions

Year	2002	2006
Emissions (CO2e)	5,929	5,929

Table 5

Year 1	Name	Street	Facility I.D.	Est. Emissions - Ton/yr	Description
2001	RHODIA CHARLESTON	2151 KING STREET EXTENSION	0560-0011	0.22975	METHANE
2001	RHODIA CHARLESTON	2151 KING STREET EXTENSION	0560-0011	11323.16	CO2
2001	ALLIED TERMINAL GREENLEAF STREET	1500 GREENLEAF STREET	0560-0015	0.14996	METHANE
2001	ALLIED TERMINAL GREENLEAF STREET	1500 GREENLEAF STREET	0560-0015	6847.39	CO2
2001	SCE&G HAGOOD	2200 HAGOOD ROAD	0560-0029	1.124595	METHANE
2001	SCE&G HAGOOD	2200 HAGOOD ROAD	0560-0029	12838	CO2
2001	NORTH SAFETY PRODUCTS:CHARLESTON PLANT1	4090 AZALEA DRIVE	0560-0032	0.128491	METHANE
2001	NORTH SAFETY PRODUCTS:CHARLESTON PLANT1	4090 AZALEA DRIVE	0560-0032	6771.369	CO2
2001	US VA HOSPITAL:CHARLESTON	109 BEE ST	0560-0047	0.033909	METHANE
2001	US VA HOSPITAL:CHARLESTON	109 BEE ST	0560-0047	1789.568	CO2
2001	STARRETT COMPANY-EVANS RULE DIVISION	6555 FAIN STREET	0560-0070	0.01556	METHANE
2001	STARRETT COMPANY-EVANS RULE DIVISION	6555 FAIN STREET	0560-0070	811.8	CO2

2001	POST AND COURIER	134 COLUMBUS STREET	0560-0071	0.003016	METHANE
2001	POST AND COURIER	134 COLUMBUS STREET	0560-0071	157.248	CO2
2001	INDUSTRIAL CONTAINER SERVICES	2819 INDUSTRIAL AVENUE	0560-0081	0.065137	METHANE
2001	INDUSTRIAL CONTAINER SERVICES	2819 INDUSTRIAL AVENUE	0560-0081	3398.46	CO2
2001	NORTH SAFETY PRODUCTS:PLANT 2	4295 ATLANTA STREET	0560-0166	0.002064	METHANE
2001	NORTH SAFETY PRODUCTS:PLANT 2	4295 ATLANTA STREET	0560-0166	107.7	CO2
2001	FELIX C. DAVIS WWTP (N. CHARLESTON SD)	1000 HERBERT STREET	0560-0190	0.982742	METHANE
2001	FELIX C. DAVIS WWTP (N. CHARLESTON SD)	1000 HERBERT STREET	0560-0190	875.4757	CO2
2001	BON SECOURS:ST FRANCIS	2095 HENRY TECKLENBURG DR	0560-0242	0.075719	METHANE
2001	BON SECOURS:ST FRANCIS	2095 HENRY TECKLENBURG DR	0560-0242	3979.354	CO2
2001	CHARLESTON MARINE CONTAINERS	2301 AVENUE D	0560-0252	2.68E-04	METHANE
2001	CHARLESTON MARINE CONTAINERS	2301 AVENUE D	0560-0252	13.98	CO2
2001	PALMETTO LIME CHARLESTON PLANT-CLOSED	1385 GREENLEAF STREET	0560-0262	0	METHANE
2001	PALMETTO LIME CHARLESTON PLANT-CLOSED	1385 GREENLEAF STREET	0560-0262	0	CO2
2001	SCE&G FABER PLACE	3680 LEEDS AVENUE	0560-0305	0.007656	METHANE
2001	SCE&G FABER PLACE	3680 LEEDS AVENUE	0560-0305	97.9506	CO2
2001	CUMMINS MERCRUISER DIESEL	4500 LEEDS AVE SUITE 500	0560-0361	0.003613	METHANE
2001	CUMMINS MERCRUISER DIESEL	4500 LEEDS AVE SUITE 500	0560-0361	188.498	CO2

Total Methane	2.82
Total CO2	49,199.95

Table 6

Year 2	Name	Street	Facility I.D.	Est. Emissions - Ton/yr	Description
2005	RHODIA CHARLESTON	2151 KING ST EXT	0560-0011	0.459185	METHANE
2005	RHODIA CHARLESTON	2151 KING ST EXT	0560-0011	14819.72	CO2
2005	KINDER MORGAN SHIPYARD RIVER TERMINAL SO	1500 GREENLEAF ST	0560-0015	0.029804	METHANE
2005	KINDER MORGAN SHIPYARD RIVER TERMINAL SO	1500 GREENLEAF ST	0560-0015	1551.416	CO2
2005	SCE&G HAGOOD	2200 HAGOOD RD	0560-0029	0.000622	METHANE
2005	SCE&G HAGOOD	2200 HAGOOD RD	0560-0029	20284.14	CO2
2005	SALISBURY ELECTRICAL SAFETY LLC	4090 AZALEA DR	0560-0032	0.110589	METHANE
2005	SALISBURY ELECTRICAL SAFETY LLC	4090 AZALEA DR	0560-0032	6174.826	CO2
2005	US VA HOSPITAL:CHARLESTON	109 BEE ST	0560-0047	0.033909	METHANE
2005	US VA HOSPITAL:CHARLESTON	109 BEE ST	0560-0047	1789.568	CO2
2005	STARRETT COMPANY-EVANS RULE DIVISION	6555 FAIN ST	0560-0070	0.01556	METHANE
2005	STARRETT COMPANY-EVANS RULE DIVISION	6555 FAIN ST	0560-0070	811.8	CO2
2005	POST AND COURIER	134 COLUMBUS ST	0560-0071	0.003016	METHANE
2005	POST AND COURIER	134 COLUMBUS ST	0560-0071	157.248	CO2
2005	INDUSTRIAL CONTAINER SERVICES	2819 INDUSTRIAL AVE	0560-0081	0.04125	METHANE
2005	INDUSTRIAL CONTAINER SERVICES	2819 INDUSTRIAL AVE	0560-0081	2152.181	CO2
2005	SALISBURY ELECTRICAL SAFETY LLC	4295 ATLANTA ST	0560-0166	0.058078	METHANE
2005	SALISBURY ELECTRICAL SAFETY LLC	4295 ATLANTA ST	0560-0166	3159.423	CO2
2005	NORTH CHARLESTON SEWER DISTRICT	1000 HERBERT ST	0560-0190	0.982742	METHANE
2005	NORTH CHARLESTON SEWER DISTRICT	1000 HERBERT ST	0560-0190	875.4757	CO2
2005	BON SECOURS:ST FRANCIS	2095 HENRY TECKLENBURG DR	0560-0242	0.075719	METHANE
2005	BON SECOURS:ST FRANCIS	2095 HENRY TECKLENBURG DR	0560-0242	3979.354	CO2
2005	SCE&G FABER PLACE	3680 LEEDS AVE	0560-0305	2.62E-06	METHANE
2005	SCE&G FABER PLACE	3680 LEEDS AVE	0560-0305	0.481787	CO2
2005	CUMMINS MERCRUISER DIESEL	4500 LEEDS AVE STE 500	0560-0361	0.003613	METHANE
2005	CUMMINS MERCRUISER DIESEL	4500 LEEDS AVE STE 500	0560-0361	188.498	CO2
			Total Methane		1.81
			Total CO2		55944.13149

2. Government (City of Charleston)

a. Overall

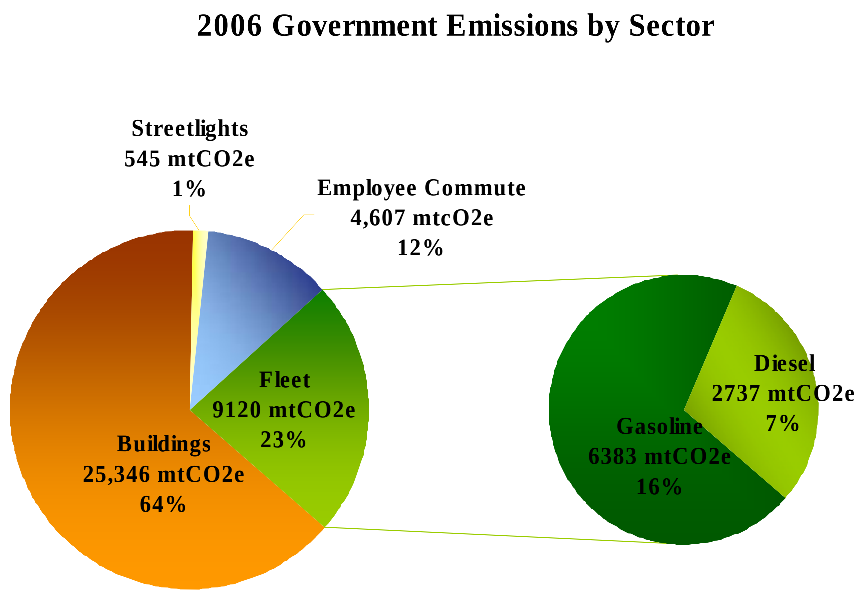


Figure 13

Sources: South Carolina Electric and Gas, City of Charleston, and CACP Software

Total Municipal Emissions 2002 = 38,046
Total Municipal Emissions 2006 = 39,391

Current Emissions (City Government)

City buildings and streetlights include all City offices and facilities, as well as all street lighting.

City vehicle fleet includes all City cars, trucks, cars, police vehicles and construction equipment.

City employee commute includes all employee transportation to and from work.

In addition to looking at emissions across the whole community, the inventories also looked specifically at Charleston municipal government emissions. Similar to emissions for the whole city, municipal government emissions are primarily from buildings and related energy use, with the rest of the emissions mostly related to transportation.

b. Buildings and Streetlights

This information was gathered from SCE&G who maintains all municipal accounts. Table 6 and 7 are the municipal buildings for 2002 and 2006 and Table 8 and 9 are municipal streetlights for 2002 and 2006.

Table 7

2002 MUNICIPAL BUILIDINGS		
ACCT TYP DESC	KWH	THERMS (NAT. GAS)
COMMERCIAL/INDUSTRIAL	44,090.00	0.00
COMMERCIAL/INDUSTRIAL	5,343,220.00	0.00
COMMERCIAL/INDUSTRIAL	39,748.00	0.00
COMMERCIAL/INDUSTRIAL	170,600.00	0.00
COMMERCIAL/INDUSTRIAL	13,028.00	0.00
COMMERCIAL/INDUSTRIAL	29,955.00	0.00
COMMERCIAL/INDUSTRIAL	319,540.00	0.00
COMMERCIAL/INDUSTRIAL	37,654.00	0.00
COMMERCIAL/INDUSTRIAL	38,043.00	0.00
COMMERCIAL/INDUSTRIAL	38.00	0.00
COMMERCIAL/INDUSTRIAL	7,814,257.00	0.00
COMMERCIAL/INDUSTRIAL	40,800.00	0.00
COMMERCIAL/INDUSTRIAL	4,811,270.00	0.00
COMMERCIAL/INDUSTRIAL	440,811.00	0.00
COMMERCIAL/INDUSTRIAL	1,728.00	0.00
COMMERCIAL/INDUSTRIAL	8,640.00	0.00
COMMERCIAL/INDUSTRIAL	540.00	0.00
COMMERCIAL/INDUSTRIAL	69,174.00	0.00
COMMERCIAL/INDUSTRIAL	1,836.00	0.00
COMMERCIAL/INDUSTRIAL	16,800.00	0.00
COMMERCIAL/INDUSTRIAL	0.00	112,219.69
COMMERCIAL/INDUSTRIAL	0.00	1,368.43
COMMERCIAL/INDUSTRIAL	0.00	535.20
COMMERCIAL/INDUSTRIAL	0.00	366.27
COMMERCIAL/INDUSTRIAL	0.00	10,680.00
COMMERCIAL/INDUSTRIAL	26,784.00	0.00
RESIDENTIAL	3.00	0.00
RESIDENTIAL	33,722.00	0.00
RESIDENTIAL	0.00	137.26
WHOLESALE	32,926.00	0.00
WHOLESALE	5,334,995.00	0.00
WHOLESALE	82,555.00	0.00
WHOLESALE	80,800.00	0.00
WHOLESALE	3,702,790.00	0.00
WHOLESALE	4,728.00	0.00
WHOLESALE	959,664.00	0.00
WHOLESALE	119,400.00	0.00
TOTAL	29,620,139.00	125,306.85

Table 8

2006 MUNICIPAL BUILDINGS		
ACCT TYP DESC	KWH	THERMS
COMMERCIAL/INDUSTRIAL	38,026.00	0.00
COMMERCIAL/INDUSTRIAL	5,120,235.00	0.00
COMMERCIAL/INDUSTRIAL	41,022.00	0.00
COMMERCIAL/INDUSTRIAL	164,160.00	0.00

COMMERCIAL/INDUSTRIAL	8,353.00	0.00
COMMERCIAL/INDUSTRIAL	165,762.00	0.00
COMMERCIAL/INDUSTRIAL	11,316.00	0.00
COMMERCIAL/INDUSTRIAL	1,105,511.00	0.00
COMMERCIAL/INDUSTRIAL	47,661.00	0.00
COMMERCIAL/INDUSTRIAL	47,950.00	0.00
COMMERCIAL/INDUSTRIAL	1,432.00	0.00
COMMERCIAL/INDUSTRIAL	0	0
COMMERCIAL/INDUSTRIAL	9,614,420.00	0.00
COMMERCIAL/INDUSTRIAL	120,864.00	0.00
COMMERCIAL/INDUSTRIAL	5,846,070.00	0.00
COMMERCIAL/INDUSTRIAL	508,967.00	0.00
COMMERCIAL/INDUSTRIAL	5,644.00	0.00
COMMERCIAL/INDUSTRIAL	9,240.00	0.00
COMMERCIAL/INDUSTRIAL	540.00	0.00
COMMERCIAL/INDUSTRIAL	19,245.00	0.00
COMMERCIAL/INDUSTRIAL	1,833.00	0.00
COMMERCIAL/INDUSTRIAL	16,800.00	0.00
COMMERCIAL/INDUSTRIAL	0.00	1,915.64
COMMERCIAL/INDUSTRIAL	0.00	83,766.83
COMMERCIAL/INDUSTRIAL	0.00	1,322.85
COMMERCIAL/INDUSTRIAL	0.00	969.65
COMMERCIAL/INDUSTRIAL	0.00	431.90
COMMERCIAL/INDUSTRIAL	0.00	38,895.40
COMMERCIAL/INDUSTRIAL	0.00	10,680.00
COMMERCIAL/INDUSTRIAL	22,980.00	0.00
RESIDENTIAL	917.00	0.00
RESIDENTIAL	83,577.00	0.00
RESIDENTIAL	0	0
RESIDENTIAL	0.00	200.78
WHOLESALE	26,955.00	0.00
WHOLESALE	5,203,804.00	0.00
WHOLESALE	79,020.00	0.00
WHOLESALE	79,200.00	0.00
WHOLESALE	2,885.00	0.00
WHOLESALE	3,324,660.00	0.00
WHOLESALE	4,728.00	0.00
WHOLESALE	959,664.00	0.00
WHOLESALE	119,400.00	0.00
TOTAL	32,802,841.00	138,183.06

Table 9

REVENUE DISTRICT	RATE PLAN #	Act. Ty. CD.	Account Type	2002 Year	2002 KWH	2002 THERMS	2006 Year	2006 KWH	2006 THERMS
481	003	M	PUBLIC/STREET LIGHTING	2002	15128	0.00000	2006	51137	0.00000
481	009	M	PUBLIC/STREET LIGHTING	2002	514427	0.00000	2006	367720	0.00000
481	013	M	PUBLIC/STREET LIGHTING	2002	235298	0.00000	2006	233333	0.00000
482	013	M	PUBLIC/STREET LIGHTING	2002	0	0.00000	2006	0	0.00000

481	017	M	PUBLIC/STREET LIGHTING	2002	864	0.00000	2006	864	0.00000
481	025	M	PUBLIC/STREET LIGHTING	2002	3876	0.00000	2006	3636	0.00000
481	029	M	PUBLIC/STREET LIGHTING	2002	3456	0.00000	2006	3456	0.00000
481	69E	M	PUBLIC/STREET LIGHTING	2002	71328	0.00000	2006	70008	0.00000
			Total	2002	**844377**	**0.00000**	2006	**730154**	**0.00000**

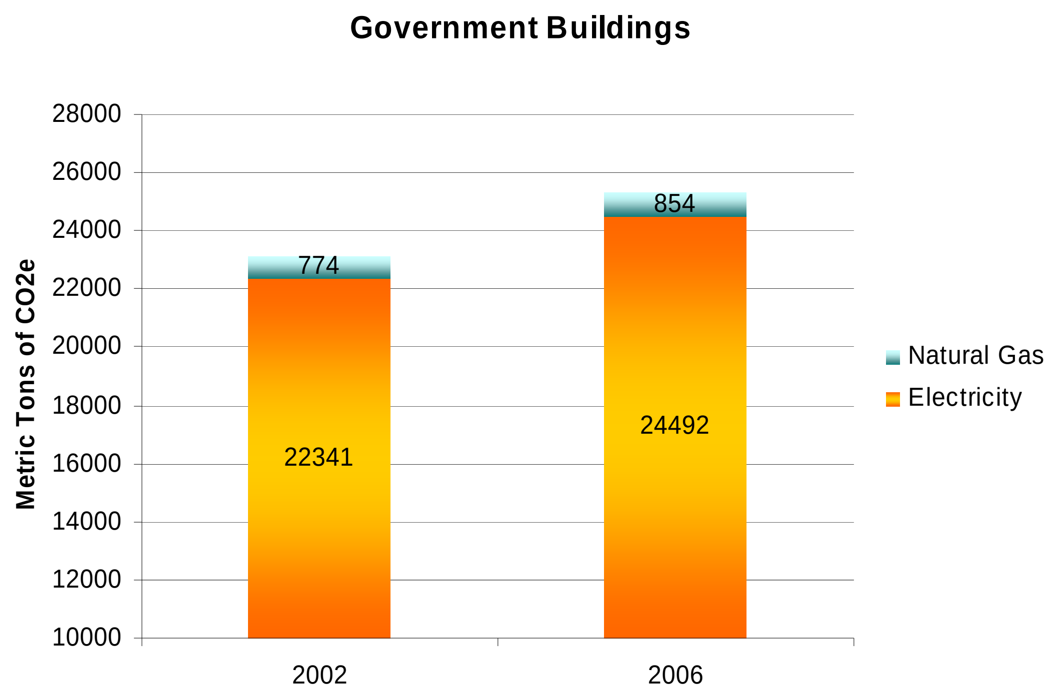


Figure 14

Sources: South Carolina Electric and Gas and CACP Software

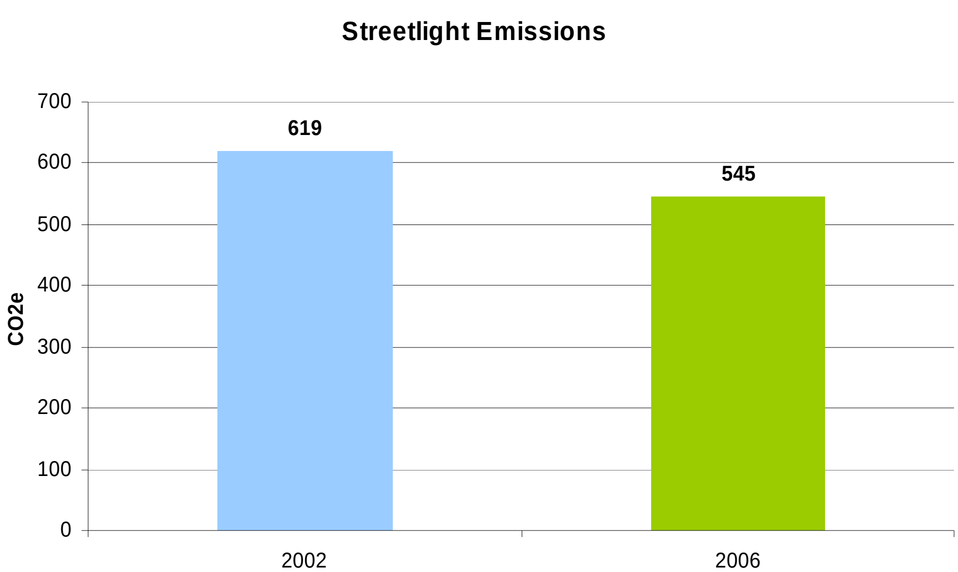


Figure 15

Sources: South Carolina Electric and Gas, City of Charleston Department of Planning, Preservation and Economic Innovation, and CACP Software

c. Vehicle Fleet

Table 10

2002 Vehicle Fleet Fuel Use		
	Gasoline	Diesel
Date entered	2002	2002
10-Jul-03	206.7	33.3
	144.4	7.1
	52.6	5550.9
	228.8	
	19.3	
	3529.5	
	1588.8	
Total	5770.1	5591.3
13-Jul-03	2564.5	652.9
	567.1	
	204	
Total	3335.6	652.9
12-Aug-03	1198.7	7560.8
	7321.6	1816.7
	19385.1	
Total	27905.4	9377.5
13-Aug-03		
	11193.3	4672.8
(Joyce)	58178	135008
***	106382.4	155302.5
Grand total	197004.4	287597.2
***total figured based on percentage completed. 54% was totaled, then that number was extrapolated for the remaining 46%.		

The data for the 2002 Vehicle Fleet spreadsheet is from Tommy Linstroth's study in 2003 (See Table 10). The 2006 data is from Scott Newsome who is the Director of Police and City Fleet Operations. However he did not have the data from 2002 so that is why we used Tommy's previous data for that year. Scott also gave us the composition of the Fleet which was used to determine the percentages of vehicle types. We classified the fleet vehicles into the classifications used by the CACP program (See Table 11 and 12). These classifications were confirmed by City of Charleston Fleet Manager Jackie Braddy.

Table 11

Milford Fleet 2006 - Gasoline				
Total Amount of Gasoline Used:	195021.55			
Auto- Full Size	Type	#	Percentage	Estimated (by %) Amount of Fuel Used
	Automobile	19		
	Sub Total	19	0.08520179	16616.18587
Light Truck/SUV				
	Mini Van	12		
	Pick Up	143		
	SUV	23		

	Van - Full	1		
	Van - Mid	13		
	Sub Total	192	0.86098655	167910.9309
Heavy Truck				
	Bus	3		
	Dump Truck	1		
	Heavy Duty Truck	1		
	Sub Total	5	0.02242152	4372.680493
Motorcycle				
	floor sweeper	2		
	gator	2		
	mower	1		
	Scooter	1		
	tractor	1		
	Sub Total	7	0.03139013	6121.752691
	Total	223	1	195021.55

Table 12

Milford Fleet 2006 - Diesel				
Total Amount of Diesel Used	258493.75			
Heavy Truck-Mediums	Type	#	Percentage	Estimated (by %) Amount of Fuel Used
	Bucket Trucks	7		
	Asphalt Tuck	1		
	Back Hoes	13		
	Bull Dozer	1		
	Bus	1		
	Crane Truck	1		
	Dump Truck	60		
	Excavator	6		
	Front Loader	14		
	Garbage	27		
	Roller	1		
	Semi	1		
	Sewer	5		
	Street Sweeper	5		
	Water Truck	1		
	Sub Total	144	94.74%	244888.8158
Light Truck-Large				
	Pick up Trucks	3		
	Sub Total	3	1.97%	5101.850329
Light Truck-Small				
	Mowers	8		
	Tractors (John Deere)	16		
	Sub Total	5	3.29%	8503.083882

				258493.75
	Grand Total of Diesel Vehicles	152	1	258493.75

Table 13
Government Vehicle Fleet CO2e Emissions

Year	**2002**	**2006**
Police Fleet	**4,313**	**4,296**
Rest of City Fleet	**5,169**	**4,823**
Total Emissions (CO2e)	**9,482**	**9,119**

Sources: City of Charleston Department of Planning, Preservation and Economic Innovation, City of Charleston Division of Fleet Management and CACP Software

d. Employee Commute

This data was collected for both 2002 and 2006 via an employee survey. We of course had to use previous survey data from Tommy Linstroth for the 2002 information; however the surveys were very similar.

Table 14
Government Employee Commute CO2e emissions

Year	2002	2006
Emissions (C02e)	5,178	4,607

Sources: City of Charleston Staff Survey and CACP Software

Table 15

2002	Avg. Miles/Year/Employee	Number of Employees	Total Number of Miles
Gasoline	5569.038462	1500	8353557.692
Diesel	150.7692308		150.7692308

Table 16

2006 SURVEY TOTALS	
Gasoline Vehicle Types	Miles
Light Truck/SUV/Pick up	170,324.80
Motorcycle	11,505.00
Passenger Vehicle	432,738.80
	614,568.60

Diesel Vehicle Types	
Transit Bus (ULSD)	425.00
Passenger Vehicle	2,080.00
	2,505.00
Of Surveyed, Total Miles Traveled per Year	617,073.60
Average Daily Commute (miles)	20.75
Average Yearly Commute (miles)	5,032.86
Total Number of Employees	1,500.00
Total Vehicle Miles Traveled per Year	7549287.93

e. Water/Sewage

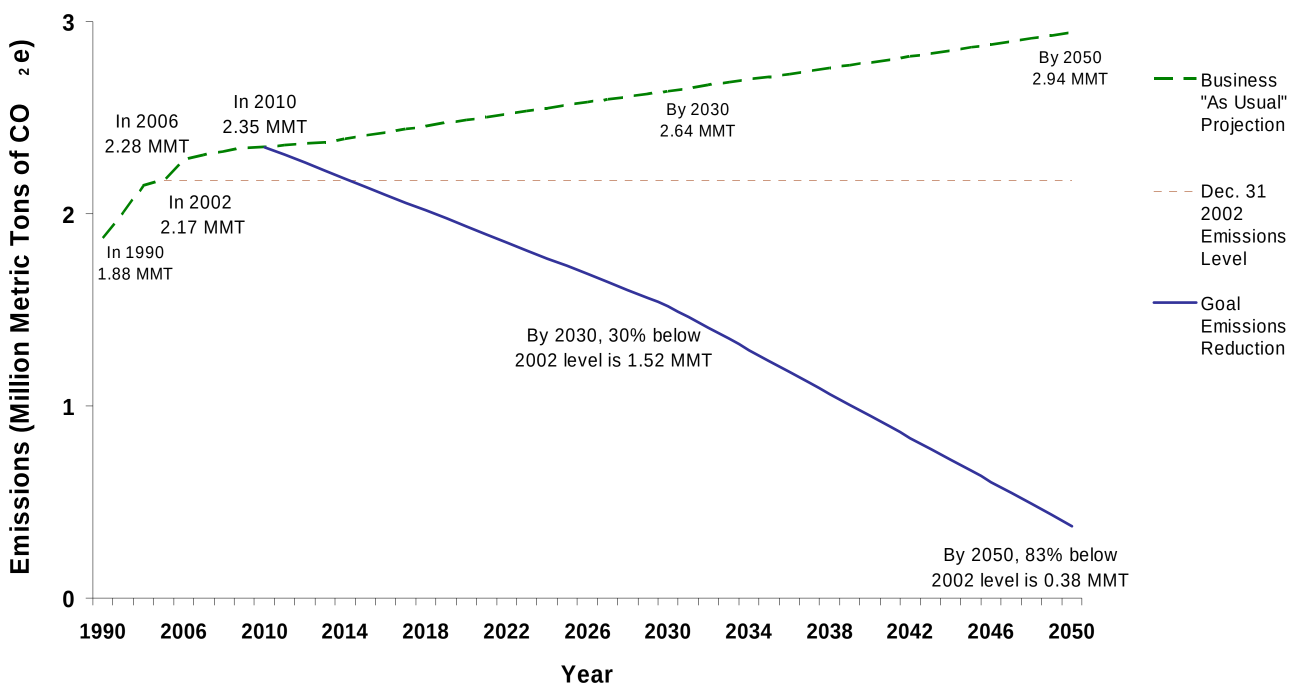
We are still waiting for Charleston Water Systems to sort out this data for us. They are having difficulty determining how much energy is used for the City, and how much is used for the rest of there service area. In addition, this data will be included in the community instead of government analysis because this is a private entity and the government has no jurisdiction over it. Currently, this data is already included within the SCE&G data for the water and sewer facilities that are within the City limits.

f. Waste

The City Government does not monitor how much waste it produces so this information is included with the community waste.

II.

Charleston Green Plan
ICLEI CACP $C0_2e$ Reduction
Metrics and Methodology



A. Overall

1. Emissions Goals

The Green Committee's next task was to determine appropriate goals for reduction of Charleston's greenhouse gas emissions. The Committee took its cues from goals currently being discussed in the international arena.

In July 2009, the leaders of the G-8 nations reached a historic consensus on ambitious goals to reduce carbon dioxide emissions. For the first time, G-8 leaders explicitly acknowledged the need to limit global warming to no more than two degrees Celsius. All agreed that developed nations should reduce emissions to 80% or more below their 1990 levels or more recent years by 2050.

The City's inventories confirm that Charleston needs to take decisive action as well. If citywide emissions continue along their current path, Charleston can expect a 25% increase in its greenhouse gas emissions by 2050.

The Green Committee recommends that Charleston do its part in lowering emissions by following the global consensus and setting a long term goal to reduce Charleston's overall emissions to 83% of its 2002 levels by 2050.

To achieve this reduction, the Green Committee recommends a midterm target of 30% reduction below 2002 levels by 2030. Setting a midterm target will allow the City to reevaluate in 2030 to see whether it is on track to reach the 2050 goal.

This plan's key recommendations will produce roughly 99% of the reduction needed to meet the City's 2030 target. As technology improves and the plan's recommendations are implemented, 100% of the 2030 goal will be achieved.

2. Measuring Success

Within the recommendations outlined in the following sections of this plan are several quantifiable strategies that, if achieved, could result in an emissions reduction of 1,104,316 tons of CO2e – 99% of our benchmark goal for 2030. The key strategies listed below form a quantifiable set of actions that include initiatives to change our transportation choices, building practices, the energy efficiency for our homes and vehicles, and waste management practices. These strategies represent several of the overarching goals within the plan, which will impact both quantifiable reductions in emissions as well as quality of life improvements.

Many of these implementation strategies are multi-faceted and have an interconnected influence among all of the Green Plan initiatives. Particularly, energy and building initiatives and their impacts are linked. Finally, no recommendations will amount to any carbon reductions without education, understanding, and necessary implementation.

Many important initiatives are not covered because their impacts are less quantifiable. Their unknown potential reductions will take Charleston closer to its climate protection goals.

TRANSPORTATION CHOICES

Improved Transportation

If Charleston maintains projected 2010 vehicle miles traveled (VMT) level by increasing use of public transportation (CARTA) and/or substitutes walking or biking for driving, it could result in a reduction of 152,940 tons of CO_2e in 2030 from projected "business as usual" 2030 level.

FUEL EFFICIENCY

Improved Transportation

If Charleston increases the fuel efficiency of all vehicles by 30% by 2030 (through encouragement of more efficient driving techniques and incentives for purchasing of more efficient vehicles), it could result in a reduction of 202,577 tons of CO_2e in 2030 from projected "business as usual" 2030 level.

ARCHITECTURE 2030

Better Buildings

If Charleston requires that all new City construction and historic renovations adhere to the guidelines of Architecture 2030 Challenge, it could result in a reduction of 10,770 tons of CO_2e from projected "business as usual" 2030 level.

If Charleston encourages 25% of residential and commercial new construction to adhere to the guidelines of Architecture 2030 Challenge each year, it could result in a reduction of 127,448 tons of CO_2e in 2030 from projected "business as usual" 2030 level.

HOME WEATHERIZATION

Better Buildings

If Charleston develops a home weatherization program for homeowners that achieves a 50% reduction in energy usage, it could result in a reduction of 160,546 tons of CO_2e in 2030 from projected "business as usual" 2030 level.

WASTE REDUCTION

Zero Waste

If Charleston reduces the waste stream by 50% from the projected 2030 amount, it could result in a reduction of 22,860 tons of CO_2e in 2030 from projected "business as usual" 2030 level.

RENEWABLE ENERGY

Cleaner Energy

If Charleston replaces 30% of the total community energy usage with renewable energy, it could result in a reduction of 427,175 tons of CO_2e in 2030 from projected "business as usual" 2030 level.

3. Reaching the Goal

These 6 key strategies could result in a reduction of 1,104,316 tons of CO_2e in 2030. This is 99% of the overall goal for an 1,120,000 tons of CO_2e reduction in 2030.

Metrics were calculated based on quantifiable measures in the Charleston Green Plan. Our target CO2e reduction goal for the year 2030 is to achieve a 30% reduction below our 2002 levels. 2002 levels were 2.17mmtCO2e, and a 30% reduction would put our target 2030 levels at 1.52 mmtCO2e in that year. Our target CO2e reduction goal for the year 2050 is to achieve an 83% reduction below our 2002 levels. This is because scientists and the recent G8 summit suggest that we must reduce CO2e levels to 80% below 1990 levels in order to sufficiently reduce global warming. We used 83% of 2002 because it is ~ equivalent to 80% of our 1990 levels.

B. Calculations and Methodology

1. Better Buildings (and Cleaner Energy)

If Charleston requires that all new City construction and historic renovations adhere to the guidelines of Architecture 2030 Challenge, it could result in a reduction of 10,770 tons of CO_2e from projected "business as usual" 2030 level.

If Charleston encourages 25% of residential and commercial new construction to adhere to the guidelines of Architecture 2030 Challenge each year, it could result in a reduction of 127,448 tons of CO_2e in 2030 from projected "business as usual" 2030 level.

a. B-1: Charleston Sustainable Building Standard

The Charleston Sustainable Building Standard requires that new construction be in line with the 2030 Challenge target stated below,

"All new buildings, developments and major renovations shall be designed to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type.

At a minimum, an equal amount of existing building area shall be renovated annually to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type.

The fossil fuel reduction standard for all new buildings and major renovations shall be increased to:

60% in 2010
70% in 2015
80% in 2020
90% in 2025
Carbon-neutral in 2030 (using no fossil fuel GHG emitting energy to operate)."

Source: Architecture 2030 www.architecture2030.org

EPA target energy performance predicts that an average office building will have an energy use of 26.53 kwh/sq. ft./year. Source: http://www.energystar.gov/index.cfm?fuseaction=target_finder

The energy use average for city buildings in Charleston has been calculated to be 28.1 kwh/sq. ft./year. Because this is similar to the national average, and is more pertinent to our specific energy usage, we will use this number as a base value from which our energy reductions must be seen.

Reduction Measures by Year:
2010-2015
It is estimated that the city of Charleston adds 11,000 sq. ft. of new construction each year. In order to meet 2030 requirements, this 11,000 sq. ft. of new construction from 2010 to 2015 must have a 60% energy reduction as compared to the base energy usage of 28.1 kwh/sq. ft./year. This is an energy reduction of (28.1 * .6) = 16.86 kwh/sq. ft./year. For 11,000 sq. ft. of new construction, this correlates to (11,000 sq. ft. * 16.86 kwh/sq. ft./year) = 185,460 kwh/year energy reduction. Because the 2030 challenge requires that an equal amount of existing building area be renovated annually to the same 60% reduction standard, we must double this number to include another 11,000 sq ft. of renovated building area. Therefore, total energy reduction would be (185,460 kwh/year * 2) = 370,920 kwh/year.

This correlates to a CO2e reduction of 271 tons/year. Multiply this number by 5 to equal a reduction of 1,355 tons of CO2e from BAU (in year 2014 from all new construction 2010-2015)

2015-2020
It is estimated that the city of Charletson adds 11,000 sq. ft. of new construction each year. In order to meet 2030 requirements, this 11,000 sq. ft. of new construction from 2015 to 2020 must have a 70% energy reduction as compared to the base energy usage of 28.1 kwh/sq. ft./year. This is an energy reduction of (28.1 * .7) = 19.67 kwh/sq. ft./year. For 11,000 sq. ft. of new construction, this correlates to (11,000 sq. ft. * 19.67 kwh/sq. ft./year) = 216370 kwh/year energy reduction. Because the 2030 challenge requires that an equal amount of existing building area be renovated annually to the same 70% reduction standard, we must double this number to include another 11,000 sq ft. of renovated building area. Therefore, total energy reduction would be (216370 kwh/year * 2) = 432,740 kwh/year.

This correlates to a CO2e reduction of 316 tons/year. Multiply this number by 5 to equal a reduction of 1,580 tons of CO2e from BAU (in year 2019 from all new construction 2015-2020)

2020-2025
It is estimated that the city of Charletson adds 11,000 sq. ft. of new construction each year. In order to meet 2030 requirements, this 11,000 sq. ft. of new construction from 2020 to 2025 must have a 80% energy reduction as compared to the base energy usage of 28.1 kwh/sq. ft./year. This is an energy reduction of (28.1 * .8) = 22.48 kwh/sq. ft./year. For 11,000 sq. ft. of new construction, this correlates to (11,000 sq. ft. * 22.48 kwh/sq. ft./year) = 247280 kwh/year energy reduction. Because the 2030 challenge requires that an equal amount of existing building area be renovated annually to the same 80% reduction standard, we must double this number to include another 11,000 sq ft. of renovated building area. Therefore, total energy reduction would be (247280 kwh/year * 2) = 494560 kwh/year.

This correlates to a CO2e reduction of 361 tons/year. Multiply this number by 5 to equal a reduction of 1,805 tons of CO2e from BAU (in year 2024 from all new construction 2020-2025)

2025-2030
It is estimated that the city of Charletson adds 11,000 sq. ft. of new construction each year. In order to meet 2030 requirements, this 11,000 sq. ft. of new construction from 2025 to 2030 must have a 90% energy reduction as compared to the base energy usage of 28.1 kwh / sq. ft. / year. This is an energy reduction of (28.1 * .9) = 25.29 kwh / sq. ft. / year. For 11,000 sq. ft. of new construction, this correlates to (11,000 sq. ft. * 25.29 kwh / sq. ft. / year) = 278,190 kwh / year energy reduction. Because the 2030 challenge requires that an equal amount of existing building area be renovated annually to the same 90% reduction standard, we must double this number to

include another 11,000 sq ft. of renovated building area. Therefore, total energy reduction would be (278,190 kwh / year * 2) = 556,380 kwh / year.

This correlates to a CO_2e reduction of 406 tons / year. Multiply this number by 5 to equal a reduction of 2,030 tons of CO_2e from BAU (in year 2029 from all new construction 2025-2030)

2030
It is estimated that the city of Charletson adds 11,000 sq. ft. of new construction each year. In order to meet 2030 requirements, this 11,000 sq. ft. of new construction in2030 must have a 100% energy reduction as compared to the base energy usage of 28.1 kwh / sq. ft. / year. This is an energy reduction of 28.1 kwh / sq. ft. / year. For 11,000 sq. ft. of new construction, this correlates to (11,000 sq. ft. * 28.1 kwh / sq. ft. / year) = 309,100 kwh / year energy reduction. Because the 2030 challenge requires that an equal amount of existing building area be renovated annually to the same 100% reduction standard, we must double this number to include another 11,000 sq ft. of renovated building area. Therefore, total energy reduction would be (309,100 kwh / year * 2) = 618200 kwh / year.

This correlates to a reduction of 451 tons of CO_2e from BAU (in year 2030)

Total CO_2e reduction: (1,355 + 1,580 + 1,805 + 2,030 + 451) = 7,221 tons of CO_2e from BAU. (in year 2030 from all new construction 2010-2030)

b. B-2: Historic Buildings, LEED for existing buildings (O&M)

Reduction Measures by Year:
2010-2015
V3 LEED for Existing Buildings requires 60-79 points to be acquired on the point system. Using this system, the city of Charleston will renovate historic buildings to be in line with the 2030 challenge, which requires a 60% energy reduction by 2010 (see B-1). Therefore, all historic buildings renovated to LEED from 2010-2015 must have a 60% energy reduction as compared to the city-owned building average (used as a regional average), of 28.1 kwh/sq. ft./year. The total sq. ft. of historic government buildings = 303,738 sq. ft. If 5% of historic buildings were upgraded to LEED Gold each year to achieve complete conversion after 20 years (by 2030), we would be upgrading 15,186.9 sq. ft. each year. 15,186.9 sq. ft. * 28.1 kwh/sq. ft./year = 426,751.89 kwh/year. We can multiply this number by 60% to find the energy reduction = 256,051.13 kwh/year. This correlates to a CO_2E reduction of 187 tons/year. Multiply this number by 5 to equal a reduction of 935 tons of CO_2e from BAU. (in year 2014 from all renovations 2010-2015)

2015-2020
The 2030 challenge requires that all historic buildings renovated to LEED from 2015-2020 achieve a 70% energy reduction as compared to the city-owned building average (used as a regional average), of 28.1 kwh/sq. ft./year With 5% of historic buildings upgraded each year, we will have an energy savings of 426,751.89 kwh/year. We can multiply this number by 70% to find the energy reduction = 298,726.32 kwh/year. This correlates to a CO_2E reduction of 218 tons/year. Multiply this number by 5 to equal a reduction of 1,090 tons of CO_2e from BAU. (in year 2019 from all renovations 2015-2020)

2020-2025

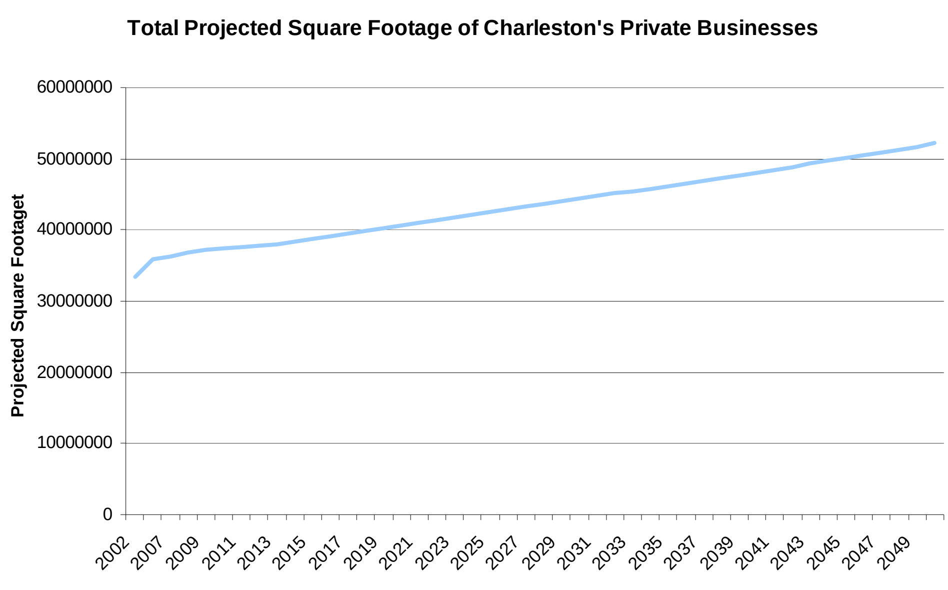
The 2030 challenge requires that all historic buildings renovated to LEED from 2020-2025 achieve an 80% energy reduction as compared to the city-owned building average (used as a regional average), of 28.1 kwh/sq. ft./year. With 5% of historic buildings upgraded each year, we will have an energy savings of 426,751.89 kwh/year. We can multiply this number by 80% to find the energy reduction = 341,401.51 kwh/year. This correlates to a CO2E reduction of 249 tons/year. Multiply this number by 5 to equal a reduction of 1,245 tons of CO2e from BAU. (in year 2024 from all renovations 2020-2025)

2025-2030
The 2030 challenge requires that all historic buildings renovated to LEED from 2025-2030 achieve an 90% energy reduction as compared to the city-owned building average (used as a regional average), of 28.1 kwh/sq. ft./year. With 5% of historic buildings upgraded each year, we will have an energy savings of 426,751.89 kwh/year. We can multiply this number by 90% to find the energy reduction = 384076.7 kwh/year. This correlates to a CO2E reduction of 280 tons/year. Multiply this number by to equal a reduction of 1,400 tons CO2e from BAU. (in year 2029 from all renovations 2025-2030)

2030
By the year 2030 all historic building will have been upgraded to LEED Gold. Therefore, there will be no additional CO2e reduction in 2030 as compared to 2029.

Total CO2e reduction: (935 + 1090 + 1,245 + 1,400) = 3,549 CO2e reduction from BAU (in year 2030 from all renovations 2010-2030)

c. B-3: Encourage Private Businesses to Meet the Charleston Sustainable Building Standard



Reduction Measures by Year:

2002
938,359,469 kwh / 28.1 kwh/sq. ft. = 33393575 sq. ft. (data from SCE&G)

2006
1,007,230,824 kwh / 28.1 kwh/sq. ft. = 35844513 sq. ft. (data from SCE&G)

2010-2015

If private owners were to adhere to the Charleston Sustainable Building Standard they would be required to have an energy reduction of 60% from 2015 to 2020 (see Architecture 2030 in B-1).
From 2010-2015, there will be an estimated 1,129,315 sq. ft. of new construction. *(this projection and all other projections in this measure are drawn from the projected sq. ft. spreadsheet, which correlates commercial sq. ft. increase with projected population increase).We hope to encourage 25% of this new construction to adhere to the Charleston Sustainable Building Standard. Therefore, (1,129,315 sq. ft. * .25) = 282,329 sq. ft. of new construction adheres to the 60% energy reduction. A 60% energy reduction would be (28.1 kwh/sq. ft./year * .6) = 16.86 kwh/sq. ft./year. (282,329 sq. ft. * 16.86 kwh/sq. ft./year) = 4,760,067 kwh/year. Adhering to the 2030 challenge, we will renovate an equal amount of square footage to achieve 60% energy reduction as well. Therefore we multiply this number by 2 to get an energy reduction of 9,520,134 kwh from BAU (in year 2014 from all new construction 2010-2015).This correlates to a reduction of 6,945 tons of CO2e from BAU.

2015-2020
If private owners were to adhere to the Charleston Sustainable Building Standard they would be required to have an energy reduction of 70% from 2015 to 2020 (see Architecture 2030 in B-1)
From 2015-2020, there will be an estimated 1,961,105 sq. ft. of new construction. We hope to encourage 25% of this new construction to adhere to the Charleston Sustainable Building Standard. Therefore, (1,961,105 sq. ft. * .25) = 490,276 sq. ft. of new construction adheres to the 70% energy reduction. A 70% energy reduction would be (28.1 kwh/sq. ft./year * .7) = 19.76 kwh/ sq. ft./year (490,276 sq. ft. * 19.76 kwh/sq. ft./year) = 9,687,854 kwh/year reduced. Adhering to the 2030 challenge, we will renovate an equal amount of square footage to achieve 70% energy reduction as well. Therefore we multiply this number by 2 to get an energy reduction of 19,375,707 kwh from BAU (in year 2019 from all new construction 2015-2020). This correlates to a reduction of 14,135 tons of CO2e from BAU.
.
2020-2025
If private owners were to adhere to the Charleston Sustainable Building Standard they would be required to have an energy reduction of 80% from 2020 to 2025 (see Architecture 2030 in B-1).
From 2020-2025, there will be an estimated 1,884,955 sq. ft. of new construction. We hope to encourage 25% of this new construction to adhere to the Charleston Sustainable Building Standard. Therefore, (1,884,955 sq. ft. * .25) = 471,239 sq. ft. of new construction adheres to the 80% energy reduction. A 80% energy reduction would be (28.1 kwh /sq. ft./year * .8) = 22.48 kwh/ sq. ft./year (471,239 sq. ft. * 22.48 kwh/sq. ft./year) = 10,593,447 kwh/year reduced. Adhering to the 2030 challenge, we will renovate an equal amount of square footage to achieve 80% energy reduction as well. Therefore we multiply this number by 2 to get an energy reduction of 21,186,894 kwh from BAU (in year 2024 from all new construction 2020-2025). This correlates to a reduction of 15,456 tons of CO2e from BAU.

2025-2030
If private owners were to adhere to the Charleston Sustainable Building Standard they would be required to have an energy reduction of 90% from 2025 to 2030 (see Architecture 2030 in B-1).
From 2025-2030, there will be an estimated 1,817,541 sq. ft. of new construction. We hope to encourage 25% of this new construction to adhere to the Charleston Sustainable Building Standard. Therefore, (1,817,541sq. ft. * .25) = 454,385 sq. ft. of new construction adheres to the 90% energy reduction. A 90% energy reduction would be (28.1 kwh /sq. ft. * .9) = 25.29 kwh/ sq. ft./year (454,385 sq. ft. * 25.29 kwh/sq. ft./year) = 11,491,403 kwh reduced. Adhering to the 2030 challenge, we will renovate an equal amount of square footage to achieve 90% energy reduction as well. Therefore we multiply this number by 2 to get an energy reduction of 22,982,806 kwh from BAU (in year 2029 from all new construction 2025-2030). This correlates to a reduction of 16,767 tons of CO2e from BAU.

2030
If private owners were to adhere to the Charleston Sustainable Building Standard they would be required to have an energy reduction of 100% in year 2030 (see Architecture 2030 in B-1).
In year 2030, there will be an estimated 356072 sq. ft. of new construction. We hope to encourage 25% of this new construction to adhere to the Charleston Sustainable Building Standard. Therefore, (356,072 sq. ft. * .25) = 89,018 sq. ft. of new construction adheres to the 100% energy reduction. A 100% energy reduction would be 28.1 kwh/ sq. ft./year (89,018 sq. ft. * 28.1 kwh/sq. ft./year) = 2,501,406 kwh reduced. Adhering to the 2030 challenge, we will renovate an equal amount of square footage to achieve 100% energy reduction as well. Therefore we multiply this number by 2 to get an energy reduction of 5,002,812 kwh from BAU (in year 2030). This correlates to a reduction of 3,650 tons of CO2e from BAU.

Total CO2 reduction: (3,650 + 16,767 +15,456 + 14,125 + 6,945) = 56,943 tons of CO2e from BAU (in year 2030 from all new construction 2010-2030)

d. B-3: Encourage Private Households to Meet the Charleston Sustainable Building Standard

Data:

Residential Units Projection Based on 2009 City Estimates

Year	2000*	2001	2002	2003	2004	2005	2006	2007
Peninsula								
West Ashley								
James Island								
Johns Island								
Daniel Is/Cainhoy								
Total	0	0	0	0	0	0	53763	0

Year 2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	1105	1210	1315	1419	1524	1758	1992	2226	2460
	5072	5320	5567	5815	6062	6616	7169	7722	8276
	2215	2237	2260	2283	2305	2356	2407	2457	2508
	1456	1565	1675	1784	1893	2137	2381	2625	2870
	3119	3182	3244	3306	3369	3508	3647	3787	3926
Total 0	57531	58077	58624	59170	59716	60938	62160	63381	64603

Year 2018	2019	2020	2021	2022	2023	2024	2025	2026
2694	2928	3162	3396	3630	3864	4098	4332	4566
8829	9382	9936	10489	11042	11596	12149	12702	13256
2559	2609	2660	2711	2761	2812	2863	2913	2964
3114	3358	3602	3846	4090	4335	4579	4823	5067
4065	4205	4344	4483	4623	4762	4901	5041	5180
Total 65824	67046	68267	69489	70710	71932	73153	74375	75596

If households adhered to the Charleston Sustainable Building Standard, they would be required to have a 60% reduction from 2010-2015, a 70% reduction from 2015-2020, an 80% reduction from 2020-2025, and a 90% reduction from 2025-2030. (See B-1 and Architecture 2030)
The City of Charleston has calculated that the average square footage for single family households is 1900 sq. ft.
"Apartments...average 1,043 square feet in 2001"
http://www.eia.doe.gov/emeu/recs/sqft-measure.html
58% of total residential units in Charleston are single family households, and will be based on charleston's single familar square foot average. The remaining 42% will be based on the national 2001 average for apartment/multi-unit square footage.

Our goal will be to encourage 5% of new residential construction to meet the Charleston sustainable building standard each year, and thus renovate an additional 5% based on architecture 2030 guidelines.

Calculations:
In 2006, there were 53,763 residential units. At 58% single family, 31,183 were single family households, and 22,580 were apartments and multi unit households. (31,183 * 1900 sq. ft.) = 59,247,700 sq. ft. of single family households. (22,580 * 1043 sq. ft.) = 23,550,940 sq. ft. of apartments. 59,247,700 + 23,550,940 = 82,798,640 total residential sq. ft. in 2006. In 2006, the residential energy usage for Charleston was 608,415,735 kwh. If we divide this number by the total sq. ft. (82,798,640) we find that households used <u>7 kwh/sq. ft.</u>

Reduction Measures by Year:
2010-2015
From 2010 – 2015, it is estimated that there will be 3407 new residential units. 3407 *.58 = 1976 * 1900 = 3754514 sq. ft. 3407 * .42 = 1431 * 1,043 = 1492533 sq. ft. + 3754514 sq. ft. = <u>5247047 sq. ft. new residential construction from 2010-2015.</u> If new residential construction adheres to the Charleston Sustainable Building Standard of a 60% reduction from the regional average from 2010-2015, then we can multiply (7 kwh/sq. ft./year * .6) = 4.2 kwh/sq. ft./year energy reduction. If we only manage to encourage 5% of new residential construction to adhere to Charleston's Sustainable Building Standard, then (5247047sq. ft. * .05) = 262352 sq. ft. of new construction will adhere to this standard of 60% reduction. Because the 2030 challenge states that we must renovate an equal amount of existing sq. ft. to 60% reduction, we will multiply this number by 2 to get 524,705 sq. ft. Therefore (524,705 sq. ft. * 4.2 kwh/sq. ft./year) = 2,203,760 kwh energy reduction from BAU (in year 2014 from all new construction 2010-2015). This correlates to a <u>reduction of 1,608 tons of CO2e from BAU.</u>

2015-2020
From 2015 – 2020, it is estimated that there will be 6110 new residential units. 6110 *.58 = 3543.8 * 1900 = 6733220 sq. ft. 6110 * .42 = 2566.2 * 1,043 = 2676547 sq. ft. + 6733220 sq. ft. = <u>9409767 sq. ft. new residential construction from 2015-2020.</u> If new residential construction adheres to the Charleston Sustainable Building Standard of a 70% reduction from the regional average from 2015-2020, then we can multiply (7 kwh/sq. ft./year * .7) = 4.9 kwh/sq. ft./year energy reduction. If we only manage to encourage 5% of new residential construction to adhere to Charleston's Sustainable Building Standard, then (9409767sq. ft. * .05) = 470,488 sq. ft. of new construction will adhere to this standard of 70% reduction. Because the 2030 challenge states that we must renovate an equal amount of existing sq. ft. to 70% reduction, we will multiply this number by 2 to get 940976 sq. ft. Therefore (940976 sq. ft. * 4.9 kwh/sq. ft./year) = 4,610,782 kwh energy reduction from BAU (in year 2019 from all new construction 2015-2020). This correlates to a <u>reduction of 3,364 tons of CO2e from BAU.</u>

2020-2025
From 2020 – 2025, it is estimated that there will be 6110 new residential units. 6110 *.58 = 3543.8 * 1900 = 6733220 sq. ft. 6110 * .42 = 2566.2 * 1,043 = 2676547 sq. ft. + 6733220 sq. ft. = <u>9409767 sq. ft. new residential construction from 2020-2025.</u> If new residential construction adheres to the Charleston Sustainable Building Standard of an 80% reduction from the regional average from 2020-2025, then we can multiply (7 kwh/sq. ft. * .8) = 5.6 kwh/sq. ft. energy reduction. If we only manage to encourage 5% of new residential construction to adhere to Charleston's Sustainable Building Standard, then (9409767sq. ft. * .05) = 470,488 sq. ft. of new construction will adhere to this standard of 80% reduction. Because the 2030 challenge states that we must renovate an equal amount of existing sq. ft. to 80% reduction, we will multiply this number by 2 to get 940976 sq. ft. Therefore (940976 sq. ft. * 5.6 kwh/sq. ft./year) = 5,269,466

kwh energy reduction from BAU(in year 2024 from all new construction 2020-2025). This correlates to a reduction of 3,844 tons of CO2e from BAU.

2025-2030
From 2025 – 2030, it is estimated that there will be 6110 new residential units. 6110 *.58 = 3543.8 * 1900 = 6733220 sq. ft. 6110 * .42 = 2566.2 * 1,043 = 2676547 sq. ft. + 6733220 sq. ft. = 9409767 sq. ft. new residential construction from 2025-2030. If new residential construction adheres to the Charleston Sustainable Building Standard of a 90% reduction from the regional average from 2025-2030, then we can multiply (7 kwh/sq. ft./year * .9) = 6.3 kwh/sq. ft./year energy reduction. If we only manage to encourage 5% of new residential construction to adhere to Charleston's Sustainable Building Standard, then (9409767sq. ft. * .05) = 470,488 sq. ft. of new construction will adhere to this standard of 90% reduction. Because the 2030 challenge states that we must renovate an equal amount of existing sq. ft. to 90% reduction, we will multiply this number by 2 to get 940976 sq. ft. Therefore (940976 sq. ft. * 6.3 kwh/sq. ft./year) = 5,928,149 kwh energy reduction (in year 2029 from all new construction 2025-2029). This correlates to a CO2e reduction of 4,325 tons of CO2e from BAU.

2030
In 2030, it is estimated that there will be 1221 new residential units. 1221 *.58 = 708 * 1900 = 1,345,542 sq. ft. 1221 * .42 = 513 * 1,043 = 534,871 sq. ft. + 1,345,542 sq. ft. = 1880413 sq. ft. new residential construction in 2030. If new residential construction adheres to the Charleston Sustainable Building Standard of a 100% reduction from the regional average in 2030, then this is a 7 kwh/sq. ft./year energy reduction. If we only manage to encourage 5% of new residential construction to adhere to Charleston's Sustainable Building Standard, then (1880413 sq. ft. * .05) = 94,021 sq. ft. of new construction will adhere to this standard of 100% energy reduction. Because the 2030 challenge states that we must renovate an equal amount of existing sq. ft. to 100% reduction, we will multiply this number by 2 to get 188,041 sq. ft. Therefore (188,041 sq. ft. * 7 kwh/sq. ft./year) = 1,316,289 kwh energy reduction (in year 2030). This correlates to a CO2e reduction of 960 tons of CO2e from BAU.

Total CO2e reduction: (960 + 4,325 + 3,844 + 3,364 + 1,608) = 14,101 tons of CO2e from BAU. (in year 2030 from all new construction 2010-2029)

*** The original encouragement of 5% has been changed to 25%, therefore, we multiply 14,101 * 5 to get a reduction of 70,505 tons of CO2e from BAU under this percentage change.

e. B-5: Home Weatherization

If Charleston develops a home weatherization program for homeowners that achieves a 50% reduction in energy usage, it could result in a reduction of 160,546 tons of CO_2e in 2030 from projected "business as usual" 2030 level.

Households in Charleston use on average 7 kwh / sq. ft.(see B-3 Households). Residential energy use for 2006 was 608,415,735 kwh. Divide this number by average kwh / sq. ft. (608,415,735 kwh / 7 kwh/sq.ft.) = 86,916,534 sq. ft. in 2006. From the end of 2006 to the beginning of 2010 it is estimated that there were (57,531-53,763) = 3,768 new residential building permits issued (see green_plan_proj.xls). 3,768 * .58 = 2185 * 1900 = 4,152,336 sq. ft. 3,768 * .42 = 1,583 * 1,043 = 1,650,610 + 4,152,336 = 5,802,946 sq. ft. + 86,916,534 sq. ft. = 92,719,480 sq. ft. in 2010.

Home weatherization is already federally funded for households below 150% of the poverty line. Therefore, this measure applies to households above 150% of poverty line.

estimated % above 150% of poverty line: 75%*
* based off of U.S. census data. Used national average poverty level income for a family of 4. Then multiplied by 150%, and found the number of families living above that income in Charleston to be ~ 75%.

Therefore, this measure applies to 75% of the total residential sq. ft. in 2010. 92,719,480 * .75 = 69,539,610 sq. ft.

2010-2015
We will aim to have phase 1-4 implemented in these years. Because phase 1 is estimated at 10% and phase 4 is estimated at 50%, we will use an average of a 30% energy reduction over these years. Over 20 years we will upgrade 5% of the 69,539,610 sq. ft. eligible each year to upgrade all by 2030. Therefore, from 2010-2015 we will upgrade 25% of the eligible homes with an energy reduction of 30%. 69,539,610 * .25 = 17,384,903 sq. ft. * 7 kwh/sq. ft./year = 121,694,318 kwh/year * .3 = 36,508,295 kwh reduction from BAU (in year 2014 from all renovations 2010-2015). This correlates to a reduction of 26,634 tons of CO2e from BAU.

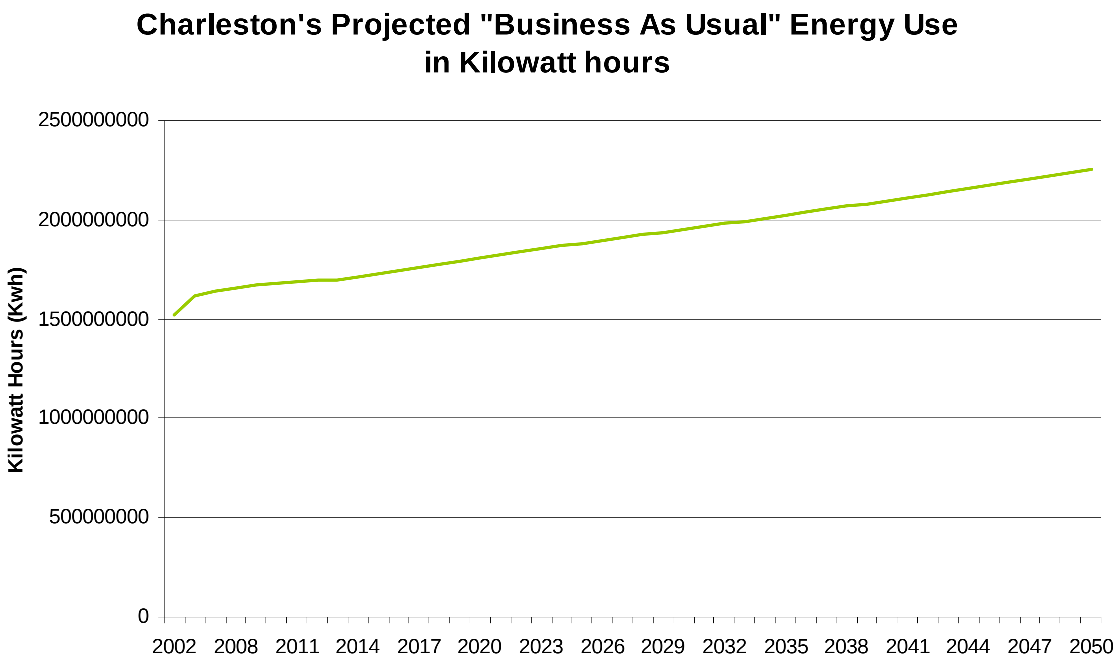
2015-2030
Phase 4 is estimated at 50% energy use reduction. From 2015-2030 we will upgrade the remaining 75% of the eligible homes. 69,539,610 * .75 = 52,154,708 sq. ft. * 7 kwh/sq. ft./year = 365,082,953 kwh/year * .5 = 182,541,476 kwh reduction (in year 2030 from all renovations 2015-2030). This correlates to a reduction of 133,169 tons of CO2e from BAU.

2030
Total CO2e Reduction: (26,634 + 133,169) = 160,546 tons of CO2e from BAU. (in year 2029 from all renovations 2010-2030)

2. <u>Cleaner Energy</u>

If Charleston replaces 30% of the total community energy usage with renewable energy, it could result in a reduction of 427,175 tons of CO_2e in 2030 from projected "business as usual" 2030 level.

a. E-3: Renewable Energy Goals



2020
Total estimated grid electricity usage in 2020 is 1,808,156,728 kwh. If we replace 15% of this energy usage with alternative energy in 2020, we will replace 271,223,509 kwh. This will result in a <u>reduction of 197,865 tons of CO2E from BAU</u> (in year 2020)

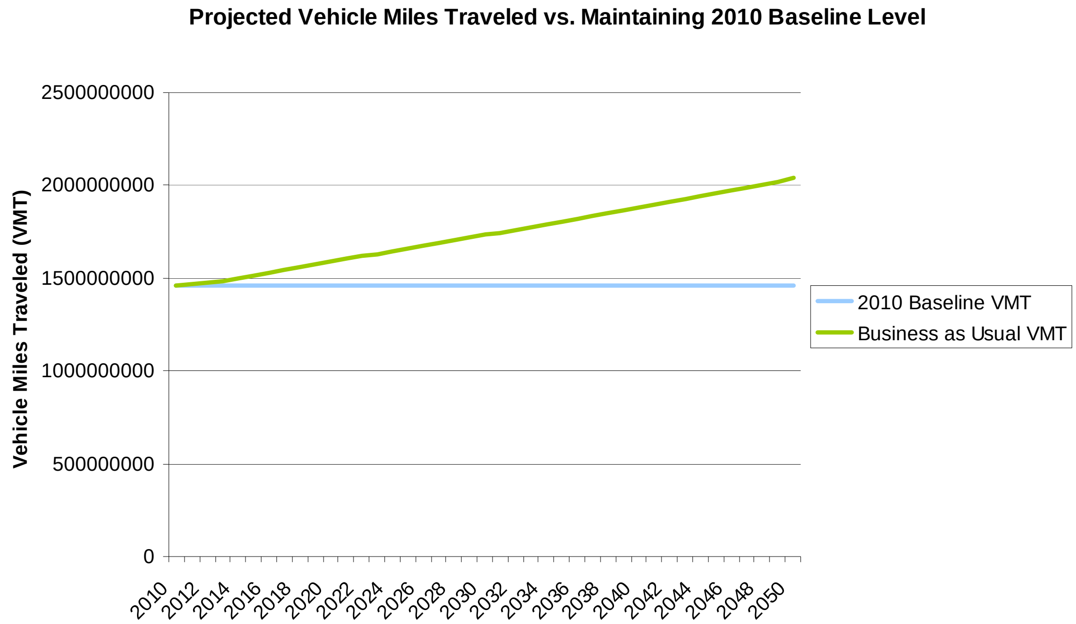
2025
Total estimated grid electricity usage by 2025 is 1,881,463,613 kwh. If we replace 20% of this energy usage with alternative energy in 2025, we will replace 376,292,723 kwh. This will result in a <u>reduction of 274,515 tons of CO2E from BAU</u> (in year 2025)

2030
Total estimated grid electricity usage by 2030 is 1,951,834,670 kwh. If we replace 30% of this energy usage with alternative energy in 2030, we will replace 585,550,401 kwh. This will result in a <u>reduction of 427,175 tons of CO2E from BAU</u> (in year 2030)

2050
Total estimated grid electricity usage by 2050 is 2,250,722,319 kwh. If we replace 50% of this energy usage with alternative energy in 2050, we will replace 1,125,361,160 kwh. This will result in a <u>reduction of 820,981 tons of CO2E from BAU</u> (in year 2050)

3. Improved Transportation (and Sustainable Communities)

If Charleston maintains projected 2010 vehicle miles traveled (VMT) level by increasing use of public transportation (CARTA) and/or substitutes walking or biking for driving, it could result in a reduction of 152,940 tons of CO_2e in 2030 from projected "business as usual" 2030 level.



a. Switch to CARTA

VMT for 2006: 1,396,329,765
VMT for 2002: 1,300,060,650
This increase was correlated with population increase over those years to find a ratio of VMT increase to population increase. This ratio was then used with population predictions to create a BAU projection for the increase in VMT for Charleston until 2050.

Estimated VMT in year 2010: 1,458,213,635
Estimated VMT in year 2020: 1,587,624,910
Estimated VMT at the beginning of year 2030: 1,732,306,267

In order to reach our goal of keeping VMT to 2010 levels, we would have a decrease from BAU of (1,587,624,910 – 1,458,213,635) = 129,411,275 VMT by the year 2020, and (1,732,306,267 – 1,458,213,635) = 274,092,632 VMT by the year 2030.

We assume that the average CARTA trip within the city of Charleston is 10 miles. CARTA averages 11,500 riders per week day and 8,000 riders per weekend day. Therefore, we multiply 11,500 by 261 weekdays in a year to get 3,001,500 weekday riders / year, and we multiply 8,000 by 104 weekend days to get 832,000 weekend riders / year. 3,001,500 + 832,000 = 3,833,500 riders / year. Multiply this by an average trip of 10 miles to get 38,335,000 VMT / year by CARTA.

Reduction Measures by Year:
2020

If we doubled CARTA ridership from 2010 levels by 2020 we would reduce VMT by 38,335,000. The reduction of 38,335,000 VMT would correlate to a reduction of 16,374 tons of CO2E from BAU (in year 2020)

2030
If we tripled CARTA ridership from 2010 levels by 2030 we would reduce VMT by 76,670,000. This would correlate to a reduction of 32,749 tons of CO2E from BAU (in year 2030).

b. Switch to Walking/Biking

Reduction Measures by Year:
2020
To achieve the goal of keeping VMT to 2010 levels, we would need a decrease from BAU in 2020 of 129,411,275 VMT. Doubling CARTA ridership accounted for 38,335,000 VMT of the needed decrease from BAU. This would be a percent of the total needed VMT reduction of (38,335,000 / 129,411,275 * 100) = 30 %. The remaining 70 % percent will be accounted for by a switch to walking and biking.

129,411,275 * .70 = 90,587,893 VMT reduced in 2020 by switching to walking/biking. This correlates to a CO2E reduction of 55,171 tons from BAU. (in year 2020)

2030
To achieve the goal of keeping VMT to 2010 levels, we would need a decrease from BAU in 2030 of 274,092,632 VMT. Tripling CARTA ridership accounted for 76,670,000 VMT of the needed decrease from BAU. This would be a percent of the total needed VMT reduction of (76,670,000/ 274,092,632 * 100) = 28 %. The remaining 72 % percent will be accounted for by a switch to walking and biking.

274,092,632 * .72 = 197,346,695 VMT reduced in 2030 by switching to walking/biking. This correlates to a CO2E reduction of 120,191 tons from BAU. (in year 2030)

Totals for Measures “Switch to CARTA” plus “Switch to Walking/Biking”

2030
Total CO2e reduction: (120,191 + 32,749) = 152,940 tons of CO2e from BAU. (in year 2030)

c. Increase Fuel Efficiency

If Charleston increases the fuel efficiency of all vehicles by 30% by 2030 (through encouragement of more efficient driving techniques and incentives for purchasing of more efficient vehicles), it could result in a reduction of 202,577 tons of CO_2e *in 2030 from projected “business as usual” 2030 level.*

Following in line with President Obama’s fuel efficiency initiatives, "...those increases - the first in more than 30 years - called for raising the average fuel economy from 27.5 miles a gallon for cars and 22 miles a gallon for trucks to 35 miles a gallon for the whole fleet by 2020." Source: http://www.cnn.com/2009/BUSINESS/01/26/obama.green/

Obama's plan would be an increase of 30% for the whole fleet on average by 2020.

"A driver's best defense against wasted fuel is to improve driving technique. Slower speed, smoother stops and starts (0 - 60 in 15 seconds instead of 10) can raise fuel mileage an average of 31%." Source: http://consumereducation.suite101.com/article.cfm/hypermiling_for_serious_fuel_efficiency

We want to encourage the purchasing of new, 30% more fuel efficient cars as in Obama's plan. This includes hybrid cars. We also want to increase the mpg of old cars by 30% through the encouragement of more efficient driving methods (speed limits, anti-idling, inflating tires, slower acceleration, etc.)

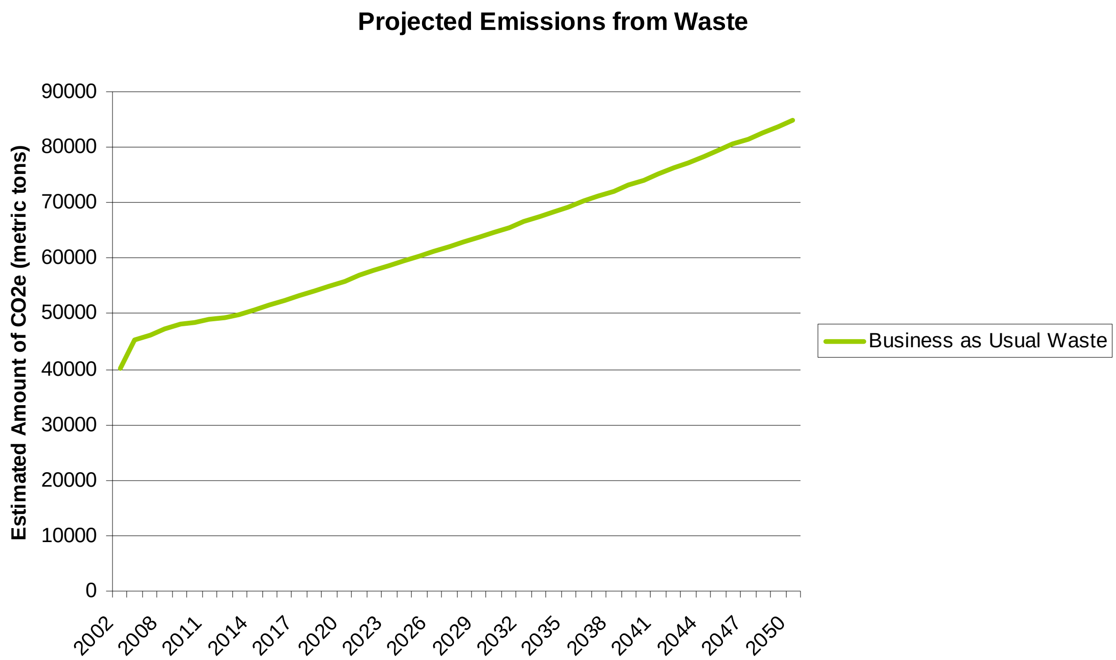
In 2007 the average mpg for all registered vehicles was 17.2. If we increase this number by 30% we would increase fuel efficiency from 17.2 mpg to 22.36 mpg. This is an increase of 5.16 mpg. Source: http://www.bts.gov/publications/national_transportation_statistics/html/table_04_09.html

Reduction Measures by Year:
2030
If we keep VMT to 2010 levels (1,458,213,635), and increase fuel efficiency by 5.16 mpg by 2030 (using 17.2 mpg as the average baseline mpg for all vehicles), this would result in a reduction of 202,577 tons of CO2e from BAU. (in year 2030)

4. Zero Waste

If Charleston reduces the waste stream by 50% from the projected 2030 amount, it could result in a reduction of 22,860 tons of CO_2e in 2030 from projected "business as usual" 2030 level.

Based on 2002 data from Bee's Ferry Landfill, the city of Charleston sent 40,166.20 tons of waste to the landfill. In 2006, the city of Charleston sent 45,154.38 tons of waste to the landfill. This increase was correlated with population increase over those years to find a ratio of waste increase to population increase. This ratio was then used with population predictions to create a BAU projection for the increase in waste for Charleston until 2050.



Reduction Measures by Year:
2010-2015
Reduce waste stream by 10%
From 2010 to 2015 there will be a total of 247,219 tons of waste sent to the landfill. If we reduce this number by 10% we will have a reduction of 24,721.9 tons of waste. This correlates to a reduction of 17,456 tons CO2E from BAU (over years 2010 through 2014)

2015-2020
Reduce waste stream by 30%
From 2015 to 2020 there will be a total of 266,518 tons of waste sent to the landfill. If we reduce this number by 30% we will have a reduction of 79,955.4 tons of waste. This correlates to a reduction of 56,457 tons of CO2E from BAU (over years 2015 through 2019)

2020-2025
Reduce waste stream by 40%
From 2020 to 2025 there will be a total of 288,634 tons of waste sent to the landfill. If we reduce this number by 40% we will have a reduction of 115,453.6 tons of waste. This correlates to a reduction of 81,523 tons of CO2E from BAU (over years 2020 through 2024)

2025-2030
Reduce waste stream by 50%
From 2025 to 2030 there will be a total of 310,612 tons of waste sent to the landfill. If we reduce this number by 50% we will have a reduction of 155,306 tons of waste. This correlates to a reduction of 109,663 tons of CO2E from BAU (over years 2025 through 2029)

*** 2030**
In the year 2030 there will be a total of 64,749 tons of waste sent to the landfill. If we reduce this number by 50% we will have a reduction of 32,375 tons of waste. This correlates to a reduction of 22,860 tons of CO2E from BAU (in year 2030)

2030-2035

reduce waste stream by 60%
From 2030-2035 there will be a total of 332725 tons of waste sent to the landfill. If we reduce this number by 60% we will have a reduction of 199635 tons of waste. This correlates to a reduction of 140,964 tons of CO2E from BAU. (over years 2030 through 2034)

2035-2040
Reduce waste stream by 70%
From 2035-2040 there will be a total of 356122 tons of waste sent to the landfill. If we reduce this number by 70% we will have a reduction of 249285.4 tons of waste. This correlates to a reduction of 176,023 tons of CO2E from BAU. (over years 2035 through 2039)

2040-2045
Reduce waste stream by 80%
From 2040-2045 there will be a total of 381164 tons of waste sent to the landfill. If we reduce this number by 80% we will have a reduction of 304931.2 tons of waste. This correlates to a reduction of 215315 tons of CO2E from BAU. (over years 2040 through 2044)

2045-2050
Reduce waste stream by 90%
From 2045-2050 there will be a total of 407967 tons of waste sent to the landfill. If we reduce this number by 90% we will have a reduction of 367170.3 tons of waste. This correlates to a reduction of 259,263 tons of CO2E from BAU. (over years 2045 through 2049)

2050
Zero waste
In the year 2050 there will be a total of 84,973 tons of waste sent to the landfill. If we reduce this number by 100% to achieve zero waste, we will have a reduction of 84,973 tons of waste. This correlates to a reduction of 60,000 tons of CO2E from BAU. (in year 2050)

5. "Business as Usual" (BAU) Projection Spreadsheets

* Data for the BAU Projection Graphs within the Metrics

a. "Business As Usual" Projected Increase in Energy Use (kwh)

Year	Business "as usual" Energy Projection (kwh)	Estimated Population (Based on 2000 US Census and City projections based on annexations, new building permits and projected growth)	Estimated Population Percentage Change	Estimated Energy Percentage Change (the year's % population change times the energy growth ratio from 2002 to 2006)	Estimated Energy Amount of Increase (% energy change times previous year's total energy)
1990	NA	**80,414**	-	-	-
2000	NA	**96,650**	-16.799%	-8.116%	0
2001	NA	**100,180**	-3.524%	-1.702%	-25827144
2002	1517202666	**101,780**	-	-	-98443893
2006	1615646559	**115,450**	13.431%	6.489%	98443893

2007	1636212602	**118,492**	2.63%	1.273%	20566043
2008	1656739216	**121,569**	2.60%	1.255%	20526614
2009	1671012691	**123,737**	1.78%	0.862%	14273474
2010	1678267272	124,849	0.90%	0.434%	7254581
2011	1685488455	125,961	0.89%	0.430%	7221183
2012	1692676687	127,073	0.88%	0.426%	7188232
2013	1699832405	128,185	0.88%	0.423%	7155718
2014	1715755818	130,670	1.94%	0.937%	15923413
2015	1731522667	133,156	1.90%	0.919%	15766849
2016	1747137386	135,642	1.87%	0.902%	15614719
2017	1762604203	138,127	1.83%	0.885%	15466817
2018	1777927156	140,613	1.80%	0.869%	15322952
2019	1793110101	143,098	1.77%	0.854%	15182945
2020	1808156728	145,584	1.74%	0.839%	15046627
2021	1823070568	148,070	1.71%	0.825%	14913839
2022	1837855001	150,555	1.68%	0.811%	14784433
2023	1852513268	153,041	1.65%	0.798%	14658267
2024	1867048478	155,526	1.62%	0.785%	14535210
2025	1881463613	158,012	1.60%	0.772%	14415135
2026	1895761539	160,497	1.57%	0.760%	14297926
2027	1909945010	162,983	1.55%	0.748%	14183471
2028	1924016673	165,469	1.53%	0.737%	14071663
2029	1937979075	167,954	1.50%	0.726%	13962402
2030	1951834670	170440	1.48%	0.715%	13855595
2031	1965789326	*172962*	*1.48%*	0.715%	13954656
2032	1979843750	*175522*	*1.48%*	0.715%	14054425
2033	1993998657	*178119*	*1.48%*	0.715%	14154907
2034	2008254764	*180755*	*1.48%*	0.715%	14256107
2035	2022612796	*183430*	*1.48%*	0.715%	14358031
2036	2037073480	*186145*	*1.48%*	0.715%	14460684
2037	2051637551	*188900*	*1.48%*	0.715%	14564071
2038	2066305748	*191695*	*1.48%*	0.715%	14668197
2039	2081078815	*194532*	*1.48%*	0.715%	14773067
2040	2095957503	*197411*	*1.48%*	0.715%	14878688
2041	2110942566	*200333*	*1.48%*	0.715%	14985063
2042	2126034764	*203297*	*1.48%*	0.715%	15092199
2043	2141234865	*206306*	*1.48%*	0.715%	15200100
2044	2156543638	*209359*	*1.48%*	0.715%	15308774
2045	2171961862	*212458*	*1.48%*	0.715%	15418224
2046	2187490319	*215602*	*1.48%*	0.715%	15528457
2047	2203129796	*218793*	*1.48%*	0.715%	15639477
2048	2218881088	*222030*	*1.48%*	0.715%	15751292
2049	2234744994	*225316*	*1.48%*	0.715%	15863906
2050	2250722319	*228651*	*1.48%*	0.715%	15977325

b. "Business As Usual" Projected Increase in Vehicle Miles Traveled (VMT)

Year	Business "as usual" VMT Projections	VMT reductions from BAU to 2010 baseline (2010 baseline VMT is 1458213635)	Estimated Population (Based on 2000 US Census and City projections based on annexations, new building permits and projected growth)	Estimated Population Percentage Change	Estimated VMT Percentage Change (the year's % population change times the VMT growth ratio from 2002 to 2006)	Estimated VMT Amount of Increase (% VMT change times previous year's total VMT)
1990	NA	NA	**80,414**	-	-	-
2000	NA	NA	**96,650**	-16.799%	-9.262%	0
2001	NA	NA	**100,180**	-3.524%	-1.943%	-25256583
2002	**1300060650**	NA	**101,780**	-	-	-96269115
2006	**1396329765**	NA	**115,450**	13.431%	7.405%	96269115
2007	1416614557	NA	**118,492**	2.63%	1.453%	20284792
2008	1436896403	NA	**121,569**	2.60%	1.432%	20281845
2009	1451024354	NA	**123,737**	1.78%	0.983%	14127951
2010	1458213635	0	124,849	0.90%	0.495%	7189281
2011	1465374188	7160553	125,961	0.89%	0.491%	7160553
2012	1472506380	14292745	127,073	0.88%	0.487%	7132192
2013	1479610570	21396935	128,185	0.88%	0.482%	7104190
2014	1495428719	37215084	130,670	1.94%	1.069%	15818149
2015	1511111871	52898236	133,156	1.90%	1.049%	15683152
2016	1526663676	68450040	135,642	1.87%	1.029%	15551805
2017	1542087620	83873985	138,127	1.83%	1.010%	15423944
2018	1557387037	99173402	140,613	1.80%	0.992%	15299417
2019	1572565116	114351481	143,098	1.77%	0.975%	15178079
2020	1587624910	129411274	145,584	1.74%	0.958%	15059794
2021	1602569344	144355709	148,070	1.71%	0.941%	14944434
2022	1617401224	159187589	150,555	1.68%	0.926%	14831880
2023	1632123242	173909607	153,041	1.65%	0.910%	14722018
2024	1646737982	188524347	155,526	1.62%	0.895%	14614740
2025	1661247929	203034294	158,012	1.60%	0.881%	14509947
2026	1675655470	217441835	160,497	1.57%	0.867%	14407541
2027	1689962903	231749268	162,983	1.55%	0.854%	14307433
2028	1704172439	245958804	165,469	1.53%	0.841%	14209536
2029	1718286210	260072574	167,954	1.50%	0.828%	14113770
2030	1732306267	274092631	170440	1.48%	0.816%	14020057
2031	1746440718	288227083	*172962*	*1.48%*	0.816%	14134451
2032	1760690497	302476862	*175522*	*1.48%*	0.816%	14249779
2033	1775056544	316842909	*178119*	*1.48%*	0.816%	14366048
2034	1789539809	331326174	*180755*	*1.48%*	0.816%	14483265
2035	1804141248	345927612	*183430*	*1.48%*	0.816%	14601438
2036	1818861824	360648189	*186145*	*1.48%*	0.816%	14720576
2037	1833702510	375488875	*188900*	*1.48%*	0.816%	14840686
2038	1848664287	390450651	*191695*	*1.48%*	0.816%	14961776
2039	1863748141	405534506	*194532*	*1.48%*	0.816%	15083854
2040	1878955070	420741434	*197411*	*1.48%*	0.816%	15206928
2041	1894286076	436072441	*200333*	*1.48%*	0.816%	15331007
2042	1909742174	451528538	*203297*	*1.48%*	0.816%	15456097

2043	1925324382	467110747	*206306*	*1.48%*	0.816%	15582209
2044	1941033731	482820096	*209359*	*1.48%*	0.816%	15709349
2045	1956871258	498657623	*212458*	*1.48%*	0.816%	15837527
2046	1972838008	514624373	*215602*	*1.48%*	0.816%	15966750
2047	1988935037	530721401	*218793*	*1.48%*	0.816%	16097028
2048	2005163406	546949770	*222030*	*1.48%*	0.816%	16228369
2049	2021524187	563310552	*225316*	*1.48%*	0.816%	16360782
2050	2038018462	579804827	*228651*	*1.48%*	0.816%	16494275

c. "Business As Usual" Projected Increase in Emissions (CO_2e) from Waste (tons)

Year	Business "as usual" Waste Projections	Estimated Population (Based on 2000 US Census and City projections based on annexations, new building permits and projected growth)	Estimated Population Percentage Change	Estimated Waste Percentage Change (the year's % population change times the waste growth ratio from 2002 to 2006)	Estimated Amount of Waste Increase (% waste change times previous year's total waste)
1990		**80,414**	-	-	-
2000		**96,650**	-16.799%	-15.533%	0
2001		**100,180**	-3.524%	-3.258%	-1309
2002	**40166**	**101,780**	-	-	-4988
2006	**45154**	**115,450**	13.431%	12.419%	4988
2007	46255	**118,492**	2.63%	2.436%	1100
2008	47365	**121,569**	2.60%	2.401%	1111
2009	48146	**123,737**	1.78%	1.649%	781
2010	48546	124,849	0.90%	0.831%	400
2011	48946	125,961	0.89%	0.824%	400
2012	49346	127,073	0.88%	0.816%	400
2013	49745	128,185	0.88%	0.809%	399
2014	50637	130,670	1.94%	1.793%	892
2015	51527	133,156	1.90%	1.759%	891
2016	52417	135,642	1.87%	1.726%	889
2017	53305	138,127	1.83%	1.694%	888
2018	54192	140,613	1.80%	1.664%	887
2019	55078	143,098	1.77%	1.634%	886
2020	55962	145,584	1.74%	1.606%	885
2021	56846	148,070	1.71%	1.579%	883
2022	57728	150,555	1.68%	1.552%	882
2023	58609	153,041	1.65%	1.527%	881
2024	59489	155,526	1.62%	1.502%	880
2025	60368	158,012	1.60%	1.478%	879
2026	61246	160,497	1.57%	1.454%	878
2027	62123	162,983	1.55%	1.432%	877
2028	63000	165,469	1.53%	1.410%	876
2029	63875	167,954	1.50%	1.389%	875
2030	64749	170440	1.48%	1.368%	874
2031	65635	*172962*	*1.48%*	1.368%	886
2032	66533	*175522*	*1.48%*	1.368%	898

2033	67443	*178119*	*1.48%*	1.368%	910
2034	68366	*180755*	*1.48%*	1.368%	923
2035	69302	*183430*	*1.48%*	1.368%	936
2036	70250	*186145*	*1.48%*	1.368%	948
2037	71211	*188900*	*1.48%*	1.368%	961
2038	72186	*191695*	*1.48%*	1.368%	974
2039	73173	*194532*	*1.48%*	1.368%	988
2040	74175	*197411*	*1.48%*	1.368%	1001
2041	75190	*200333*	*1.48%*	1.368%	1015
2042	76219	*203297*	*1.48%*	1.368%	1029
2043	77262	*206306*	*1.48%*	1.368%	1043
2044	78319	*209359*	*1.48%*	1.368%	1057
2045	79391	*212458*	*1.48%*	1.368%	1072
2046	80477	*215602*	*1.48%*	1.368%	1086
2047	81578	*218793*	*1.48%*	1.368%	1101
2048	82695	*222030*	*1.48%*	1.368%	1116
2049	83826	*225316*	*1.48%*	1.368%	1132
2050	84973	*228651*	*1.48%*	1.368%	1147

d. "Business As Usual" Projected Increase in Private Businesses (square footage)

Year	Business "as usual" Sq. Ft. Projection	Estimated Population (Based on 2000 US Census and City projections based on annexations, new building permits and projected growth)	Estimated Population Percentage Change	Estimated Sq. Ft. Percentage Change (the year's % population change times the sq. ft. growth ratio from 2002 to 2006)	Estimated Sq. Ft. Amount of Increase (% Sq. Ft. change times previous year's total sq. ft.)
1990	NA	**80,414**	-	-	-
2000	NA	**96,650**	-16.799%	-9.180%	0
2001	NA	**100,180**	-3.524%	-1.926%	-643013
2002	**33393575**	**101,780**	-	-	-2450938
2006	**35844513**	**115,450**	13.431%	7.340%	2450938
2007	36360634	**118,492**	2.63%	1.440%	516121
2008	36876614	**121,569**	2.60%	1.419%	515980
2009	37235992	**123,737**	1.78%	0.975%	359377
2010	37418852	124,849	0.90%	0.491%	182860
2011	37600974	125,961	0.89%	0.487%	182122
2012	37782366	127,073	0.88%	0.482%	181393
2013	37963039	128,185	0.88%	0.478%	180673
2014	38365307	130,670	1.94%	1.060%	402268
2015	38764104	133,156	1.90%	1.039%	398797
2016	39159526	135,642	1.87%	1.020%	395421
2017	39551661	138,127	1.83%	1.001%	392135
2018	39940595	140,613	1.80%	0.983%	388935
2019	40326412	143,098	1.77%	0.966%	385817
2020	40709189	145,584	1.74%	0.949%	382777
2021	41089002	148,070	1.71%	0.933%	379813

2022	41465924	150,555	1.68%	0.917%	376922
2023	41840023	153,041	1.65%	0.902%	374099
2024	42211367	155,526	1.62%	0.888%	371344
2025	42580019	158,012	1.60%	0.873%	368652
2026	42946041	160,497	1.57%	0.860%	366022
2027	43309492	162,983	1.55%	0.846%	363451
2028	43670430	165,469	1.53%	0.833%	360937
2029	44028908	167,954	1.50%	0.821%	358478
2030	44384980	170440	1.48%	0.809%	356072
2031	44743932	*172962*	*1.48%*	0.809%	358952
2032	45105787	*175522*	*1.48%*	0.809%	361855
2033	45470569	*178119*	*1.48%*	0.809%	364781
2034	45838300	*180755*	*1.48%*	0.809%	367731
2035	46209005	*183430*	*1.48%*	0.809%	370705
2036	46582709	*186145*	*1.48%*	0.809%	373703
2037	46959434	*188900*	*1.48%*	0.809%	376726
2038	47339206	*191695*	*1.48%*	0.809%	379772
2039	47722050	*194532*	*1.48%*	0.809%	382844
2040	48107990	*197411*	*1.48%*	0.809%	385940
2041	48497050	*200333*	*1.48%*	0.809%	389061
2042	48889258	*203297*	*1.48%*	0.809%	392207
2043	49284637	*206306*	*1.48%*	0.809%	395379
2044	49683214	*209359*	*1.48%*	0.809%	398577
2045	50085014	*212458*	*1.48%*	0.809%	401800
2046	50490063	*215602*	*1.48%*	0.809%	405050
2047	50898388	*218793*	*1.48%*	0.809%	408325
2048	51310016	*222030*	*1.48%*	0.809%	411627
2049	51724972	*225316*	*1.48%*	0.809%	414956
2050	52143284	*228651*	*1.48%*	0.809%	418312

* Red numbers highlight inventory years and target years. **Bold** numbers are observed or collected data. *Italicized* numbers are linear growth estimations made after 2030, which was the last year with data for projected population.