Appendix B: Greenhouse Gas Emissions Reductions Analysis Calculations

Appendix B: Greenhouse Gas Emissions Reductions Analysis Calculations

This appendix outlines the assumptions, sources, and calculations behind estimates of greenhouse gas emission reductions. Most estimates were facilitated through the Climate and Air Pollution Planning Assistant (CAPPA) tool developed by ICLEI. The tool, currently in Beta, was created to assist local governments in developing customized plans for reducing climate change. CAPPA provides information and quantification tools for over 100 emission reduction strategies in its current form. City-specific data is entered into the CAPPA software and combined with emission coefficients, current research, and the results of pilot programs or case studies in other jurisdictions.

All CAPPA sources were evaluated for reliability and applicability before the calculation was made. Where a CAPPA reduction analysis wasn't available or appropriate, other research and City data was compiled to create an estimate or to display that an estimate is not currently possible. All conversion and assumption sources, whether embedded in CAPPA or original work, are cited below.

The calculations, estimates, and assumptions go as far as the input data (kWh, therms, vehicle miles, tons of waste, etc). The conversion to CO2e was completed in the CACP software or CAPPA software using verified emissions coefficients.

* = Information Item only. Emission reductions not included in final reduction estimate.

1. Expand energy saving opportunities to businesses

1.1. Consider developing a tax rebate program for efficiency improvements in businesses.
GHG Reduction: No calculation possible

1.2. Expand energy saving opportunities for large and small commercial and industrial properties.
2,100 businesses in San Carlos in 2009 (Communication between PMC and the San Carlos Chamber of Commerce Secretary, November 2008). Assume 2,000 businesses in 2005.

Assume existing businesses will achieve an average reduction of 10% by 2020, which is equivalent to 11,500 kWh and 367 therms annually. Reduction estimates per business based on the following reduction estimates and sources built into CAPPA:

KWh Reduction per business = 11,500
Boulder carbon tax of $0.0004/kWh costs $46/business annually, indicating average use of 115,000 kWh. 10% savings assumed per ICLEI recommendation.
Source:
http://www.bouldercolorado.gov/files/Environmental%20Affairs/climate%20and%20energy/cap_tax_faq_26mar07_final.pdf

Therm Reduction per business = 367
Based on 8,160 ft^2, 0.45 therms/ft^2, 10%savings.
Therms/ft^2 source: 2003 Commercial Building Energy Consumption Survey
http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set10/2003excel/c14.xls.   8160 ft^2 calculated from 115,000 kWh, 14.1 kWh/ft^2.

Boulder carbon tax of $.0004/kWh costs $46/business annually, indicating average use of 115,000 kWh. Source:
http://www.bouldercolorado.gov/files/Environmental%20Affairs/climate%20and%20energy/cap_tax_faq_26mar07_final.pdf
kWh/ft^2 Source:
http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set11/2003excel/c24.xls

GHG Reduction: 13,300 Metric Tons per year

2. Improve residential energy efficiency

2.1. Establish energy efficiency standards for new construction and remodel projects that exceed the State's 2008 Title 24 energy standards by 15%

2008 Title 24 Energy Efficiency Improvements in comparison to 2005 baseline Title efficiency standards (Source: California Energy Commission, *Impact Analysis: 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings,* November 2007):

Sector (Energy Type)	Reduction from 2008 Standards	Tier 1 Reduction (+15%)	Tier 2 Reduction (+30%)	2020 Tier 1 Reductions	2030 Tier 2 Reductions
Residential New Construction (electricity)	21.80%	36.80%	51.80%	334.68864	*972.51
Residential New Construction (natural gas)	9.82%	24.82%	39.82%	458.306264	*1974.49
Nonresidential New Construction (electricity)	4.90%	19.90%	34.90%	2150.2348	5083.86904
Nonresidential New Construction (natural gas)	9.40%	24.40%	39.40%	1240.6912	2700.88576
Total	--	--	--	4183.920904	10731.7548

* Represents entire growth in residential electricity in natural gas after 2020. The recent California Long-Term Energy Efficiency Plan recommended that Title 24 standards be updated to require all new residential buildings will be zero net energy by 2020. Assuming that this is implemented, Title 24 would result in at least a 2,947 metric tons of CO_2e reduction.

This is based on the following change in emissions between 2005, 2020, and 2030. Based on current trends, it is estimated that 2/3 of pre-2020 growth will occur between the effective date of these standards and 2020.

Business-As-Usual Emissions growth	Change from 2005 - 2020	Change from 2020- 2030
Residential electricity	1364.22	972.51
Residential natural gas	2769.78	1974.49
Nonresidential electricity	16207.8	14566.96
Nonresidential natural gas	7627.2	6855.04
Total	27969	24369

GHG Reduction: 4,184 metric tons per year by 2020
*   10,732 metric tons per year by 2030*

2.2. Perform energy-efficient lighting retrofits and/or home energy audits.

Difference between an efficient and non-efficient home in San Carlos from the Home Energy Saver calculator developed by the Lawrence Berkeley National Laboratory - http://hes.lbl.gov/ (Session ID# 1260074). Calculator estimates difference of 2,400 kilowatt-hours (kWh) of electricity and 445 therms of natural gas per year. Assuming that an energy auditing program serves at least 500 existing homes before 2030 (250 before 2020 and 250 before 2020), we can estimate that energy consumption in San Carlos would decrease by 600,000 kWh and 111,250 therms per year by 2020 and 1,200,000 kWh and 222,500 therms per year by 2030.

GHG Reduction: 1,452 metric tons per year

2.3. Expand the distribution of free or subsidized energy and water saving devices and services to the mass market.

Assumption that at least 10,000 CFLs, 500 showerheads, and 500 faucets will be distributed and used before 2020. Assumptions based on a previous device distribution project by San Carlos Green. kWh savings of various devices obtained from the U.S. Department of Energy – Energy Efficiency and Renewable Energy (http://www.eere.energy.gov/buildings/info/documents/pdfs/lmc_vol1_final.pdf)

This reduction measure would reduce energy consumption associated with lighting and with water filtration, movement, and heating. Specifically, this reduction measure would reduce greenhouse gas emissions from the following sources in the following ways:

- Compact Fluorescent Lightbulbs (CFLs): Each CFL saves an average of 44 kWh per year when replacing traditional incandescent bulbs.[1] We estimate that 10,000 incandescent lightbulbs will be replaced with CFLs by 2020 and 10,000 more incandescent lightbulbs will be replaced with CFLs by 2030. Assuming that CFLs continue to be used after initial replacement, we can estimate that energy consumption will reduce by 440,000 kWh per year. This is equivalent to 93 metric tons of CO_2e per year.

- Low-flow showerheads: Low-flow showerheads save energy associated with water filtration, movement, and heating. Assuming that 1,000 low-flow showerheads are distributed and used, this reduction measure could save 66 metric tons of CO_2e per year from the filtration, movement, and treatment of water. However, since energy for these purposes is not included in the baseline 2005 inventory, this reduction is provided as an information item only. Low-flow showerheads also save energy because they require less water to be heated. Assuming that 42 percent of San Carlos residents use electric water heaters and the rest use gas, this reduction measure would result in an additional reduction of 66 metric tons CO_2e per year. Since energy for heating water within homes is included in the 2005 baseline, this figure will be included in the analysis of San Carlos' total reductions.

- Low-flow faucets: Low-flow faucets, much like showerheads, save energy associated with water filtration, movement, and heating. As an information item, 1,000 low-flow faucets would save 6 metric tons of CO_2e per year from water filtration, movement, and treatment. In addition, this measure would save 12 metric tons of CO_2e from less water

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[1] ICLEI CAPPA software estimates 44 kWh a year in savings based on replacing half 100watt and half 60w incandescent bulbs with 25w and 15w cfls respectively (i.e. avg 80w replaced with avg 20w, for 60w per bulb savings). Assumes each bulb is on 2 hours per day, which is average for residential lights according to National Lighting Inventory and Energy Consumption Estimate 2002. http://www.eere.energy.gov/buildings/info/documents/pdfs/lmc_vol1_final.pdf.
60w x 2hours/day x 365 days/year = 44 kWh/year

having to be heated. As described above, only the emissions reductions associated with in-home heating of the water will be included in the total of San Carlos' reductions.

CFLs, low-flow showerheads, and low-flow faucets together save an estimated 243 metric tons of CO_2e per year, 171 metric tons of which will be included in the final analysis of San Carlos' reductions.

GHG Reduction: 171 metric tons per year

2.4. Expand and better integrate programs that increase energy efficiency in low-income households.
Assumption that 1,000 homes will be served by weatherization programs (feasible number based on weatherization programs in neighboring Bay Area cities). Reduction estimates per household based on the following reduction estimates and sources built into CAPPA:

Energy savings per home = 1,300
Source: Report on the impacts and costs of the Iowa low-income weatherization program-- calendar year 2006. http://www.waptac.org/si.asp?id=1143.

Therms savings per home = 222
Source: Report on the impacts and costs of the Iowa low-income weatherization program-- calendar year 2006. http://www.waptac.org/si.asp?id=1143.

GHG Reduction: *1,760 metric tons per year*

3. Adopt a green building standard for all new development and major remodels

3.1A. Provide information and support to developers on LEED and GreenPoint standards.
It is estimated that promotion of voluntary Code requirements and promotion of LEED/GreenPoint certification would lower energy consumption in new development and remodels by an estimated 2.5% in addition to Energy Use Measure 2.1.

	2005-2020 Increase	2020-2030 Increase
Business-as-Usual Energy Use	27,969	24,369
2.5% Reduction	*466	**535.5

*Assume 2/3 of growth will occur after promotion has begun and Code is enforceable (Jan 2010)
**Reductions from commercial sector only. Residential sector considered zero net energy in 2.1.

GHG Reduction: *466 metric tons annually by 2020*
                 535.5 metric tons

3.1B. Create a green building ordinance requiring a GreenPoint, LEED, or equivalent green building certification per development category.

LEED, GreenPoint, or equivalent standards are estimated to lower energy consumption in new development and remodels by an estimated 30%. This is a low estimate of an estimate given by the US Green Building Council (USGBC) which estimated a 50% reduction.[2]

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[2] US Green Building Council, CEO of U.S. Green Building Council discusses benefits of green building, http://www.usgbc.org/News/USGBCInTheNewsDetails.aspx?ID=2882, accessed December 2, 2008.

GHG Reduction: *11,868 metric tons annually by 2020*

4. Create water and waste efficient landscapes

*4.1. Formalize the City's efficient landscaping practice by writing it into the Parks Master Plan.
According to the San Carlos Parks Master Plan, there are 143 Acres of park land in San Carlos. For this analysis, we will assume that 50% of park land is landscaped. This estimate is supported by City staff as the exact percentage and/or acreage of landscaped open space is unavailable. Energy savings from water calculated using the CEC's "Redefining Estimates of Water Related Energy Use In California" in 2006.

GHG Reduction: **69 metric tons per year*

*4.2. Expand the current landscaping ordinance to require efficient landscaping in conjunction with all residential and commercial property improvements.
General Plan Buildout estimates show an increase of 1,686 households before 2030. For the analysis, 50% (843) were assumed to be detached family houses requiring efficient landscaping. Since recent California-specific data is unavailable, the national average yard size (.5 acres) was used as well as national averages for lawn mower gasoline consumption, average waster consumption per acre of lawn, and average energy use per gallon of water.

The average acre of lawn in the U.S. uses 652,000 gallons of water each year. Source: http://dare.agsci.colostate.edu/thilmany/golfresource.pdf. p.4

In northern California, 10,000 gallons of water takes 54 kWh for indoor use and 35 kWh for outdoor use for transport, treatment, distribution, and wastewater treatment. Source: California Energy Commission. REFINING ESTIMATES OF WATER RELATED ENERGY USE IN CALIFORNIA. 2006. Table ES-1.

Using these figures, it can be estimated that a more efficient landscaping requirement would reduce emissions by 416 metric tons of CO_2e per year solely from new development.

GHG Reduction: **416 metric tons per year*

5. Identify opportunities for on-site renewable energy generation on City and privately-owned property

5.1. Identify opportunities for increasing solar system installations in the community and on City facilities.
Assumption that a minimum of 400 kW would be installed on city property. Hours of sunlight per day in San Carlos obtained from www.rockygrove.com.

Annual kWh Produced = kWh Installation * Hours of sunlight per day * 365
                      = 400 kWh * 4.5 hours * 365 = 657,000 kWh

GHG Reduction: *263 metric tons per year*

5.2. Identify opportunities for Wind energy generation.
Assumption that ten small-scale wind turbines will be installed before 2020. Each turbine of 10-kW will produce approximately 22,000 kWh per year based on information from the American Wind Energy Association (AWEA). Total of 328,500 kWh of clean energy produced per year in San Carlos.

GHG Reduction: 131 metric tons per year

5.3. Identify opportunities for Biomass energy opportunities.

GHG Reduction: No Calculation

6. Implement reduction strategies included in the energy audit of City facilities. Continue to monitor City facility performance.

The total GHG reduction from a City audit and retrofit is unknown until the audit is completed. However, the audit and retrofit recommendations of the Adult Community Center will produce 16 metric tons of GHG emissions.

GHG Reduction: 16 metric tons per year

7. Provide for increased albedo (reflectivity) of all urban surfaces including roads, driveways, sidewalks, and roofs in order to increase reflectivity and minimize the urban heat island effect

The Lawrence Berkeley National Laboratory Urban Heat Island Group estimates that pavement reflectivity can be raised on average only 15% in an urban area. This 15% causes four metric tons of carbon dioxide to be offset per 1,000 square feet replaced when compared to traditional asphalt. Assuming that 12% of San Carlos is covered in pavement, or approximately 2 million square feet, and assuming that 30% of all hardscape controlled by the City is repaved with high albedo content material by 2020, we estimate that this measure will result in at least 2,320 metric tons of CO_2 equivalent savings per year.

Source:
Global Cooling: Increasing World-wide Urban Albedos to Offset CO2," by Hashem Akbari, Surabi Menon, and Arthur Rosenfeld, appeared in *Climatic Change* June 2009

GHG Reduction: 2,320 metric tons per year

8. Encourage tree planting

8.1.   Provide for City assistance to community tree planting programs and efforts

Assumption that at least 400 new trees would be planted as a result of this program. Energy savings from increased shading and reduced urban heat island effect calculated by CAPPA. CAPPA assumptions/sources:

<u>Annual Electricity Savings per Tree = 7 kWh</u>
Energy savings are from reduction of urban heat island effect.
Savings = 0.22F temperature decrease/1% increase in canopy cover x 1% canopy/.75
        tree/person x 1.75 % change in peak energy/degree F x 12,600 kWh/person*yr x 0.11
        decrease in average energy/decrease in peak energy.
0.22 F/1% canopy is middle of .07-.36 F range from EPA Heat Island Effect.
        http://www.epa.gov/heatisland/strategies/vegetation.html.
1.75% change in peak energy /F is middle of 1.5-2% range from
        http://www.epa.gov/heatisland/about/energysavings.html.
1% canopy=.75 tree/person from http://www.fs.fed.us/ne/syracuse/NatUFAssessments.htm. 3.8
        Billion urban trees provide 27% canopy cover for 75% of US population who live in urban
        areas in 1990. 1990 population 249million from US Census for urban population of 187
        million and 20 trees/person.

20 trees/27% cover = .75tree/1% cover.

12,600kWh/person from CIA World Factbook: 3.7 x 10^12 kWh total US electricity consumption in 2004, 3.01x 10^8 population in 2007 with 0.9% growth for estimated 2004 population of 293 million.

0.11 decrease in average energy/decrease in peak energy from http://eetd.lbl.gov/HeatIsland/EnergyUse/. Peak energy savings worth $100,000/hr is worth $100 million/year, for 1000 hrs/yr of savings out of 8760 hrs. 1000/8760=0.11

Annual CO2 Sequestered per Tree = 0.25 metric tons
Source: Tree Benefit Estimator http://www.appanet.org/treeben/calculate.asp.

GHG Reduction: *102 metric tons per year*

## 8.2.	Require a specific tree coverage and tree replacement requirement for all new development

Assumption that at least 900 new trees would be planted as a result of this program. Tree benefit from APPA Tree Benefit Estimator using the same sources and estimates as outlined above in 8.1.

GHG Reduction: *228 metric tons per year*

## 8.3.	Develop and implement a shading requirement for all City-owned parking lots

Assumption that at least 50 trees will be planted as a result of this measure. Tree benefit from APPA Tree Benefit Estimator using the same sources and estimates as outlined above in 8.1.

GHG Reduction: *26 metric tons per year*

Transportation and Land Use

1. Encourage development that is mixed-use, infill, and higher density.

1.1. Revise municipal codes to encourage and allow for mixed-use, infill, and higher-density development

Assumption that half of the development in San Carlos from 2005 to 2030 will be mixed-use, infill and higher-density. Development growth based on General Plan projections. VMT reduction of 25% for affected development based on research by the Victorial Transportation Planning Institute (VPTI) www.vtpi.org.

GHG Reduction: 5,544 metric tons per year

2. Increase housing density near transit.

2.1. Revise municipal codes to encourage and allow for higher-density commercial and residential centers near transit corridors with the express intent of encouraging transit ridership and reducing the use of personal automobiles

Assumption that half of the development in San Carlos from 2005 to 2030 will be transit-oriented development growth based on General Plan buildout. CO2e reduction based on a 2003 California TOD travel characteristics study which found TOD office workers within a half mile of rail transit stations have transit commute shares averaging 19% as compared to 5% region wide. For residents, the statewide average transit share for TODs within a half mile of the station was 27% compared to 7% for residences between a half mile and three miles of the station.[3]

GHG Reduction: 4,957 metric tons per year

3. Increase bike parking.

3.1.   Increase the bicycle parking requirement for commercial projects in order to promote cyclist safety, security, and convenience

Assumption that bike parking would replace 300 average-length weekly car trips.

Assumption that average bike/car trips are 10 miles.
Source: National Household Travel Survey. 2001. 2,298 Billion miles / 235 Billion trips = 9.8mi/trip.
http://www.bts.gov/publications/highlights_of_the_2001_national_household_travel_survey/html/table_02.html

GHG Reduction: 75 metric tons per year

3.2. Require large employers to provide facilities that encourage bicycle commuting including shower facilities and covered or indoor bicycle parking

Assumption that bike parking would replace 200 average-length weekly car trips based on case studies. Assumption that average bike/car trips are 10 miles as sourced above in 3.1.

GHG Reduction: 50 metric tons per year

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[3] Victoria Transport Policy Institute. "Transit Oriented Development." Online TDM Encyclopedia, http://www.vtpi.org/tdm, accessed Sept. 30, 2008.

4. Create travel routes that ensure that destinations may be reached conveniently by public transportation, bicycling, and walking.

4.1.   Promote traffic calming methods on City streets such as landscaped median barriers and traffic circles
4.2.   Establish clear and convenient pedestrian rights of way with shade and minimal tripping hazards.
4.3. Incorporate bicycle-friendly intersections and boulevards into street design as recommended by the Bicycle Transportation Plan currently being updated
4.4.   Promote "Walk pools" or "Walking buses" to increase the number of students who walk to school
To quantify the greenhouse gas emissions reduction from this measure, it was combined with components 5.2, 5.3 and 5.4 under this measure in order to create a scenario parallel to similar quantified case studies and research. It is therefore estimated that these four reduction measures will cause a total of 750 additional weekly biking and walking trips originating from within the City of San Carlos. Assumption that average bike/car trips are 10 miles as sourced in 3.1.

GHG Reduction: 170 metric tons per year

5. Actively promote walking and biking as safe modes of local travel, particularly for children attending local schools.

5.1.   Create a plan to identify and address barriers to safe or convenient walking, biking, and transit ridership from major residential areas to public areas of interest and see to the plan's implementation
GHG Reduction: No estimate

5.2.   Make it a condition for approval that new large-scale developments address transit, biking, and walking access to the location. Require parking lots to be designed in a way that promotes pedestrian, transit, and bicycle travel to and from the site
Estimate that this reduction measure will result in an additional 400 walking and biking trips per week. Assumption that average bike/car trips are 10 miles as sourced in 3.1.

GHG Reduction: 122 metric tons per year

5.3. Provide for an education program to residents and businesses as well as increased code enforcement in order to minimize vegetation that degrades access along public rights of way

GHG Reduction: No estimate

6. Provide for a shuttle service connecting areas not adequately served by public transit to public transit.

6.1.   Establish a shuttle service within the City of San Carlos connecting areas not adequately served by public transit to Caltrain
Assumption that a shuttle program would attract 500 new daily rider to public transit that weren't previously using transit. Based on data from the City's pilot shuttle program, SCOOT. Assumption that average car trips are 10 miles (round trip) as sourced in 3.1.

GHG Reduction: 1,733 metric tons per year

7. Promote car sharing programs.

7.1.   See to the establishment of a car sharing program
7.2.   Provide parking spaces for car share vehicles at convenient locations accessible by public transportation

It is estimated that a car share program in San Carlos would reduce greenhouse gas emissions by at least 1,158 metric tons of CO2e per year. This estimate is assuming that a car share program would attract at least 1,000 members and that those members would reduce vehicles miles traveled by at least 30%, figures based a study of carshare programs by Robert Cervero. Source: Victoria Transportation Planning - http://www.vtpi.org/tdm/tdm7.htm\

GHG Reduction: 1,158 metric tons per year

8. Enforce affordable housing requirements

8.1. Continue to enforce the City's Below Market Rate (BMR) Ordinance (as amended) to support the development of affordable housing in the area

This estimate is based on San Carlos's current BMR ordinance, which requires 15% BMR units for every development over 7 units.

URBEMIS provides a 4% reduction in vehicle trips for each deed-restricted BMR unit.15 Thus, the total reduction is as follows: Trip reduction = % units that are BMR * 0.04
Source: Nelson/Nygaard Consulting Associates, *Creating Low-Traffic Developments: Adjusting Site-Level Vehicle Trip Generation Using URBEMIS,* 2005.

According to the 2009 Housing Element, 35% of development constructed in 2006-2007 was BMR. Assuming constant growth trends of affordable vs. market rate, 35% * .04 = .013825 reduction.

Assume transportation-related GHG growth in San Carlos is due to increases in jobs and populations, equally. As a result, 27% of emissions growth would be the cause of population and 72% jobs. Applying the 1.38% reduction to the 27% population-related emissions growth gives us a reduction of 95 metric tons per year by 2020 and 192 metric tons per year by 2030.

GHG Reduction: 95 metric tons per year by 2020
                        192 metric tons per year by 2020

9. Convert more City vehicles to hybrid, electric, alternative fuel, or smaller vehicles.

9.1.   Replace 18 traditional automobiles in the City's fleet with hybrid, electric, alternative fuel, or smaller vehicles by 2020.

Assumption that the City will replace 18 vehicles with hybrid vehicles.

Hybrid miles per gallon = 46
Source: Combined city/hwy mileage for 2008 Toyta Prius.
http://www.fueleconomy.gov/feg/findacar.htm

Miles per gallon of vehicle replaced= 20
Source: 19.7 mpg average for passenger vehicles from American Public Transportation Association: 6348 Btu/vehicle mile. 125,000 Btu/gallon / 6348 Btu/gallon = 19.7 mpg

Average annual miles per vehicle: 12,042
Source: Source: National Household Travel Survey.
http://www.eia.doe.gov/emeu/rtecs/nhts_survey/2001/index.html
2.3 x 10^12 vehicle miles / 191 million vehicles.

GHG Reduction: 59 metric tons annually

10. Increase accommodation and promotion of alternatively fueled vehicles and hybrids.

10.1. Offer prioritized parking for hybrid or alternative fuel cars on City streets
GHG Reduction: No Estimate

10.2. Encourage siting of alternative fueling stations within close proximity to potential customers

Assumption that a biodiesel station in San Carlos would cause at least 1,000 gallons of pure biodiesel to be purchased and consumed per month. This estimate is based on the sales of San Mateo Petroleum and adjusted by population and estimated increases in demand (Personal Communication between PMC and San Mateo Petroleum, October 2008). Biodeisel reduction compared to gasoline from National Biodiesel Board, "Biodiesel emissions factsheet," http://biodiesel.org/pdf_files/fuelfactsheets/emissions.pdf, accessed November 1, 2008.

GHG Reduction: 19 metric tons per year

10.3. Encourage developers to dedicate parking lot spaces to electric vehicle recharging stations

Assumption that 25 electric vehicle recharging stations would be installed before 2020. Assumes recharging stations would be used for daily commutes and replace vehicles with an average of 20 MPG (19.7 mpg average for passenger vehicles from American Public Transportation Association: 6348 Btu/vehicle mile. 125,000 Btu/gallon / 6348 Btu/gallon = 19.7 mpg).

Assumes 4,704 annual vehicle miles replaced per charging station. Calculated assuming parking spots are used for commuting: 5 days/week, 48 weeks/year, 9.8 miles each way.
Source for trip length: National Household Travel Survey. 2001. 2,298 Billion miles / 235 Billion trips = 9.8mi/trip.
http://www.bts.gov/publications/highlights_of_the_2001_national_household_travel_survey/html/table_02.html

GHG Reduction: 30 metric tons per year

Solid Waste

1. Support Zero Waste

1.1. For municipal operations, establish a zero waste policy

Municipal operations produced 93 metric tons of GHG emissions in 2005 (Source: ICLEI, 2005 Municipal Inventory). Goal of diverting 90% of City-generated solid waste would result in a reduction of 83.7 metric tons assuming all waste is diverted equally.

GHG Reduction: 83.7 metric tons per year

2. Increase recycling and composting at public events

2.1.   Require recycling and composting as a condition of approval for public events
2.2. In support of zero waste, establish an environmentally preferable purchasing program (EPP) for government operations

Assumption that requiring recycling and composting at public events would increase overall waste diversion by 2%. Based on studies of San Francisco's ordinance scaled for the number and size of public events in San Carlos.

GHG Reduction: 255 metric tons per year

4. Increase overall waste diversion by at least 1% per year

4.1.   Increase required Construction and Demolition (C&D) diversion rate to 60%

4.2.   Provide for expanded recycling outreach and services to multi-family residential buildings, including renter-occupied apartment buildings

4.3. Mandate commercial recycling

These two measures along with planned improvements to waste collection would increase waste diversion by 1% per year. A 1% increase per year as compared to the previous year (compounded) would bring San Carlos' total waste diversion rate to over 70% by 2030. Waste characterization assumed to be constant.

GHG Reduction: 6,222 metric tons per year