Appendix B: Greenhouse Gas Reductions

This appendix summarizes the assumptions and parameters used to calculate GHG emission reduction performance of Greenhouse Gas Reduction Plan (GGRP) measures. The table below summarizes the GHG reductions generated by measures in the GGRP.

Summary Table of Greenhouse Gas Reduction Measure Performance

Measure Number and Title	GHG Emission Reductions (MT CO_2e)	
Community Engagement and Leadership	*Without Statewide Reductions*	*With Statewide Reductions*
1-1.D: Community workshops and education programs	*49,504 *Reduction not counted separately*	
Transportation and Connectivity		
3-2.A: Develop Ride Share Infrastructure	1,230	930
3-4.A: Low-Carbon and Alternative Fuel Vehicles		
Purchase hybrid and electric vehicles	11,085	11,085
Installation of electric charging stations	1,125	1,125
3-5.A: Increase Bicycle and Pedestrian Mode Share	3,730	2,830
3-6.A: Increase Public Transit Mode Share	2,490	1,890
3-7.A: Increase Fuel Efficiency of City Fleet	40	40
3-7.B: Alternative Transportation Incentives for City Employees	60	60
Energy Efficiency and Conservation		
4-2.B: Upgrade to Solar Water Heaters		
Residential solar hot water systems	7,480	7,480
Commercial solar hot water systems	1,190	1,190
4-2.C: Solar Power Program		
Residential solar rooftop systems	9,300	9,300
Commercial solar rooftop systems	2,400	2,400
4-3.A: Residential Benchmark Program	5,730	5,730
4-3.B: Commercial Benchmark Program	1,490	1,490
4-3.D: Energy Efficiency Upgrade	12,338	12,338
4-3.E: Smart Grid Integration		
Existing residential smart grid appliances	1,510	1,510
Existing commercial smart grid appliances	1,050	1,050
New construction smart grid appliances	600	600
4-5.A: Increase Green energy Purchase in City Facilities	10	10
4-5.B: Reduce City Facilities' Energy Consumption	215	215
4-5.C: Improve Street Light Efficiency	544	544
Water Efficiency and Conservation		
5-1.A: Water Demand Reduction	4,030	4,030
5-4.A: Municipal Irrigation Water Demand Reduction	<1	<1
Waste Reduction		
6-1.A: Increase Recycling, Composting, and Waste Diversion Programs	18,880	18,880
Green Infrastructure, Public Health and Safety		
7-1.A: Increase Urban Forest	740	740
Statewide Legislation		
AB 1493: Vehicle Emission Standards	-	39,240
Low Carbon Fuel Standard (LCFS)	-	20,970
Total Reductions	***87,267***	***145,677***

Notes:
1. Totals may not appear to add up as emission reductions within each sector have been rounded to the nearest whole number.
2. The GGRP measures provided in Chapter 3 report GHG emissions without assuming Statewide reductions.
3. The GHG reductions with Statewide implementation of AB 1493 and LCFS mainly affect transportation measures. The combined effects of statewide reductions along with the GGRP measures will increase the efficiency of the plan.
4. Does not include supporting measures

GHG Reduction Analysis for GGRP Measures

Community Leadership and Engagement

1-1.D: Conduct regular community workshops and education programs to increase community participation and understanding of various transit, energy, water, waste and green infrastructure efficiency strategies and technologies.

GHG Reduction Calculation Supported by Public Outreach				
Measure	**Participation Rate**	**Reduction MT CO_2e**	**Public Outreach Assumption**	**Portion of Reductions Due to Public Outreach**
Residential Retrofit	15%	5,730	5%	1,910
Commercial Retrofit	10%	1,490	5%	745
Smart Grid Residential - Retrofit	30%	1,510	30%	1,510
Smart Grid Commercial - Retrofit	40%	1,050	40%	1,050
Photovoltaic - Residential	10%	9,300	5%	4,650
Photovoltaic - Commercial		2,400	25%	600
Solar Hot Water - Residential	30%	7,480	5%	1,247
Solar Hot Water - Commercial	20%	1,190	5%	298
Appliance Efficiency				
Refrigerator Upgrade - Res		796	100%	796
Dishwasher Upgrade - Res		390	100%	390
Clothes Washer Upgrade - Res		265	100%	265
Exit Signs Upgrade - Com		93	100%	93
Copy Machine Upgrade - Com		130	100%	130
Water Cooler Upgrade - Com		35	100%	35
Monitor & Computer Upgrade - Com		90	100%	90
Light Bulb Replacement - Res		10,080	100%	10,080
Cool Roofs		461	100%	461
Bike and Ped		3,730	10%	373
Public Transit		2,490	10%	249
Rideshare		1,230	25%	308
Electric charging stations		1,121	5%	56
Hybrid and Electric Vehicles - Community		11,085	100%	11,085
Waste		18,880	50%	9,440
Water		4,030	80%	3,224
Shade Trees - Building Energy		105	100%	105
Street Trees - Carbon Sequestration and Urban heat island		631	50%	316
Sum		**85,792**		**49,504**

3-2.A: Rideshare

Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
3-2.A: Develop rideshare infrastructure to facilitate participation by those travelling from Citrus Heights to major employment centers such as Downtown Sacramento or Roseville.	This measure requires the City to implement a series of prescribed actions that will facilitate and encourage the use of carpooling for City residents to commute to major employment centers. These actions include working with nearby cities and major companies to develop car-share and local car rental opportunities, requiring ride-share parking spaces at employment and commercial centers, and requiring ride-share parking spaces near bus stops, employment centers and commercial areas (e.g., Sunrise MarketPlace, Auburn Boulevard). This measure estimates the reduction in transportation-related emissions resulting from a 1.5% mode-shift from single-occupancy vehicles to rideshare alternatives. According to the 2000 US Census, about 13% of Citrus Heights residents carpooled to get to work. Literature indicates that ridesharing programs typically attract 5–15% of commute trips if they offer only information and encouragement, and 10–30% if they also offer financial incentives such as parking cash out or vanpool subsidies (York and Fabricatore, 2001). The measure assumes that enhanced ride matching and rideshare infrastructure will increase the mode share from 10% to 12%. The percent of total trips that are assumed to be commute trips was obtained from URBEMIS2007 Version 9.2.4.			
	Transportation sector emissions (without statewide reductions): 248,963 MT CO_2e/yr	Percent commute trips of total trips: 33% Percent of mode shift: 1.5%	Without statewide reductions:1,230 MT CO2e/yr	*U.S Census 2000, Citrus Heights, Commute to work.* *Mixed-use neighborhood center VMT reduction performance* *Dagang, Deborah. 1995. Transportation impact factors: Quantifiable relationships. Victoria Transport Policy Institute. Victoria BC.*
	Transportation sector emissions (with statewide reductions): 188,753 MT CO_2e/yr		With statewide reductions: 930 MT CO_2e/yr	
Supporting Measure	3-2.B: Work with employers to offer incentives and services that increase use of alternatives to single-occupant autos.			

3-4.A: Alternative Fuel

Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
3-4.A: Create infrastructure to promote use of low-carbon and alternative fuel vehicles.	This measure requires the City to implement a series of infrastructure improvements, incentives, and educational programs to promote the use of alternative fueled vehicles. Infrastructure improvements include priority parking and charging stations for neighborhood electric vehicles and installation of secured charging stations at new residential, commercial, and office buildings. Incentive programs include financial incentives for purchasing lower-carbon vehicles such as hybrids and electric automobiles. The emission reductions achieved through implementation of this measure were estimated using the ICLEI Climate and Air Pollution Planning Assistant Version 1.0 calculator for alternative fueled vehicles (ICLEI 2010). Implementation of Measure 3-4.A assumes that over the next 10 years, Citrus Heights residents will add 1,500 hybrid vehicles and 1,500 electric vehicles that will replace old vehicles in the community. The emission reductions also assume that 700 electric vehicle charging stations will be installed in the community as support infrastructure to promote electric vehicles.			
	See CAPPA tables below	Hybrid vehicles: 1,500 Electric vehicles: 1,500 Electric charging stations: 700	Hybrid and electric vehicles: 11,085 MT CO_2e/yr Electric charging stations: 1,125 MT CO_2e/yr Total: 12,210 MT CO_2e/yr	*Climate and Air Pollution Planning Assistant (CAPPA).* *Available: http://www.icleiusa.org/action-center/tools/cappa-decision-support-tool*
Supporting Measure	3-4.B: Promote communitywide use of alternative fuels by providing public outreach and education regarding the benefits of low-carbon and alternative fuels.			

ICLEI CAPPA V 1.0 - Hybrid Vehicle Calculations:

Degree of Implementation

The default values below are based on a typical degree of implementation of this strategy, as well as your previous responses to user input questions. However, your local scenario may vary signficantly. CAPPA will assume that if you choose to include this strategy in your local climate action plan, this degree of implementation will apply. Adjust as appropriate to your local circumstance by editing the cell in blue below. **Changes to the Degree of Implementation must be saved using the Save Changes button before navigating away from this sheet.**

Community

1,500	Number of Hybrids Used

Save Changes

Cost Impacts

The default values below are based on the reported collective experience of US local governments throughout the ICLEI network. CAPPA will assist you in estimating emissions and cost impacts and developing a local climate action plan based on these values. Adjust as appropriate to your local circumstance by editing the blue cells below. **Changes made to blue cells here need to be saved using the Save function from the Excel File Menu.**

Community

$2.64	Price of Gasoline ($ per gallon)
46	Hybrid Miles per Gallon
19.7	Miles per Gallon of Vehicle Replaced
12,042	Average Annual Miles per Vehicle
$2,530	Incremental Cost of Hybrid
524,230	Annual Gasoline Savings (gallons)
$1,383,966	Annual Cost Savings
2.7	Simple Payback (years)

Restore Defaults

Associated Annual Greenhouse Gas and Criteria Air Pollutant Emissions Reductions

The values below are calculated using default emissions factors consistent with those contained in the Clean Air and Climate Protection software.

Government Operations

CO2e (metric tons)	NOx (lbs)	SOx (lbs)	CO (lbs)	VOCs (lbs)	PM10 (lbs)
49	16	1	3,544	372	8

View Complete Emission Coefficients Set

Community

CO2e (metric tons)	NOx (lbs)	SOx (lbs)	CO (lbs)	VOCs (lbs)	PM10 (lbs)
4,934	1,566	102	354,391	37,166	762

Per Unit Reductions

CO2e (metric tons) per vehicle	NOx (lbs) per vehicle	SOx (lbs) per vehicle	CO (lbs) per vehicle	VOCs (lbs) per vehicle	PM10 (lbs) per vehicle
3.29	1.04	0.07	236.26	24.78	0.51

ICLEI CAPPA V 1.0 - Electric Vehicle Calculations:

Degree of Implementation

The default values below are based on a typical degree of implementation of this strategy, as well as your previous responses to user input questions. However, your local scenario may vary signficantly. CAPPA will assume that if you choose to include this strategy in your local climate action plan, this degree of implementation will apply. Adjust as appropriate to your local circumstance by editing the cell in blue below. **Changes to the Degree of Implementation must be saved using the Save Changes button before navigating away from this sheet.**

Community

1,500	Number of Electric Vehicles

Save Changes

Cost Impacts

The default values below are based on the reported collective experience of US local governments throughout the ICLEI network. CAPPA will assist you in estimating emissions and cost impacts and developing a local climate action plan based on these values. Adjust as appropriate to your local circumstance by editing the blue cells below. **Changes made to blue cells here need to be saved using the Save function from the Excel File Menu.**

Community

$3.00	Price of Gasoline ($ per gallon)
$ 0.1094	Price of Electricity ($ per kWh)
19.7	Miles per Gallon of Vehicle Replaced
12,042	Average Annual Miles per Vehicle
$10,000	Incremental Cost of Electric Vehicle
916,904	Annual Gasoline Savings (gallons)
7,232,432	Annual Electricity Use (kWh)
$1,959,483	Annual Cost Savings
7.7	Simple Payback (years)

Restore Defaults

Associated Annual Greenhouse Gas and Criteria Air Pollutant Emissions Reductions

The values below are calculated using default emissions factors consistent with those contained in the Clean Air and Climate Protection software.

Select utility region: WECC California (CAMX)

Community

CO2e (metric tons)	NOx (lbs)	SOx (lbs)	CO (lbs)	VOCs (lbs)	PM10 (lbs)
6,152	-1,728	-3,662	615,753	64,542	-2,283

View Complete Emission Coefficients Set

Per Unit Reductions

CO2e (metric tons) per vehicle	NOx (lbs) per vehicle	SOx (lbs) per vehicle	CO (lbs) per vehicle	VOCs (lbs) per vehicle	PM10 (lbs) per vehicle
4.10	-1.15	-2.44	410.50	43.03	-1.52

ICLEI CAPPA V 1.0 – Electric Vehicle Charging Station Calculations:

Degree of Implementation

The default values below are based on a typical degree of implementation of this strategy, as well as your previous responses to user input questions. However, your local scenario may vary signficantly. CAPPA will assume that if you choose to include this strategy in your local climate action plan, this degree of implementation will apply. Adjust as appropriate to your local circumstance by editing the cell in blue below. **Changes to the Degree of Implementation must be saved using the Save Changes button before navigating away from this sheet.**

Community

700	Number of Charging Spaces

Save Changes

Cost Impacts

The default values below are based on the reported collective experience of US local governments throughout the ICLEI network. CAPPA will assist you in estimating emissions and cost impacts and developing a local climate action plan based on these values. Adjust as appropriate to your local circumstance by editing the blue cells below. **Changes made to blue cells here need to be saved using the Save function from the Excel File Menu.**

Community

$2.64	Price of Gasoline ($ per gallon)
$ 0.0988	Price of Electricity ($ per kWh)
19.7	Miles per Gallon of Vehicle Replaced
4,704	Average Annual Vehicle Miles per Charging Space
167,147	Annual Gasoline Savings (gallons)
1,318,438	Annual Electricity Use (kWh)
$311,007	Annual Cost Savings

Restore Defaults

Associated Annual Greenhouse Gas and Criteria Air Pollutant Emissions Reductions

The values below are calculated using default emissions factors consistent with those contained in the Clean Air and Climate Protection software.

Select utility region: WECC California (CAMX)

3-5.A: Bikes and Pedestrians

Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
3-5.A: **Maximize pedestrian and bicycle use through high-quality design, enhanced infrastructure, and enforcing bike and pedestrian travel rights.**	Quantification of this measure assumes that implementation would result in a 1.5% mode shift from total single-occupancy vehicles to bicycle travel and walking. The anticipated mode shift assumption is based on the past trend shown for walking and biking options to commute to work per the Census data (2000). According to the 2000 US Census, less than 2% of Citrus Heights residents biked or used another means to get to work. However the final emission reduction calculation is based on mode shift in all types of trips.			
	Transportation sector emissions (without statewide reductions): 248,963 MT CO_2e/yr	Percent of mode shift: 1.5%	Without statewide reductions: 3,730 MT CO_2e/yr	*U.S Census 2000, Citrus Heights, Commute to work.*
	Transportation sector emissions (with statewide reductions): 188,753 MT CO_2e/yr		With statewide reductions: 2,830 MT CO_2e/yr	
Supporting Measure	3-5.B: Increase bicycle infrastructure by requiring bicycle parking in new development, retrofitting parking lots in underserved civic and commercial areas to include bike racks and bike parking facilities, and participating in a regional bikesharing program.			

3-6.A: Public Transit

Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
3-6.A: **Conduct a public transit gap study analyzing strategies to increase transit use and funding sources for transit improvements. Work with regional transit agencies to provide bus route coverage to underserved areas.**	Quantification of this measure assumes that implementation would result in a 1% mode shift from total single-occupancy vehicles to public transit. The anticipated mode shift assumption is based on the trend in transit ridership from Census data (2000 and 2008) and based on City's plans for operation and expansion of service. However, the transportation emission calculates mode shift to transit for all types of trips.			
	Transportation sector emissions (without statewide reductions): 248,963 MT CO_2e/yr	Percent of mode shift: 1.0%	Without statewide reductions: 2,490 MT CO_2e/yr	*York and Fabricatore (2001), Puget Sound Vanpool Market Assessment, Office of Urban Mobility, WSDOT* *Rimpo and Associates Inc.. 2008. URBEMIS2007 for Windows Version 9.2.4. Available: http://www.urbemis.com/.*
	Transportation sector emissions (with statewide reductions): 188,753 MT CO_2e/yr		With statewide reductions: 1,890 MT CO_2e/yr	
Supporting Measure	3-6.B: Work with Regional Transit, E-Tran, Roseville Transit, Amtrak and other transit agencies to develop a regional pass system.			

3-7: Municipal Transportation Policies

3-7.A: **Improve fuel-efficiency of the City fleet by purchasing low or zero-emission vehicles when vehicles are retired from service. (Public safety vehicles are exempted from this requirement.)**	This measure assumes that the City will replace 10 vehicles from the municipal fleet with electric vehicles. The emission reductions achieved through implementation of this measure were estimated using the ICLEI Climate and Air Pollution Planning Assistant Version 1.0 calculator for alternative fueled vehicles (ICLEI 2010).

ICLEI CAPPA V 1.0 - Electric Vehicle Calculations:

Degree of Implementation

The default values below are based on a typical degree of implementation of this strategy, as well as your previous responses to user input questions. However, your local scenario may vary signficantly. CAPPA will assume that if you choose to include this strategy in your local climate action plan, this degree of implementation will apply. Adjust as appropriate to your local circumstance by editing the cell in blue below. **Changes to the Degree of Implementation must be saved using the Save Changes button before navigating away from this sheet**.

Government Operations

10	Number of Electric Vehicles

Cost Impacts

The default values below are based on the reported collective experience of US local governments throughout the ICLEI network. CAPPA will assist you in estimating emissions and cost impacts and developing a local climate action plan based on these values. Adjust as appropriate to your local circumstance by editing the blue cells below. **Changes made to blue cells here need to be saved using the Save function from the Excel File Menu.**

Government Operations

$2.64	Price of Gasoline ($ per gallon)
$ 0.0988	Price of Electricity ($ per kWh)
19.7	Miles per Gallon of Vehicle Replaced
12,042	Average Annual Miles per Vehicle
$10,000	Incremental Cost of Electric Vehicle
6,113	Annual Gasoline Savings (gallons)
48,216	Annual Electricity Use (kWh)
$11,374	Annual Cost Savings
8.8	Simple Payback (years)

Associated Annual Greenhouse Gas and Criteria Air Pollutant Emissions Reductions

The values below are calculated using default emissions factors consistent with those contained in the Clean Air and Climate Protection software.

Select utility region: WECC California (CAMX)

Government Operations

CO2e (metric tons)	NOx (lbs)	SOx (lbs)	CO (lbs)	VOCs (lbs)	PM10 (lbs)
41	-12	-24	4,105	430	-15

3-7: Municipal Transportation Policies

3-7.B:
Provide financial incentives to encourage ridesharing and/or public transit use among City employees.

This measure assumes that the 8.5% of City employees use flexible work schedules in any given day. This helps to reduce peak hour traffic congestion and increase flexibility to work from home, thereby reducing GHG emissions associated with driving. The City would also provide financial incentives to its employees to promote alternative transportation modes such as public transit, and rideshare. The emission reductions achieved through implementation of this measure were estimated using the ICLEI Climate and Air Pollution Planning Assistant Version 1.0 calculator for alternative fueled vehicles (ICLEI 2010).

Energy Efficiency and Conservation

4-2: Solar Hot Water Systems

Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
4-2.B: **Collaborate with utility companies to provide financial incentives/rebates for residential and commercial buildings to upgrade from inefficient water heaters to solar water heaters.**	For solar hot water systems, a bottom-up calculation was performed assuming that solar hot water heaters will supply approximately 70% of the energy required for water heating. The emission reductions were calculated by multiplying participation rates of residential and commercial buildings by the percent reduction in natural gas consumption for water heating.			
	Residential: 60% Reduction in Natural Gas Reduction in Energy Consumption *Commercial*: 40% Reduction in Natural Gas Reduction in Energy Consumption	30% of total residential 20% of total commercial	Residential:7,480 MT CO_2e/yr Commercial:1,190 MT CO_2e/yr	*Energy Star. 2009. Solar Water Heater.* www.energystar.gov/ia/new_homes/features/WaterHtrs_062906.pdf *Department of Energy. California Energy Commission [CEC] 2007. Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings* *CEC source: CEC 2005. Electricity usage during Peak Periods. Available: www.energy.ca.gov/electricity/peak_loads.html*

4-2: Community-wide Solar Power Program

Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
4-2.C: **Create a community-wide Solar Power program and remove physical and code barriers to support installation of solar panels in commercial and residential districts.**	This measure assumes that at least 10% of total residential roof tops and 500,000 square feet of commercial roof tops will be identified by the City for photovoltaic panel installation. The carbon offset capacity of a solar panel is calculated by multiplying solar irradiance with system efficiency. The measure assumes that for six hours of daily solar generation, the system offsets 0.00479107 MT/ sq.ft/year (when solar irradiance =5.43KWh/sq.m/ day and system efficiency is 21.6KWh/sq.ft/ year).			
	Carbon offset 0.00479107 MT/sq.ft/year	10% of total residential roof tops 500,000 sq.ft of total commercial roof tops	Residential:9,300 MT CO_2e/yr Commercial:2,400 MT CO_2e/yr	*SMUD Electricity Emissions Factor = 489 lbs/Mwh* *http://www.findsolar.com/index.php?page=rightforme*

4-3: Residential Energy Efficiency Retrofits				
Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
4-3.A: Develop a Residential Energy Benchmark program to assist homeowners to identify voluntary retrofit opportunities and funding options to increase building energy performance by 30% from baseline.	The energy efficiency retrofit program is designed to encourage homeowners to implement energy conservation measures. The GHG emission reductions were calculated based on the estimated participation rate of 15% of existing residential homes. The assumption is that since most homes in Citrus Heights were constructed prior to Title 24 implementation, the community can reduce GHG emissions by retrofitting older homes to comply with Title 24 standards. Title 24 energy efficiency standards for new construction have also improved over the years so that buildings constructed in the last 15 years, in particular, perform much better than buildings constructed 15 to 30 years ago. Therefore, the GHG reduction is calculated on the assumption that by creating a Citrus Heights-specific Residential Energy Benchmark program that enlists a number of ways to reduce energy consumption the City can reduce almost 30% of energy use for baseline year.			
	30% reduction in energy consumption from baseline	15% of Existing Residential Buildings by 2020	5,730 MT CO_2e/yr	*Sacramento County. 2009. Greenhouse Gas Emissions Inventory for Sacramento County.*

4-3: Commercial Energy Efficiency Retrofits				
Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
4-3.B: Develop a Commercial Energy Benchmark program to assist business owners to identify voluntary retrofit opportunities and funding options to increase building energy performance by 30% from baseline.	The energy efficiency retrofit program is designed to encourage commercial building owners to implement energy conservation measures. The GHG emission reductions were calculated based on the estimated participation rate of 10% of existing commercial buildings. Most commercial buildings were built prior to Title 24 energy efficiency standards. The community can reduce GHG emissions by retrofitting older commercial and office buildings to comply with Title 24 standards. By developing an Energy Benchmark program, the City will encourage higher levels of voluntary participation and acceptance of the program. Measures will include sealing building envelopes through insulation and weatherization, replacing old windows with modern energy efficient windows, and converting older boilers with new Energy Star models.			
	30% reduction in energy consumption from baseline	10% of Existing Commercial Buildings by 2020	1,490 MT CO_2e/yr	*Sacramento County. 2009. Greenhouse Gas Emissions Inventory for Sacramento County.*

4-3: Household Appliances

Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
	Energy efficient appliances and building materials generate GHG emissions reductions through decreasing the electricity demand of a given building. The appliances, along with reflective envelope treatments (cool roof) listed below all have an average energy savings compared to the typical conventional systems. This energy savings was assumed and applied to the participating home and building owners to arrive at a total annual energy savings (kWh/yr). The participation rates for these various appliance upgrades are based on the average appliance life of 25 years, which results in 4% of all appliances being replaced each year. The final calculation was based on the ICLEI model.			
4-3.D: **Develop an Energy Efficient Upgrade program for residents and business owners to promote upgrades from inefficient appliances, lighting and roofing to Energy Star certified systems.**	<u>Energy Savings</u> Refrigerator: 464 kWh/year Dishwasher: 137kWh/year Clothes Washer: 144 kWh/year Light bulbs: 44 kWh year Copy machines: 12 – 1,702 kWh/year Exit Signs: 272 kWh/year Water Coolers: 408 kWh/year Monitors: 61 kWh/year Computers: 201 kWh/year Cool roofs: 0.84kWh/sq.ft/year	Refrigerator: 5,000 households Dishwasher: 5,000 households Clothes Washer: 5,000 households Light bulbs (assumes 20 replacements per building): 669,000 bulbs Copy machines: 500 Exit Signs: 1,000 Water Coolers: 500 Monitors: 1,000 Computers: 1,000 Cool Roofs: 1,500,000 sq.ft	Refrigerators: 796 MT CO_2e/yr Dishwashers: 390 MT CO_2e/yr Clothes Washers: 265 MT CO_2e/yr Light Bulbs: 10,080 MT CO_2e/yr Copy machines: 130 MT CO_2e/yr Exit signs: 91 MT CO_2e/yr Water Coolers: 35 MT CO_2e/yr Monitors: 20 MT CO_2e/yr Computers: 70 MT CO_2e/yr Cool roofs: 461 MT CO_2e/yr **Total: 12,338 MT CO_2e/yr**	*Climate and Air Pollution Planning Assistant (CAPPA). Available: http://www.icleiusa.org/action-center/tools/cappa-decision-support-tool*
Supporting Measure	4-3.C: Develop a Multi-family Energy Efficiency program to provide comprehensive, performance-based energy testing and installation of energy saving improvements for qualified multi-family residents.			

4-3: Smart Grid

Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
	This measure would catalyze the City's integration into the "Smart Grid" system. This system would help the community manage and serve its electricity needs more efficiently in every demand scenario (e.g., peak and off-peak). The City's integration into the "Smart Grid" system is anticipated to reduce total electricity consumption from the existing residential and commercial buildings by 6% and 8%, respectively.			
4-3.E: **Collaborate with local utility companies and adjacent cities to accelerate smart-grid integration in the community.**	Existing Residential Buildings: 6% reduction in fossil fuel generated electricity Existing Commercial Buildings: 8% reduction in fossil fuel generated electricity New Construction: 8% reduction in fossil fuel generated electricity	Existing residential buildings with smart-meters: 30% Existing commercial buildings with smart-meters: 40% New construction with smart-meters: 60%	Existing Residential Buildings: 1,510 MT CO_2e/yr Existing Commercial Buildings: 1,050 MT CO_2e/yr New Construction: 600 MT CO_2e/yr	*SMART 2020: Enabling the low carbon economy in the information age, The Climate Group on behalf of the Globale Sustainability Initiative (GeSI)* *Estimating the Benefits of the GridWise Initiative Phase I Report Walter S. Baer, Brent Fulton, Sergej Mahnovski TR-160-PNNL, May 2004 Prepared for the Pacific Northwest National Laboratory (p. 25)*

4-5: Municipal				
Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
4-5.A: Collaborate with SMUD to increase the use of green energy within City facilities.	This measure credits the City for installing solar panels on public buildings, such as on the roofs of the Community Center (65 kilowatt-hour [Kwh] panels producing 23,922 Kwh/yr) and City Hall (32 Kwh panels producing 11,680 Kwh of electricity annually).			
	Carbon offset = production * SMUD emissions factor	65 Kwh panel on Community Center and 32 Kwh panel on City Hall	10 MT CO_2e/yr	*SMUD Electricity Emissions Factor = 489 lbs/Mwh* *http://www.findsolar.com/index.php?page=rightforme*

4-5: Municipal				
Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
4-5.B: Reduce energy consumption in City buildings by 40% from baseline.	The quantification for this measure assumes that first the City will partner with SMUD to determine baseline electricity use, and then create a plan to reduce electricity consumption by 40% from baseline by 2020. Based on a 2005 analysis, the City Hall used 4,364,487 Kwh/year of electricity and 17,583 therms of natural gas (total energy consumption produces 1,061.6 CO_2e/year). By implementing a plan that reduces energy use by 40%, the City will produce less GHG emissions associated to energy usage (total of 849.3 CO_2e/year)			
	Carbon offset = production X Emfac	40% reduction in energy use	212 MT CO_2e/yr	*SMUD Electricity Emissions Factor = 489 lbs/Mwh;* *Natural gas Emissions Factor = 53.06 lbs/Kwh*

4-5: Municipal				
Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
4-5.C: Improve lighting efficiency and decrease energy consumption in public spaces.	Citrus Heights maintains 4,179 streetlights and 64 traffic lights. This measure credits the City for replacing all incandescent street light to LED lights. The emission reductions achieved through implementation of this measure were estimated using the ICLEI Climate and Air Pollution Planning Assistant Version 1.0 calculator (ICLEI 2010).			

ICLEI CAPPA V 1.0 – LED Streetlights Calculation:

Degree of Implementation

The default values below are based on a typical degree of implementation of this strategy, as well as your previous responses to user input questions. However, your local scenario may vary signficantly. CAPPA will assume that if you choose to include this strategy in your local climate action plan, this degree of implementation will apply. Adjust as appropriate to your local circumstance by editing the cell in blue below. **Changes to the Degree of Implementation must be saved using the Save Changes button before navigating away from this sheet.**

Government Operations

4,179	Street Lights Replaced with LED Street Lights

Save Changes

Cost Impacts

The default values below are based on the reported collective experience of US local governments throughout the ICLEI network. CAPPA will assist you in estimating emissions and cost impacts and developing a local climate action plan based on these values. Adjust as appropriate to your local circumstance by editing the blue cells below. **Changes made to blue cells here need to be saved using the Save function from the Excel File Menu.**

Government Operations

11	Hours of Streetlight Operation
$ 0.0988	Price of Electricity ($ per kWh)
20	Percent Mercury Vapor Lamps
6	Percent Metal Halide Lamps
64	Percent High Pressure Sodium Lamps
10	Percent Low Pressure Sodium Lamps
182	Wattage of Mercury Vapor Lamps
200	Wattage of Metal Halide Lamps
192	Wattage of High Pressure Sodium Lamps
180	Wattage of Low Pressure Sodium Lamps
1,587,935	Total Annual Energy Savings (kWh)
$156,888	Annual Cost Savings
0.2	Simple Payback (years)

Restore Defaults

Associated Annual Greenhouse Gas and Criteria Air Pollutant Emissions Reductions

The values below are calculated using default emissions factors consistent with those contained in the Clean Air and Climate Protection software.

Select Utility Region: WECC California (CAMX)

Government Operations

CO2e (metric tons)	NOx (lbs)	SOx (lbs)	CO (lbs)	VOCs (lbs)	PM10 (lbs)
544	981	843	899	102	794

Water Efficiency and Conservation

5-1: Source Reduction				
Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
5-1.A: **Work with the water agencies to develop plans to implement SB 7 to achieve a 20% reduction in urban water demand by 2020.**	In order to estimate the GHG reductions associated with implementation of these water conservation measures, 2005 urban water consumption and population values were used to estimate baseline per capita water consumption. Water consumption in 2020, under a business-as-usual scenario, was estimated using 2020 population growth estimates consistent with the General Plan. Assuming achievement of the water conservation target, a 20% reduction (from the 2005 baseline) in the per capita water consumption rate and the projected 2020 population were used to estimate 2020 water consumption levels with conservation, which were subtracted from the projected 2020 water consumption levels without conservation to calculate the annual water savings achieved in year 2020. Similar to the methods used to calculate water-related GHG emissions for the inventory, these annual water savings were used to calculate the amount of electricity consumption and GHG emissions (associated with conveyance, distribution, and treatment of the water) that would be avoided as a result of achieving the 20% target. Thus, this measure would result in a GHG emissions reduction of approximately 4,030 MT CO2e/yr.			
	20% reduction in water use for indoor applications	235 gallons per capita/ day	4,030MT CO_2e/yr	*CCAR General Reporting Protocol Version 3.1 (Table C.2)*
Supporting Measures	5-1.B: Continue to provide a free irrigation review program for residential and commercial buildings and implement a monitoring plan to evaluate if program users are effectively using the irrigation review report to reduce water demand by 20%. 5-1.C: Adopt a landscape ordinance for new development, consistent with Department of Water Resources guidance. 5-2.B: Develop an outreach program to educate residents and business owners on ways to minimize wastewater generation and reuse techniques.			

Waste Diversion and Reduction Action Area (WR)

6-1: Waste Reduction Policies				
Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
6-1.A: **Establish a 2020 waste reduction target of 75% below 2005 levels and work with the County, neighboring cities and other organizations to create a low-waste plan and provide public education regarding low-waste strategies and implementation.**	This measure assumes a 75% reduction in landfill waste by 2020. The baseline waste generation rate from 2005 was projected for 2020. This measure would apply to GHG emissions associated with new waste only and would not apply to waste in place.			
	75% waste diversion rate by 2020	N/A	18,880 MT CO_2e/yr in 2020	*Sacramento County. 2009. Greenhouse Gas Emissions Inventory for Sacramento County.*
Supporting Measures	6-1.B: Increase recycling and composting programs to divert waste from landfills.			

7-1: Urban Forestry				
Measure	Performance	Participation Rate	GHG Reduction (MT CO_2e/year)	Sources
7-1.A: **Enhance the City's urban forest and other green infrastructure to reduce building energy use, improve comfort, augment neighborhood aesthetics, improve stormwater quality, and maximize carbon capture and storage.**	This measure is based on extrapolating the carbon sequestration potential of a typical tree palette across the public tree planting goals (5,000 trees planted on public land within rights-of-way in the City by 2020). Carbon sequestration rates specific to the species and age of the planted trees were used to calculate the annual sequestration potential of the trees from 2010 to 2020.			
	N/A	1,500 trees by 2020	110 MT CO_2e/yr (building energy savings) 630 MT CO_2e/yr (carbon capture and storage)	*The Center for Urban Forest Research Tree Carbon Calculator.* *California Energy Commission [CEC] 2005. Electricity Usage During Peak Periods.* *California Energy Commission [CEC] 2007. Impact Analysis 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings*

Statewide Greenhouse Gas Emission Reductions

Assembly Bill 1493 (Pavley)

AB 1493, California's mobile-source GHG emissions regulations for passenger vehicles, was signed into law in 2002. The GHG reductions associated with AB 1493 that would affect the City in 2020 were calculated using ARB's *Pavley I + Low Carbon Fuel Standard Postprocessor* Version 1.0 (ARB 2010 [1]). This model applies an approximate 15.76% reduction to light and medium duty vehicle on-road mobile-source GHG emissions for AB 1493 in 2020 (ARB 2010).

Transportation Sector Emissions	Regulated Performance Improvement in 2020	Emission Reductions (MT CO2e/year)
248,963	15.76%	**39,240**

Sources of information:
ARB. 2010. Pavley I and Low Carbon Fuel Standard Postprocessor Version 1.0. Available: http://www.arb.ca.gov/cc/sb375/tools/postprocessor.htm.

Low Carbon Fuel Standard

The Low Carbon Fuel Standard (LCFS) is a program developed to reduce the carbon intensity of fuels used within California. In addition, the LCFS is designed to accelerate the availability and diversity of low-carbon fuels. The ARB's *Pavley I + Low Carbon Fuel Standard Postprocessor* Version 1.0 was used to quantify the GHG reductions from LCFS that would apply to the City in 2020. This model applies an approximate 10.0% reduction to on-road mobile-source GHG emissions for LCFS in 2020 (ARB 2010).

[1] Pavley I and Low Carbon Fuel Standard Postprocessor Version 1.0. Available: http://www.arb.ca.gov/cc/sb375/tools/postprocessor.htm.

Total 2020 Transportation Sector Emissions	2020 Transportation Sector Emissions minus AB 1493	Regulated Performance Improvement in 2020	Emissions Reductions (MT CO2e/year)
248,963	209,723	10.0%	**20,970**

Sources of information:

ARB. 2010. Pavley I and Low Carbon Fuel Standard Postprocessor Version 1.0. Available at http://www.arb.ca.gov/cc/sb375/tools/postprocessor.htm.

Notes:

[1] *Transportation emissions shown represent the total 2020 transportation emissions after reductions associated with AB 1493 have been achieved. This method was used to avoid double counting and overestimating GHG reductions associated with statewide actions.*

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