APPENDIX A

COMMUNITY WORKSHOP SUMMARY

Workshop Summary

Vacaville General Plan Update
Community Workshop #4 – Climate Action Plan
March 17, 2012

Community Workshop #4 was focused on understanding what a Climate Action Plan (CAP) is, why the City is preparing one, and what types of measures should be included in the CAP. This workshop took place on Saturday, March 17, 2012 at the McBride Senior Center. Seven members of the public and four Steering Committee members attended the workshop. The workshop began with a presentation about climate change and legislation requiring the reduction of greenhouse gases. The presentation was followed by questions and a discussion about climate change and the need for a CAP. The group then discussed potential greenhouse gas (GHG) reduction strategies to include in the CAP. The discussion is summarized below by topic.

General Comments on CAP:

- Many Vacaville residents are not interested in the CAP, as evidenced by the low turnout, while others are likely opposed to it. Given this attitude, how can the CAP be effective?
- Several workshop participants don't agree with the notion that climate change is happening, and/or that it is caused by human activity. However, the group agreed that the City needs to do something in order to comply with State law and avoid a lawsuit and a General Plan legal challenge.
- The building community and the City don't have the financial resources to implement "green" policies, especially in this economy. However, the building community can agree to reasonable, practical measures, such as Build-It-Green, energy efficiency, planting trees, and a lawnmower exchange program.
- How can the City reduce GHG emissions while still promoting growth in the General Plan Update?
- Air quality is more important to Vacaville residents than GHG emissions because it has a more direct impact. Solano County has some of the worst air pollution in the country. The CAP will focus on reducing carbon dioxide emissions, but we should instead focus on ozone and other criteria air pollutants that have adverse health impacts.
- A separate community group should be formed to develop a new set of measures to reduce GHG emissions.
- The City should focus on a limited amount of realistic measures. Numerous measures are a waste of time if they can't be implemented due to their cost.
- When considering which measures to include in the CAP, evaluate if the measures will result in long term costs to the City.

Comments on Land Use and Community Design Measures

- There should only be the one Town Square in Vacaville located in the Downtown. A second town square in the East of Leisure Town Road Growth Area would not work economically.
- Support for bicycle/pedestrian through-connections.
- Mixed use works in the Downtown, but not elsewhere in the city. Local-serving commercial can work in other areas, although major grocery stores will want freeway access.
- Support for telecommuting. Can the City assist with the infrastructure needs of telecommuters, for example by requiring access to high internet speeds in the Building Code for new development?
- Affordable housing doesn't work in Vacaville.

- In this economy, accessory units don't work, but they are supported. Consider removing the owner-occupied requirement for accessory units.
- Allow flexibility in residential setbacks to promote higher density while still maintaining the look of a traditional neighborhood (e.g. the Chelsea lots in Southtown). The smaller lawns can have an added water conservation benefit.
- Promote infill and high density development around transit areas and in the Downtown through reduced fees and expedited permit review.

Comments on Transportation Measures

- Encourage residents to purchase four-cylinder and/or electric cars, similar to past efforts to promote electric vehicle purchases in the city.
- Support for high-quality bicycle parking.
- Encourage traffic circles in place of stop signs.
- Extend City Coach bus service times to 8:00 pm for commuters.

Comments on Green Building Measures

- LEED does not work financially for developers. Build-It-Green only costs developers about $3,000 to $5,000 per house, while LEED certification costs $10,000 to $15,000 per house. Meritage Homes supports Build-It-Green.
- Cement substitutes and recycling building materials should be voluntary.
- Support for tax and fee credits for green building.

Comments on Renewable Energy and Low Carbon Fuels Measures

- "Green" energy (e.g. solar and wind) costs more than traditional energy sources, and solar panels have many environmental impacts, including the use of toxic materials and creation of solid waste. However, one commenter still would like some measures to target solar energy in the CAP because solar helps to improve air quality.
- Support for permit fee waivers for solar installations.
- Support for incentives for parking lot solar.
- Wind turbines have significant biological impacts (on birds) and are not cost-effective. In addition, wind turbines have aesthetic, solid waste, safety, and noise impacts. While there is support for wind energy, wind turbines are not supported.

Comments on Water and Wastewater Measures

- Methane gas should be captured and converted to energy to fuel the Wastewater Treatment Plant's energy needs.
- Promote xeriscape (i.e. landscaping to minimize water use).

Comments on Solid Waste Measures

- Methane gas should be captured and converted to energy to fuel the landfill's energy needs (although the landfills are located outside of Vacaville).

Comments on Open Space Measures

- The City should institute a tree-planting program.
- Avoid agricultural land conversion.

APPENDIX B

BASELINE INVENTORY AND 2020 FORECASTS TECHNICAL DOCUMENTATION

Summary of Vacaville's GHG Emissions

		2008		2020 BAU			2035 BAU			2020 Adjusted			2035 Adjusted	
	2005 STA Inventory for Vacaville	MTons*	Percent	MTons*	Percent	Increase MTons from 2008	MTons*	Percent	2020 Adjusted MTons	MTons*	Percent	Increase MTons from 2008	MTons*	Percent
Transportation***	193,893	598,040	63%	808,140	67%	210,100	1,070,390	70%	639,785	639,790	68%	41,750	794,760	70%
Residential	122,551	153,210	16%	172,440	14%	19,230	196,470	13%	131,940	131,940	14%	-21,270	147,360	13%
Purchased Electricity	54,964	66,760		75,140		8,380	85,610		35,726	35,730		-31,030	38,940	
Natural Gas	67,587	86,450		97,300		10,850	110,860		96,214	96,210		9,760	108,420	
Commercial/Industria/Municipal	112,381	156,390	16%	174,510	15%	18,120	197,160	13%	126,873	126,870	13%	-29,520	140,050	12%
Purchased Electricity	59,482	79,820		89,090		9,270	100,680		42,602	42,600		-37,220	46,160	
Natural Gas	52,899	76,570		85,420		8,850	96,480		84,270	84,270		7,700	93,890	
Water/Wastewater****	18,342	10,680	1%	12,780	1%	2,100	15,410	1%	8,687	8,690	0.9%	-1,990	10,760	1.0%
Electricity	NA	7,460		8,370		910	9,520		4,280	4,280		-3,180	4,870	
Fugitive	NA	690		770		80	870		769	770		80	870	
Municipal	NA	2,530		3,640		1,110	5,020		3,638	3,640		1,110	5,020	
Waste*****	51,820	19,030	2%	21,370	2%	2,340	24,300	2%	21,372	21,370	2%	2,340	24,300	2%
Offroad Equipment from STA Inventory	11,994	11,990	1%	13,470	1%	1,480	15,310	1%	12,121	12,120	1%	130	13,780	1%
Industrial (Permitted)**	0	25,620		25,620			25,620		25,617	25,620			25,620	
Total (with Permitted)	**0**	974,960		1,228,330			1,544,660		966,395	966,400			1,156,630	
Total (without Permitted)	**510,981**	**949,340**	**100%**	**1,202,710**	**100%**	**253,370**	**1,519,040**	**100%**	**940,777**	**940,780**	**100%**	**-8,560**	**1,131,010**	**100%**
2020 Target: 21.7% Below BAU				941,722						941,722				
GHG Reductions Needed				260,988						-942				
Local Reductions										-63,472			-72,262	
TOTAL with Reductions					**Percent Change**		**1,519,040**	**Percent Change**	**940,777**	**877,308**			**1,058,748**	
Short of 21.7% Goal										**-64,414**				
Population	87,340			98,300	26.69%		112,000	60.01%	98,300	98,300			112,000	
Employment	30,248			33,738			38,100		33,738	33,738			38,100	
Service Population	117,588			132,038			150,100		132,038	132,038			150,100	
				14,450										
MTons/SP	8.07			9.11			10.12		7.13	7.13			7.54	
MTons/SP with Reductions									7.13	6.64			7.05	

*Inventory is rounded to the tens place.

** Not included in Target setting since permitted (industrial) sources of GHG emissions are under the jurisdiction of YSAQMD and not the City of Vacaville.

*** Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the Climate Change Scoping Plan Measure Documentation Supplement.

**** Excludes GHG emissions from wastewater generated by land uses outside of the City but treated at the City's wastewater treatment plant. Baseline treatment plant annual MTCO2e emissions were estimated to be 4,688 in 2008 and 7,775 in 2035. 2020 MTCO2e emissions estimated using linear regression.

***** Excludes GHG emissions from waste disposed of in the City but generated by land uses outside of the City. The 2008 emissions estimate is significantly lower than the total presented in the 2005 analysis because 2008 inlcudes 75% landfill gas capture rate. The Landfill gas capture efficiency is based on the California Air Resources Board's (CARB) Local Government Operations Protocol (LGOP), Version 1.1. Because the landfill gas captured is not under the jurisdiction of Vacaville, the landfill gas emissions from the capture system are not included in Vacaville's inventory. Only fugitive sources of GHG emissions from landfill are included.

Energy - Purchase Electricity and Natural Gas

Pacific Gas & Electric - Emission Factors

	Intensity factor				CO_2e
Electricity	lbs CO_2/MWH	MTons CO_2/MWh	CH4 MTons/MWH	N2O MTons/MWH	MTons/MWh
2005	489	0.222	0.000013	0.000005	0.224
2006	456	0.207	0.000013	0.000005	0.209
2007	636	0.288	0.000013	0.000005	0.290
2008	641	0.291	0.000013	0.000005	0.293
2009	575	0.261	0.000013	0.000005	0.263
2010	559	0.254	0.000013	0.000005	0.256
3-Year Average (2006-2008) based on PG&E Request	577	0.262	0.000013	0.000005	**0.263**
2020 (CO_2)	290	0.133	0.000013	0.000005	**0.135**
Source: Pacific Gas & Electric (PG&E). 2012, April. Community Wide GHG Inventory Report for Vacaville 2003 to 2010. The Intensity factor is based on an average of Kwh and CO2			CH_4 and N_2O intensity based on California E-Grid data (CH_4 = 0.029 lbs/MWH; N_2O = 0.011 lbs/MWH)		

Note: The 2020 emissions rate is estimated by PG&E. It includes reductions from 33% Renewable Portfolio Standard (RPS), Cap-and-Trade, and other regulatory reductions for High Global Warming Potential (HGWP) gases such as reductions of SF_6.

Natural Gas	Intensity factor				CO_2e
	lbs CO_2/Therm	MTons CO_2/Therm	CH4 MTons/Therm	N2O MTons/Therm	MTons/Therm
All Years	11.7	0.00531	0.00005	0.000001	**0.00667**
CO2 intentsiy based on PG&E's third-party-verified GHG inventory submitted to the California Climate Action Registry (CCAR)6 (2003-2008) or The Climate Registry (TCR) (2009).			CH4 and N2O intensity based on Table G.3 of the LGOP for residential and non-residential (CH4: 0.005 kg/MMBtu; N2O: 0.0001 kg/MMBtu)		

General Conversion Factors

kg to MTons	0.001
Mmbtu to Therm	0.1
killowatt hrs to megawatt hrs	0.001
lbs to Tons	2000
Tons to Mton	0.9071847

Source: California Air Resources Board (CARB). 2010. Local Government Operations Protocol. Version 1.1. Appendix F, Standard Conversion Factors

	Global Warming Potentials (GWP)
CO2	1
CH4	21
N2O	310

Souce: Intergovernmental Panel on Climate Change (IPCC). 2001. Third Assessment Report: Climate Change 2011.

Vacaville Electricity & Natural Gas Use (based on a 3-year average, 2006 to 2008)

Electricity	2008 (avg) Kwh/Year	2020 Kwh/Year	2035 Kwh/Year
Residential	253,500,590	285,311,519	325,075,179
Commercial	273,743,688	305,326,095	344,804,104
Municipal	29,342,050	32,947,742	37,454,857
Total	556,586,329	623,585,356	707,334,140

Electricity	2008 (avg) CO_2e MTons/Year	2020 CO_2e MTons/Year	2035 CO_2e MTons/Year
Residential	66,764	75,142	85,615
Commercial	72,096	80,413	90,811
Municipal	7,728	8,677	9,864
Total	146,588	164,233	186,290

Natural Gas	2008 (avg) Therms/Year	2020 Therms/Year	2035 Therms/Year
Residential	12,966,918	14,594,093	16,628,061
Commercial	11,224,750	12,519,774	14,138,554
Municipal	260,574	292,595	332,621
Total	24,452,243	27,406,462	31,099,236

Natural Gas	2008 CO_2e MTons/Year	2020 CO_2e MTons/Year	2035 CO_2e MTons/Year
Residential	86,451	97,299	110,860
Commercial/Industrial	74,836	83,470	94,262
Municipal	1,737	1,951	2,218
Total	163,024	182,720	207,340

Summary	CO_2e MTons/Year	CO_2e MTons/Year	CO_2e MTons/Year
Residential	153,215	172,441	196,474
Commercia/Industrial*	156,396	174,511	197,155
Total	309,611	346,953	393,629

*includes Municipal

Adjusted Forecast - 2020 PG&E CO2 Intensity

least 20 percent by December 30, 2010. The California Air Resources Board (CARB) has now approved an even higher goal of 33 percent by 2020. Investor-owned utilities, such as PG&E are also required to participate in CARB's Cap-and-Trade program and reduce High Global Warming Potential (HGWP) gases, such as reductions of SF6.

Source: Pacific Gas & Electric (PG&E). 2011, April 8. Greenhouse Gas Emission Factors Info Sheet.
http://www.pge.com/includes/docs/pdfs/shared/environment/calculator/pge_ghg_emission_factor_info_sheet.pdf

Note: Energy and Building reductions in the measures below are based on the PG&E 2020 GHG Intensity. (i.e., applied RPS then accounted for additional reductions)

Electricity	2008 CO_2e MTons/Year	2020 Adjusted CO_2e MTons/Year	2035 Adjusted CO_2e MTons/Year
Residential	66,764	38,467	43,828
Commercial	72,096	41,165	46,488
Municipal	7,728	4,442	5,050
Total	146,588	84,074	95,365
GHG Reductions	0	80,159	90,925

Adjusted Forecast - Title 24 Cycle Updates to the California Building Code

The 2008 Building and Energy Efficiency standards (Title 24, Part 6) are approximately 15 percent more energy efficient than the 2005 Building and Energy Efficiency standards, which were in place at the time of CARB's Scoping Plan. The 2014 Building and Energy Efficiency Standards become effective January 1, 2014 and are 25% more energy efficient than the 2008 Building and Energy Efficiency Standards for residential building and 30% more energy efficient thant the 2008 Standards for non-residential buildings.

Local Measures that support Statewide Energy Reductions

GB-1	Allow greater permitting-related development flexibility and other incentives for LEED-Silver, Build It Green, or GreenPoint or equivalent rating, for example by giving green projects priority in plan review, processing, and field inspection services.
GB-2	Require measures that reduce energy use through solar orientation by taking advantage of shade, prevailing winds, landscaping, and sun screens, unless prohibited by topographical conditions or other site-specific constraints.
GB-3	Provide links to programs and information about green building, including training and technical assistance, on the City's website.
GB-4	Coordinate with other local governments, special districts, nonprofits, and other public organizations to share resources, achieve economies of scale, and develop green building policies and programs that are optimized on a regional scale.
GB-5	Develop a "heat island" mitigation plan that includes guidelines for cool roofs, cool pave-ments, and strategically placed shade trees.
EC-3	Require all new development and major rehabilitation (i.e. additions of 25,000 square feet of office/retail commercial or 100,000 square feet of industrial floor area) projects to incorporate any combination of the following strategies to reduce heat gain for 50 percent of the non-roof impervious site landscape, which includes roads, sidewalks, courtyards, parking lots, and driveways: shaded within five years of occupancy; paving materials with a Solar Reflectance Index (SRI) of at least 29; open grid pavement system; and parking spaces underground, under deck, under roof, or under a building. Any roof used to shade or cover parking must have an SRI of at least 29.
EC-6	Seek partnerships with local utilities and private entities to share resources and promote energy conservation.

Reductions

13% Non-Residential Natural Gas Reduction (2008 Building and Energy Efficiency Standards)
10% Residential Natural Gas Reduction (2008 Building and Energy Efficiency Standards)
40% Energy Efficiency Standards + Title 25 Appliance Energy Efficiency Standards

Electricity	2008 (avg) **Kwh/Year**	New Buildings 2020 **Kwh/Year**	New Building 2035 **Kwh/Year**	Total 2020 **Kwh/Year**	Total 2035 **Kwh/Year**
Residential	253,500,590	19,086,557	23,858,196	272,587,147	296,445,343
Commercial	273,743,688	18,949,444	23,686,805	292,693,132	316,379,937
Municipal	29,342,050	2,163,415	2,704,269	31,505,466	34,209,734
Total	556,586,329	40,199,416	50,249,270	596,785,745	647,035,015

Electricity	2008 w/2020 **CO_2e MTons/Year**	2020 **CO_2e MTons/Year**	2035 **CO_2e MTons/Year**	Total 2020 **CO_2e MTons/Year**	Total 2035 **CO_2e MTons/Year**
Residential	34,178	2,573	3,217	36,751	39,968
Commercial	36,907	2,555	3,194	39,462	42,655
Municipal	3,956	292	365	4,248	4,612
Total	75,041	5,420	6,775	80,460	87,235

Natural Gas	2008 (avg) **Therms/Year**	New Buildings 2020 **Therms/Year**	New Building 2035 **Therms/Year**	Total 2020 **Therms/Year**	Total 2035 **Therms/Year**
Residential	12,966,918	1,464,457	1,830,571	14,431,375	16,261,946
Commercial	11,224,750	1,126,671	1,408,339	12,351,421	13,759,760
Municipal	260,574	27,858	34,822	288,432	323,255
Total	24,452,243	2,618,986	3,273,732	27,071,228	30,344,961

Natural Gas	2008 w/2020 **CO_2e MTons/Year**	New Buildings 2020 **CO_2e MTons/Year**	New Building 2035 **CO_2e MTons/Year**	Total 2020 **CO_2e MTons/Year**	Total 2035 **CO_2e MTons/Year**
Residential	86,451	9,764	12,204	96,214	108,419
Commercial/Industrial	74,836	7,512	9,389	82,347	91,737
Municipal	1,737	186	232	1,923	2,155
Total	163,024	17,461	21,826	180,485	202,311

Summary	**2008 CO_2e MTons/Year**	**2020 BAU CO_2e MTons/Year**	**2035 BAU CO_2e MTons/Year**	**Adjusted 2020 CO_2e MTons/Year**	**Adjusted 2035 CO_2e MTons/Year**
Residential	153,215	172,441	196,474	132,965	148,387
Commercia/Industrial*	156,396	174,511	197,155	127,980	141,159
Total	309,611	346,953	393,629	260,945	289,546
Reduction from BAU				-86,008	-104,083
			Reductions from Title 24	-5,848	-13,158

*includes Municipal

Adjusted Forecast - SMART Grid

electric grid in the state. Pursuant to Senate Bill 17, the CPUC developed requirements for a Smart Grid deployment plan. In July 2011, California Utilities filed with

Local Measures that support Statewide Energy Reductions

Partner with Pacific Gas & Electric and other appropriate energy providers to promote energy conservation, including the following:
- Conduct outreach to educate the public about available rebates and other incentives from energy providers.
- Promote the purchase of ENERGY STAR appliances.
- Inform the public about where to find low-cost compact fluorescent light (CFL) bulbs and/or fixtures.
- Offer a halogen torchiere lamp exchange to community members.
- Promote energy efficiency audits of existing buildings to check, repair, and readjust heating, ventilation, air conditioning, lighting, water heating equipment, insulation and weatherization.
- Encourage energy audits to be performed when residential and commercial buildings are sold. Energy audits would include information regarding the opportunities for energy efficiency improvements, and would be presented to the buyer. Commercial buildings are encouraged to be "benchmarked" using EPA's ENERGY STAR Portfolio Manager Tool. Consider requiring energy audits if future evaluations of ECAS performance demonstrate that City is not meeting its target.
- Promote individualized energy management planning and related services for large energy users.

EC-2 - Fund and schedule energy efficiency retrofits or "tune-ups" of existing buildings.

EC-6 Seek partnerships with local utilities and private entities to share resources and promote energy conservation.

EC-7 Continue to offer innovative, low-interest financing for energy efficiency and renewable energy projects for existing and new development through the PACE program.

Reduction in Energy Consumption

	Low	High	% Reduction
Residential	1%	10%	3%
Commercial/Office	1%	10%	3%

http://energyenvironment.pnnl.gov/news/pdf/PNNL-19112_Revision_1_Final.pdf. Table 3.3 Estimated Direct Impacts of the Conservation Effect of Consumer

Energy Savings Applied to Existing Land Uses Only

Electricity	2008 (avg) Adjusted **Kwh/Year**	New Buildings 2020 **Kwh/Year**	New Building 2035 **Kwh/Year**	Total 2020 **Kwh/Year**	Total 2035 **Kwh/Year**
Residential	245,895,573	19,086,557	23,858,196	264,982,130	288,840,326
Commercial	265,531,378	18,949,444	23,686,805	284,480,822	308,167,627
Municipal	29,342,050	2,163,415	2,704,269	31,505,466	34,209,734
Total	540,769,001	40,199,416	50,249,270	580,968,417	631,217,687

Electricity	2008 w/2020 (Adjusted) **CO_2e MTons/Year**	New Buildings 2020 **CO_2e MTons/Year**	New Building 2035 **CO_2e MTons/Year**	Total 2020 **CO_2e MTons/Year**	Total 2035 **CO_2e MTons/Year**
Residential	33,152	2,573	3,217	35,726	38,942
Commercial	35,800	2,555	3,194	38,355	41,548
Municipal	3,956	292	365	4,248	4,612
Total	72,908	5,420	6,775	78,328	85,103

For Natural Gas for the Adjusted Forecast - see Title 24 Updates

Summary	**2008 BAU CO_2e MTons/Year**	**2020 BAU CO_2e MTons/Year**	**2035 BAU CO_2e MTons/Year**	**Adjusted 2020 CO_2e MTons/Year**	**Adjusted 2035 CO_2e MTons/Year**
Residential	153,215	172,441	196,474	131,940	147,361
Commercia/Industrial*	156,396	174,511	197,155	126,873	140,052
Total	309,611	346,953	393,629	258,813	287,413
Reduction from BAU				-88,140	-106,216
*includes Municipal			Reductions from Smart Grid	-2,133	-2,133

California Natural Gas Use by End Use

Source: California Energy Commission.Residential End Use Survey. http://energyalmanac.ca.gov/naturalgas/residential_use.html

Residential	Annual Energy % Total	Non-Title 24	Title 24
Water Heating	44%		44%
Space Heating	44%		44%
Pools, Spas, Misc.	2%	2%	
Clothes Dryers	3%	3%	
Cooking	7%	7%	
Total	100%	12%	88%

Source: California Energy Commission. 2006, March. California Commercial End-Use Survey. Prepared by Itron. CEC-300-2006-005. http://www.energy.ca.gov/2006publications/CEC-300-2006-005/CEC-300-2006-005.PDF

Commercial	Annual Energy % Total	Non-Title 24	Title 24
Water Heating	31.8%		32%
Heating	36.4%		36%
Cooling	1.5%	2%	
Process	5.9%	6%	
Miscellaneous	1.8%	2%	
Cooking	22.6%	23%	
Total	100%	32%	68%

California Electricity Consumption by End Use

Source: Brown, Richard E. and Koomey, Jonathan G., 2002, May. *Electricity Use in California: Past Trends and Present Usage Patterns.* University of California, Berkeley (UCB), Energy analysis Department, Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory. lBL-47992. http://enduse.lbl.gov/Projects/CAdata.html

	Annual Energy TWh	Annual Energy % Total	% of Sector	Non-Title 24	Title 24
Commercial					
Air Conditioning	13.8	5%	15%		15%
Interior Lighting	30.3	12%	34%		34%
Other	19.9	8%	22%	22%	
Ventilation	9.1	4%	10%		10%
Refrigeration	6.5	3%	7%	7%	
Office Equipment	1.6	1%	2%	2%	
Domestic Hot Water	0.5	0%	1%		1%
Exterior Lighting	5.0	2%	6%		6%
Cooking	0.6	0%	1%	1%	
Space Heating	2.1	1%	2%		2%
Total Commercial	*89.5*	*36%*	100%	*32%*	*68%*
Residential					
Air Conditioning	4.8	2%	6%		6%
Miscellaneous	24.6	10%	33%	33%	
Refrigerator	13.7	5%	18%	18%	
Cooking	3.6	1%	5%	5%	
Dryer	5.7	2%	8%	8%	
Pools & Spas	4.1	2%	5%	5%	
Domestic Hot Water	4.2	2%	6%		6%
Television	3.4	1%	5%	5%	
Freezer	2.5	1%	3%	3%	
Dishwasher	2.0	1%	3%	3%	
Waterbed Heater	2.1	1%	3%	3%	
Clothes Washer	0.7	0%	1%	1%	
Space Heating	0.4	2%	1%		1%
Total Residential	*75.4*	*30%*	100%	83%	12%
Industrial					
Assembly	33	13%	62%	62%	
Process	14	6%	26%	26%	
Other	6.1	2%	11%	11%	
Total Industrial	*53.5*	*21%*	100%	99%	
Agricultural					
Total Industrial	*17.8*	*7%*	100%	100%	
Transport & Street Lighting					
Total Transport & Lighting	*15.3*	*6%*	100%	100%	
Total Statewide	251.6	100%			

Off-Road Emissions

Solano Transportation Agency Greenhouse Gas Inventory

GHG Emissions Summary

City of Vacaville

COMMUNITY-WIDE

Emission Sector	Subsector	Emissions (MT CO_2e/yr)	Percent	2020 BAU Emissions (MT CO2e/yr)	2020 Adjusted for LCFS	2035 BAU Emissions (MT CO2e/yr)	2020 Adjusted for LCFS
Off-Road Equipment	TOTAL	**11,994**	2%	**13,468**	12,121	**15,310**	13,779
	Construction	8,097	2%	9,092	8,182	10,335	9,302
	Lawn and Garden	851	0%	955	860	1,086	977
	Light Commercial	1,649	0%	1,852	1,667	2,105	1,895
	Industrial	1,397	0%	1,569	1,258	1,784	1,605

Year 2020 Adjusted	2020 MTons of CO2e	Notes
Industrial Equipment	1,412	With LCFS (10% reduction)
Construction Equipment	8,182	With LCFS (10% reduction)
Lawn&Garden Equipmen	860	With LCFS (10% reduction)
Light Commercial Equipn	1,667	With LCFS (10% reduction)
TOTAL	12,121	MTons

Year 2035 Adjusted	2035 MTons of CO2e	Notes
Industrial	1,605	With LCFS (10% reduction)
Construction Equipment	9,302	With LCFS (10% reduction)
Lawn&Garden Equipmen	977	With LCFS (10% reduction)
Light Commercial Equipn	1,895	With LCFS (10% reduction)
TOTAL	13,779	MTons

Local Measures that support Statewide Other Reductions

EC-5	Continue to support the Yolo Solano Air Quality Management District's lawnmower ex-change program for residents to exchange conventional gas-powered lawnmowers for electric and rechargeable battery-powered lawnmowers.
OS-1	Continue to identify and inventory potential community garden and urban farm sites in existing parks, public easements, right-of-ways, and schoolyards, and develop a program to establish pesticide-free community gardens in appropriate locations.
OS-2	Encourage significant new residential developments over 250 units to include space that can be used to grow food.
OS-3	Establish a process through which a neighborhood can propose and adopt a site as a community garden.
OS-4	Continue to support the Vacaville Farmers' Market as a source for locally-grown food.
OS-5	fee program.
P-1	Develop policies, incentives, and design guidelines that encourage the public and private purchase and use of durable and nondurable items, including building materials, made from recycled materials or renewable resources.
CA-1	Develop and implement an outreach plan to engage local businesses in GHG emissions reduction programs.
CA-2	Establish and maintain a “sustainability information center” at City Hall to inform the public and distribute available brochures, and provide information on sustainability on the City's website.
CA-3	Continue to conduct outreach to encourage residents to shop locally and support local business.

Source: LSA 2012. Based on EMFAC2011	Daily VMT	Tons/Day CO2	MTons/Day CO2	MTons/Year CO2 BAU	Tons/Day CO2 (Pavley+LCFS)	MTons/Day CO2 (Pavley+LCFS)	MTons/Year CO2 (Pavley+LCFS)
2008	3,075,131	1,899.8	1,723.5	598,044	1,899.8	1,723.5	598,044
2020	3,913,894	2,567.2	2,328.9	808,137	2,032.4	1,843.8	639,785
2020 w/ECAS	3,585,434	2,351.8	2,133.5	740,327	1,861.9	1,689.1	586,104

*** Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the Climate Change Scoping Plan Measure Documentation Supplement.

Water and Wastewater

	2008 avg	2020	2035	2008 avg	2020	2035
	Cubic Feet Per year			Million Gallons Per Year		
Water	866,582,697	973,072,538	1,106,184,839	6,482	7,279	8,275
Wastewater	390,341,186	438,308,184	498,266,932	2,920	3,279	3,727

	2008 avg	2020	2035	2008 avg	2020	2035
	Acre-Feet/Year			Liters Per/Year		
Water	19,894	22,339	25,395	24,536,218,323	27,551,346,587	31,320,256,917
Wastewater	8,961	10,062	11,439	11,052,028,370	12,410,154,658	14,107,812,518

Wastewater use is estimated based on 2008 data; however, it is correct to say that wastewater fluctuates up and down from year to year, partially dependent on the amount and timing of precipitation.

GHG Emissions	2008	2020	2035	Adjusted 2020	Adjusted 2035
	MTons/Year				
Energy	7,458	8,374	9,520	4,280	4,865
Fugitive	685	769	875	769	875
Easterly Treatment Plant*	2,531	3,638	5,021		
Total Water/Wastewater	10,674	12,781	15,416	5,049	5,740

*GHG Inventory for Project EIR, Easterly Wastewater treatment Plant, Ryan Hougham, E.I.T, December 29, 2009

General Conversion Factors

Cubic Feet to Gallons	7.480519	
killowatt hrs to megawatt hrs	0.001	
million gallons to AF	0.3259	325851.429
gallons to Liters	3.785	
lbs to Tons	2000	
Tons to Mton	0.9071847	

Source: California Air Resources Board (CARB). 2010. Local Government Operations Protocol. Version 1.1. Appendix F, Standard Conversion Factors

Wastewater - Fugitive Emissions

WASTEWATER: Wastewater in Vacaville is collected, transported, and treated by the Easterly Wastewater treatment Plant. The majority of wastewater is treated to secondary levels and then discharged into Old Alamo Creek.

Fugitive Emissions from Wastewater Associated with Aerobic and Anaerobic Process

CH4 - Microorganisms can biodegrade soluble organic material in wastewater under aerobic (presense of oxygen) or anaerobic (absense of oxygen) conditions. Aneorbic conditions result in the production of CH4.

N2O - Treatment of domestc wastwater during both nitrification and denitrification of the nitrogen present leads to the formation of N2O, usually in the form of urea, ammonia, and proteins. These compounds are converted to nitrate through the aerobic process of nitrification. Denitrification occus under anoxic conditions (without free oxygen), and incolves the biological conversion of nitrate into dinitrogen. N2O can be an intermediate product of both processes, but more often is associated with denitrification.

Notes: Waste Discharge facilities in compliance with the United States Environmental Protection Agency's Clean Water Standards do not typically result in CH4 emissions. However, poorly-operated aerobic wastewater treatment systems can result in the generation of CH4. Because wastewater treatment systems are assumed to operate in compliance with state and federal laws pertaining to water quality, CH4 emissions from centralized aerobic treatments are not included in the inventory.

Fugitive Emissions - Process Emissions from WWTP with Nitrification/Denitrification

LGOP Version 1.1. Equation 10.9.

N2O = Wastewater x 10^-6 x Nload x EF effluent x 10^3

	2008	2020	2035
wastewater (Liters)=	11,052,028,370	12,410,154,658	14,107,812,518
10^-6 =	1.00E-06	conversion factor; kg/mg	
N Load	40.00	mg/L of wastewater	USEPA 2008
EF effluent	0.01	kg//N2O/kg N	
10^-3 =	1.00E-03	conversion factor: MTons/kg	

	2008	2020	2035
		MTons	
N2O	2.210	2.482	2.822
CO2e =	685	769	875

Source: California Air Resources Board (CARB). 2010, May. Local Government Operations Protocol (LGOP), Version 1.1. The LGOP protocol provides default values for all the terms except the Nitrogen Load, which is assumed to be 40 mg of N per Liter of wastewater effluent based on USEPA methodology outlined in the CalEEMod program manual. South Coast Air Quality Management District (SCAQMD). 2011. California Emissions Estimator Model (CalEEMod), Version 2011.1.1. User's Manual. USEPA. 2008. Page 8-12. USEPA cites Metcalf & Eddy, Inc., 1991, "Wastewater Engineering: Treatment Disposal, and Reuse," 3rd Ed. McGraw Hill Publishing.

Water and Wastewater - Embodied Energy (electricity)

East Bay Municipal Utility District (EBMUD)

Water Supply and Conveyance	Water Treatement	Water Distribution	Total Water	Wastewater Treatment
		kWhr/million gallons		
2,117	111	1,272	3,500	1,911

Source: California Energy Commission (CEC). 2006, December. Refining Estimates of Water-Related Energy Use in California. CEC-500-2006-118. Prepared by Navigant Consulting, Inc. Based on the electricity use for Northern California

Pacific Gas & Electric - Emission Factors

	Intensity factor				CO_2e
	lbs CO_2/MWH	MTons CO_2/MWh	CH4 MTons/MWH	N2O MTons/MWH	MTons/MWh
2005	489	0.222	0.000013	0.000005	0.224
2006	456	0.207	0.000013	0.000005	0.209
2007	636	0.288	0.000013	0.000005	0.290
2008	641	0.291	0.000013	0.000005	0.293
2009	575	0.261	0.000013	0.000005	0.263
2010	559	0.254	0.000013	0.000005	0.256
erage (2006-2008) based on PG&E	578	0.262	0.000013	0.000005	**0.264**
2020 (CO_2)	290	0.133	0.000013	0.000005	**0.135**
Source: Pacific Gas & Electric (PG&E). 2011, April. Greenhouse Gas Emissions Factors Info Sheet. *CO2 intentsiy for 2010 and earlier is based on PG&E's third-party-verified GHG inventory submitted to the California Climate Action Registry (CCAR) (2003-2008) or The Climate Registry (TCR).			Source: CH_4 and N_2O intensity based on California E-Grid data (CH_4 = 0.029 lbs/MWH; N_2O = 0.011 lbs/MWH)		

Note: The 2020 emissions rate is estimated by PG&E. It includes reductions from 33% Renewable Portfolio Standard (RPS), Cap-and-Trade, and other regulatory reductions for High Globa Warming Potential (HGWP) gases such as reductions of SF_6.

2011 GHG Emissions from Water Use - Purchased Energy

Energy Associated with Water Use	2008 MwH/Year	2020	2035
Water	22,689	25,477	28,962
Wastewater	5,580	6,266	7,123
Total Water/Wastewater	28,269	31,743	36,085

Indirect GHG Emissions from Energy Associated with Water	2008 MTons/Year	2020	2035
Water	5,986	6,721	7,641
Wastewater	1,472	1,653	1,879
Total Water/Wastewater	7,458	8,374	9,520

Adjusted Forecast - 2020 PG&E CO2 Intensity

Under the RPS, certain retail sellers of electricity were required to increase the amount of renewable energy each year by at least 1 percent in order to reach at least 20 percent by December 30, 2010. The California Air Resources Board (CARB) has now approved an even higher goal of 33 percent by 2020. Investor-owned utilities, such as PG&E are also required to participate in CARB's Cap-and-Trade program and reduce High Global Warming Potential (HGWP) gases, such as reductions of SF6.

Source: Pacific Gas & Electric (PG&E). 2011, April 8. Greenhouse Gas Emission Factors Info Sheet.
http://www.pge.com/includes/docs/pdfs/shared/environment/calculator/pge_ghg_emission_factor_info_sheet.pdf

Indirect GHG Emissions from Energy Associated with Water	2008 MTons/Year	Adjusted 2020	Adjusted 2035
Water	5,986	3,435	3,905
Wastewater	1,472	845	960
Total Water/Wastewater	7,458	4,280	4,865

APPENDIX C

GHG EMISSIONS REDUCTIONS MEASURES MODELING DATA

Summary of Vacaville's GHG Reductions

Measures		MTons 2020	MTons 2035
Land Use and Transportation			
State Measures	*Pavley and LCFS (included in the ABAU)*	*168,350*	*275,630*
LU and TR (combined)		53,682	53,682
Electricity and Natural Gas Reductions			
State Measures	*Title 24 Cycle Updates, 33% RPS, SmartGrid (included in ABAU)*	*88,140*	*106,216*
	Total Local	570	890
RE-1	Require that new or major rehabilitations of commercial, office, or industrial development greater than or equal to 10,000 square feet in size incorporate solar or other renewable energy generation to provide 15 percent or more of the project's energy needs unless prohibited by topographical conditions or other site-specific constraints. Major rehabilitations are defined as additions of 25,000 square feet of office/retail commercial or 100,000 square feet of industrial floor area. Remove regulatory barriers to incorporating renewable energy generation.	20	110
EC-3	Require all new development and major rehabilitation (i.e. additions of 25,000 square feet of office/retail commercial or 100,000 square feet of industrial floor area) projects to incorporate any combination of the following strategies to reduce heat gain for 50 percent of the non-roof impervious site landscape, which includes roads, sidewalks, courtyards, parking lots, and driveways: shaded within five years of occupancy; paving materials with a Solar Reflectance Index (SRI) of at least 29; open grid pavement system; and parking spaces underground, under deck, under roof, or under a building. Any roof used to shade or cover parking must have an SRI of at least 29.	220	420
EC-1	Mandate the use of energy-efficient appliances in new development that meet Energy Star standards and the use of energy-efficient lighting technologies that meet or exceed Title 24 standards.	10	10
EC-2	Partner with Pacific Gas & Electric and other appropriate energy providers to promote energy conservation, including the following: - Conduct outreach to educate the public about available rebates and other incentives from energy providers. - Promote the purchase of ENERGY STAR appliances. - Inform the public about where to find low-cost compact fluorescent light (CFL) bulbs and/or fixtures. - Offer a halogen torchiere lamp exchange to community members. - Promote energy efficiency audits of existing buildings to check, repair, and readjust heating, ventilation, air conditioning, lighting, water heating equipment, insulation and weatherization. - Encourage energy audits to be performed when residential and commercial buildings are sold. Energy audits would include information regarding the opportunities for energy efficiency improvements, and would be presented to the buyer. Commercial buildings are encouraged to be "benchmarked" using EPA's ENERGY STAR Portfolio Manager Tool. Consider requiring energy audits if future evaluations of ECAS performance demonstrate that City is not meeting its target. - Promote individualized energy management planning and related services for large energy users. - Fund and schedule energy efficiency retrofits or "tune-ups" of existing buildings.	70	100
EC-4	Continue to replace City street lights with LED, induction, or other energy-efficient lighting, and require similar energy-efficient street lights in new development.	250	250
Waste & Recycling Reductions			
SW-1		7,770	15,990
Water and Wastewater Reductions			
	33% RPS (included in ABAU)	*4,095*	*4,655*
WW-1		1,450	1,700
Other Emissions Sources			
	LCFS (included in the ABAU)	*1,347*	*1,531*
State Scoping Plan Reductions		*261,932*	*388,032*
Local Reductions		63,472	72,262

Energy & Green Buildings Measures

Electricity	Residential 2020		Non-Residential 2020		Residential 2035		Non-Residential 2035	
	Existing Kwh	New Kwh	Existing Kwh	New Kwh	Existing Kwh	New Kwh	Existing Kwh	New Kwh
Title 24	30,655,416	2,379,491	200,316,251	14,342,590	30,655,416	2,974,364	200,316,251	17,928,238
Non-Title 24	203,499,784	15,795,771	94,227,710	6,746,679	203,499,784	19,744,714	94,227,710	8,433,349
	234,155,200	18,175,262	294,543,960	21,089,269	234,155,200	22,719,078	294,543,960	26,361,587

Natural Gas	Residential 2020		Non-Residential 2020		Residential 2035		Non-Residential 2035	
	Existing Therms	New Therms	Existing Therms	New Therms	Existing Therms	New Therms	Existing Therms	New Therms
Title 24	11,410,888	1,288,722	7,832,991	787,389	11,410,888	1,610,903	7,832,991	984,236
Non-Title 24	1,556,030	175,735	3,652,333	367,140	1,556,030	219,669	3,652,333	458,925
	12,966,918	1,464,457	11,485,325	1,154,529	12,966,918	1,830,571	11,485,325	1,443,161

Sources: Brown, Richard E. and Koomey, Jonathan G., 2002, May. Electricity Use in California: Past Trends and Present Usage Patterns. University of California, Berkeley (UCB), Energy analysis Department, Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory. lBL-47992. http://enduse.lbl.gov/Projects/CAdata.html; California Energy Commission. Residential End Use Survey. http://energyalmanac.ca.gov/naturalgas/residential_use.html; and California Energy Commission. 2006, March. California Commercial End-Use Survey. Prepared by Itron. CEC-300-2006-005.

Renewable Energy Generation - New or Existing Non-Residential

RE-1	Require that new or major rehabilitations of commercial, office, or industrial development greater than or equal to 10,000 square feet in size incorporate solar or other renewable energy generation to provide 15 percent or more of the project's energy needs unless prohibited by topographical conditions or other site-specific constraints. Major rehabilitations are defined as additions of 25,000 square feet of office/retail commercial or 100,000 square feet of industrial floor area. Remove regulatory barriers to incorporating renewable energy generation.	Reduces GHGs by:	25
Support Measures			
EC-2	Partner with Pacific Gas & Electric and other appropriate energy providers to promote energy conservation, including the following: - Conduct outreach to educate the public about available rebates and other incentives from energy providers. - Promote the purchase of ENERGY STAR appliances. - Inform the public about where to find low-cost compact fluorescent light (CFL) bulbs and/or fixtures. - Offer a halogen torchiere lamp exchange to community members. - Promote energy efficiency audits of existing buildings to check, repair, and readjust heating, ventilation, air conditioning, lighting, water heating equipment, insulation and weatherization. - Encourage energy audits to be performed when residential and commercial buildings are sold. Energy audits would include information regarding the opportunities for energy efficiency improvements, and would be presented to the buyer. Commercial buildings are encouraged to be "benchmarked" using EPA's ENERGY STAR Portfolio Manager Tool. Consider requiring energy audits if future evaluations of ECAS performance demonstrate that City is not meeting its target. - Promote individualized energy management planning and related services for large energy users. - Fund and schedule energy efficiency retrofits or "tune-ups" of existing buildings.	Supports RE-1	
RE-3	- Establishes citywide measurable goals; - Identifies the allowable and appropriate alternative energy facility types within the city, such as solar photovoltaic (PV) on residential and commercial roofs and wind turbines for home use; - Proposes phasing and timing of alternative energy facility and infrastructure development; - Establishes development review protocol for new alternative energy projects; - Reviews City policies and ordinances to address alternative energy production;	Supports RE-1	
RE-4	Coordinate with other local governments, special districts, nonprofits, and other public organizations to share resources, achieve economies of scale, and develop alternative energy policies and programs that are optimized on a regional scale.	Supports RE-1	
RE-5	Require that all new buildings be constructed to allow for the easy, cost-effective installation of future solar energy systems, unless prohibited by topographical conditions or other site-specific constraints. "Solar ready" features should include: proper solar orientation (i.e. south-facing roof area sloped at 20° to 55° from the horizontal); clear access on the south sloped roof (i.e. no chimneys, heating vents, plumbing vents, etc.); electrical conduit installed for solar electric system wiring; plumbing installed for solar hot water system; and space provided for a solar hot water storage tank.	Supports RE-1	
RE-6	Encourage the installation of solar photovoltaic arrays in new parking lots and re-placement in existing parking lots.	Supports RE-1	
EC-6	Continue to offer innovative, low-interest financing for energy efficiency and renewable energy projects for existing and new development through the PACE program.	Supports RE-1	
Non-Residential:	Assumes 4.5 non-residential buildings constructed/remodeled over the next 8 years (0.6 per year) that will include PV (20 by 2035).		4.5

			Power Offset			2020
Non-Residential	40,472	kwh/unit/year	182,004	kwh	25	GHG MTons
			Power Offset			2035
Non-Residential	40,472	kwh/unit/year	809,440	kwh	109	GHG MTons

Source: California Energy Commission (CEC). 2012. Clean Power Estimator. http://www.gosolarcalifornia.org/tools/clean_power_estimator.php. Based on a 25,000 Watt-ac PV system (commercial or 25.0 kw-ac system) in zip code 95687 and the number of units forecast to be built.

Existing Non-Residential Building Retrofits

EC-3	Require all new development and major rehabilitation (i.e. additions of 25,000 square feet of office/retail commercial or 100,000 square feet of industrial floor area) projects to incorporate any combination of the following strategies to reduce heat gain for 50 percent of the non-roof impervious site landscape, which includes roads, sidewalks, courtyards, parking lots, and driveways: shaded within five years of occupancy; paving materials with a Solar Reflectance Index (SRI) of at least 29; open grid pavement system; and parking spaces underground, under deck, under roof, or under a building. Any roof used to shade or cover parking must have an SRI of at least 29.	avg non-residential square feet/year 2006-2009	389,761	Reduces GHGs by:	222 MTCO2e
					average of all buildings is greater than 100,000 sq ft
Support Measures		avg non-res permits/avg non-residential sq ft=			109,573

	Partner with Pacific Gas & Electric and other appropriate energy providers to promote energy conservation, including the following: - Conduct outreach to educate the public about available rebates and other incentives from energy providers. - Promote the purchase of ENERGY STAR appliances. - Inform the public about where to find low-cost compact fluorescent light (CFL) bulbs and/or fixtures. - Offer a halogen torchiere lamp exchange to community members. - Promote energy efficiency audits of existing buildings to check, repair, and readjust heating, ventilation, air conditioning, lighting, water heating equipment, insulation and weatherization. - Encourage energy audits to be performed when residential and commercial buildings are sold. Energy audits would include information regarding the opportunities for energy efficiency improvements, and would be presented to the buyer. Commercial buildings are encouraged to be "benchmarked" using EPA's ENERGY STAR Portfolio Manager Tool. Consider requiring energy audits if future evaluations of ECAS performance demonstrate that City is not meeting its target. - Promote individualized energy management planning and related services for large energy users.			jobs generated through new non-res permits
EC-2	- Fund and schedule energy efficiency retrofits or "tune-ups" of existing buildings.	Supports EC-3	974	(assumes 400 sq ft/job)
EC-6	Continue to offer innovative, low-interest financing for energy efficiency and renewable energy projects for existing and new development through the PACE program.	Supports EC-3	28,500	total avg. Jobs 2006-2009
			3.4%	of jobs affected

Assumes	15%	percent increase in energy efficiency
Assumes	3.4%	of energy use from existing jobs would be affected by 2020.
Assumes	6.4%	of energy use from existing non-residential buildings would be affected by 2035.

Based on building permits from 2006 to 2009. Average non-residential square footage is 109,573, generating 974 new jobs. There was 28,500 new jobs between 2006 to 2009 (or 3.4% of employees work in buildings that would be classified as major rehabilitations or new projects)

	Electricity Ratio for 1% over Title 24	Natural Gas Ratio for 1% over Title 24
Residential (avg)	0.08	0.90
multi-family	0.12	0.88
single-family	0.04	0.91
Non-Residential	0.23	0.71
Commercial	0.26	0.72
Office	0.36	0.95
Industrial	0.06	0.46

Source: California Air Pollution Control Officer's Association (CAPCOA). 2010, August. Quantifying Greenhouse Gas Mitigation Measures. Table BE-1.1 and BE-1.2, Climate Zone 5.

		2020			2035		
Electricity	Title 24 Kwh from Existing (pRE-1005 Title 24)	Kwh from existing non-residential that would improve energy efficiency	Kwh Reductions with 15% improvement	GHG Reductions (MTons)	Kwh from existing non-residential that would improve energy efficiency	Kwh Reductions with 15% improvement	GHG Reductions (MTons)
Non-Residential	200,316,251	6,848,725	232,857	31	12,841,359	436,606	59

		2020			2035		
Natural Gas	Title 24 Therms from Existing (pRE-1005 Title 24)	Therms from existing non-residential that would improve energy efficiency	Therms Reductions with 15% improvement	GHG Reductions (MTons)	Therms from existing non-residential that would improve energy efficiency	Therms Reductions with 15% improvement	GHG Reductions (MTons)
Non-Residential	7,832,991	267,807	28,521	190	502,137	53,478	357
				222			415

New Residential - Energy Star Appliances

EC-1 Mandate the use of energy-efficient appliances in new development that meet Energy Star standards and the use of energy-efficient lighting technologies that meet or exceed Title 24 standards. Reduces GHGs by: 8

Assumes developers would provide energy-efficient appliances or residents would purchase new appliances, which meet the Title 25 Energy Code.

Percent of Total Electricity	Residential
Refrigerators	18%
Clothes washer	1%
Dishwasher	3%

Sources: Brown, Richard E. and Koomey, Jonathan G., 2002, May. Electricity Use in California: Past Trends and Present Usage Patterns. University of California, Berkeley (UCB), Energy analysis Department, Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National

Energy Star appliances Increased Efficiency - CLIMATE ZONE 5

	Single Family	Multi-Family	Townhome	Residential (average)
Refrigerators	1.99%	3.07%	2.78%	2.61%
Clothes washer	0.58%	0.03%	0.35%	0.32%
Dishwasher	0.14%	0.12%	0.14%	0.13%

Source: California Air Pollution Control Officers Association (CAPCOA). 2010, August. Quantifying GHG Mitigation Measures. Average based on percentage multi-family and single-family units anticipated in Climate Zone 5.

Lighting (hard-wired interior [6%] and exterior [33%]) is 39% of total commercial energy use (CEC). Hard-wired lighting is regulated under Title 24 and therefore not included in reductions.

ENERGY STAR Appliances:	2020		2035	
	kwh	MTon	kwh	MTon
Energy Saving from New Residential Units:	58,551	8	73,189	10

Existing Residential - Turnover to Energy Efficient Appliances

	Partner with Pacific Gas & Electric and other appropriate energy providers to promote energy conservation, including the following: - Conduct outreach to educate the public about available rebates and other incentives from energy providers. - Promote the purchase of ENERGY STAR appliances. - Inform the public about where to find low-cost compact fluorescent light (CFL) bulbs and/or fixtures. - Offer a halogen torchiere lamp exchange to community members. - Promote energy efficiency audits of existing buildings to check, repair, and readjust heating, ventilation, air conditioning, lighting, water heating equipment, insulation and weatherization. - Encourage energy audits to be performed when residential and commercial buildings are sold. Energy audits would include information regarding the opportunities for energy efficiency improvements, and would be presented to the buyer. Commercial buildings are encouraged to be "benchmarked" using EPA's ENERGY STAR Portfolio Manager Tool. Consider requiring energy audits if future evaluations of ECAS performance demonstrate that City is not meeting its target. - Promote individualized energy management planning and related services for large energy users.	
EC-2	- Fund and schedule energy efficiency retrofits or "tune-ups" of existing buildings.	Reduces GHGs by 71
Support Measures		

ENERGY STAR APPLIANCES - EXISTING

Assume a portion of the existing residential uses would purchase new energy-efficient appliances which meet the Title 25 Energy Code.

Percent of Total Electricity	Residential
Refrigerators	18%
Clothes washer	1%
Dishwasher	3%

Sources: Brown, Richard E. and Koomey, Jonathan G., 2002, May. Electricity Use in California: Past Trends and Present Usage Patterns. University of California, Berkeley (UCB), Energy analysis Department, Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory. lBL-47992. http://enduse.lbl.gov/Projects/CAdata.html.

Energy star appliances Increased Efficiency

	Residential Increase in Efficiency (average multi & single family)	Average Appliance Life Expectancy	Residential Turnover in the next 10 years	Residential Turnover in the next 27 years
Refrigerators	1.99%	14 years	70%	100%
Clothes washer	0.58%	12 years	60%	100%
Dishwasher	0.14%	12 years	60%	100%

Source: California Air Pollution Control Officers Association (CAPCOA). 2010, August. Quantifying GHG Mitigation Measures. Based on single-family units anticipated in Climate Zone 5 for existing single-family residential in the City.

Source: Appliance Life Expectancy. http://www.mrappliance.com/expert/life-guide/ Based on the life expectancy of appliances as reported in the 23rd annual portrait of the U.S. appliance industry.

ENERGY STAR Appliances:

	2020		2035	
	kwh	MTons	kwh	MTons
Energy Saving from Existing Residential Units:	526,176	71	754,326	102

Existing Lighting

EC-4 Continue to replace City street lights with LED, induction, or other energy-efficient lighting, and require similar energy-efficient street lights in new development..

Reduces GHGs by: 252

Non-Residential Exterior Lighting: 6% of Total Energy Use

of California, Berkeley (UCB), Energy analysis Department, Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National

Energy-Efficient exterior lighting is assumed to be LED technology

Efficiency of LED vs. High Pressure Sodium Lighting

	Average Power (Watts)	Power Saving (Watts)	Annual Energy Saving (KWh) Per Luminaire	Lifespan (hours)	Annual Hours
High Pressure Sodium Luminaire	121			30,000	4,100
LED Luminaire	77.7	43	178		
	Percent Reduction	36%	Turnover (years)	7.3	100% in 10 years

Source: U.S. Department of Energy (DOE). 2008, January. Final Report Prepared in Support of the U.S. DOE Solid-State Lighting Technology Demonstration Gateway Program and PG&E Emerging Technologies Program. Prepared by Energy Solutions.

NON-RESIDENTIAL EXTERIOR LIGHT REPLACEMENT

	2020		2035	
	kwh	MTon	kwh	MTon
Energy Saving from Non-Residential Lighting (Existing):	1,870,720	252	1,870,720	252

Local Waste Reduction Measures

Waste	Existing (Average 2006-2008)			
	Tons/Day	GHG MTons	Diverted Tons/Day	Total
Solid Waste	105,168	NA	NA	
ADC	5,864	NA	NA	
Total	111,032	19,033	95,860	206,892

Waste	2020			
	Tons/Day	GHG MTons	Diverted Tons/Day	Total
Solid Waste	118,092	NA	NA	
ADC	6,584	NA	NA	
Total	124,676	21,372	107,640	232,316
Increase	0	2,339		

0

Waste	2030			
	Tons/Day	GHG MTons	Diverted Tons/Day	Total
Solid Waste	134,246	NA	NA	
ADC	7,485	NA	NA	
Total	141,731	24,295	122,364	264,095
Increase	17,055	2,924		

Average Diversion Rate

CalRecycle average diversion rate for Vacaville (2004 to 2006; not reported after 2007) 54%

2004	53%
2005	56%
2006	52%

Source: CalRecycle. Countywide, Regionwide, and Statewide Jurisdiction Diversion/Disposal Progress Report
http://www.calrecycle.ca.gov/LGCentral/Reports/jurisdiction/diversiondisposal.aspx

Local Measures that Support Waste Reduction and the Statewide Goal of 75% Waste Diversion

Assembly Bill 939 (AB 939), the California Integrated Waste Management Act of 1989, requires jurisdictions to divert 50 percent of waste from landfills. In 2011, the Governor signed Assembly Bill 341 (AB 341) expanding the waste reduction goals by ensuring the state is diverting 75 percent of municipal solid waste. AB 341 identifies a goal of the state that not less than 75 percent of solid waste generated be source reduced, recycled, or composted by the year 2020.

SW-1	Support waste reduction through the following sub-measures. Solid waste sub-measures SW-1A through SW-1H support measure SW-1 and when com-bined reduce GHG emissions in Vacaville by 7,770 MTC02e or 9 percent of the total GHG emission reductions. The modeling conservatively assumes a 66 percent waste diversion rate (approximately 12 percent increase) based on historic trends in waste disposal in the City for 2020 and 75 percent goal for 2035. Therefore, the matrix does not show a quantified percent of total GHG reductions for each sub-measure, and it does not list any assumptions.
SW-1A	Continue to require at least 50 percent diversion (i.e. reuse or recycling) of non-hazardous construction waste from disposal, consistent with CALGreen - the Statewide Green Building code.
SW-1B	Require all new and existing multi-family developments that are redeveloping or re-modeling to provide recycling areas for their residents. Allow a reduction in the parking requirement if necessary to allow adequate space for the recycling area.
SW-1C	Continue to promote recycling and waste diversion in Vacaville through marketing efforts to increase participation by residents and businesses. As part of this program, continue to conduct through the City's Recycling Coordinator public education and outreach about reuse and recycling, including existing programs for appliance disposal, yard debris and kitchen waste collection and composting, waste to energy, and zero waste programs. Where applicable, coordinate recycling outreach efforts with the City's contracted solid waste hauler Recology Vacaville Solano (RVS).
SW-1D	Encourage the use of salvaged and recycled-content materials and other materials that have low production energy costs for building materials, hard surfaces, and non-plant landscaping. Require sourcing of construction materials locally, as feasible.
SW-1E	Investigate the provision of recycling containers Downtown and in City-owned parks.

Based on historical trends in waste disposal reduction, as reported by CalRecycle, for the City of Vacaville. Not corrected for SOI or Planning Area population and employment. Although population and employment increased, generally waste disposal has decreased.

Disposal Year	Solid Waste Disposal Tons	Alternative Daily Cover Tons	Total Tons
2005	103,319	3,913	107,232
2006	113,418	3,348	116,766
2007	105,120	9,532	114,652
2008	96,967	4,710	101,677
2009	85,502	2,854	88,356
2010	83,129	3,260	86,389

Source: California Department of Resources Recycling and Recovery (CalRecycle). Disposal Reporting System. Jurisdiction Disposal by Facility, Vacaville, 2005-2010. http://www.calrecycle.ca.gov/lgcentral/Reports/DRS/Default.aspx

1 Includes materials used for Alternative Intermediate Cover (AIC) in ADC. However, AIC materials are stipulated under the Public Resources Code Section 41781.3 as recycling and not disposal and are calculated separately in disposal years 2006 and after.

	Percent Reduction MSW	Percent Reduction ADC
2005-2006	9.8%	-14.4%
2006-2008	-14.5%	40.7%
2008-2009	-11.8%	-39.4%
Average % Reduction Per Year	-5.5%	-4.4%

Exponential Equation

Reduction = Beginning Amount (1 + r)^t

r = rate

t = time (8 years from 2012 to 2020)

Note: Outlier data for 2007 was omitted.

The modeling conservatively assumes a 66% waste diversion rate (approximately 12 percent increase) based on historic trends in waste disposal in the City for 2020 and 75% goal for 2035.

Waste	2020 MSW Adjusted Tons/Day	2020 ADC Adjusted Tons/Day	GHG MTons	Diversion Rate
Total	74,992	4,598	13,597	66%
Reduction	43,100	1,986	7,775	

Waste	2035 MSW Adjusted Tons/Day	2035 ADC Adjusted Tons/Day	GHG MTons	Diversion Rate
Total	45,660	3,191	8,303	75%
Reduction	88,586	4,294	15,993	

VACAVILLE ECAS

2020 VMT Summary

Measure		Daily VMT		VMT Reduction from BUA		VMT Reduction (Normalized)		Percent VMT Reduction	
		Vacaville Roads Only	All Roads	Vacaville Roads Only	All Roads	Vacaville Roads Only	All Roads	Vacaville Roads Only	All Roads
None	Business as Usual	1,137,892	3,913,894						
LU-1	Emphasis on Pedestrian Entrances	1,137,865	3,913,863	(27)	(31)	(28)	(31)	0.00%	0.00%
LU-2	Pedestrian or Bicycle Connections	1,136,890	3,912,895	(1,002)	(999)	(1,037)	(1,011)	-0.09%	-0.03%
LU-3	Traditional Development Patterns	1,137,853	3,913,870	(39)	(24)	(40)	(24)	0.00%	0.00%
LU-4	Pedestrian Access	1,137,869	3,913,874	(23)	(19)	(24)	(20)	0.00%	0.00%
TR-1	Bikeway Plan	1,137,827	3,913,821	(65)	(72)	(68)	(73)	-0.01%	0.00%
TR-2	Bike Parking in Comm. Dev. and PNR	1,136,243	3,912,111	(1,649)	(1,783)	(1,707)	(1,804)	-0.15%	-0.05%
TR-3	Shared Parking and Infill Reductions	1,117,602	3,838,526	(20,290)	(75,367)	(21,000)	(76,279)	-1.88%	-1.99%
TR-4	Voluntary Trip Reduction Program	1,115,491	3,805,881	(22,401)	(108,012)	(23,184)	(109,319)	-2.08%	-2.87%
TR-5	Commute Reduction Strategies	1,125,442	3,855,576	(12,450)	(58,318)	(12,886)	(59,023)	-1.14%	-1.53%
TR-6	School Trip Reduction	1,124,710	3,863,119	(13,182)	(50,774)	(13,643)	(51,389)	-1.21%	-1.33%
TR-7	Shuttle Service for Major Emp. Centers	1,137,489	3,912,182	(403)	(1,712)	(417)	(1,733)	-0.04%	-0.04%
TR-8	Parking Cash-out	1,136,761	3,910,220	(1,131)	(3,674)	(1,171)	(3,718)	-0.10%	-0.10%
TR-9	Transit Network Expansions	1,133,004	3,890,146	(4,888)	(23,748)	(5,059)	(24,035)	-0.45%	-0.62%
	TOTAL INDIVIDUAL MEASURES			(77,552)	(324,534)	(80,264)	(328,460)		
Maximum ECAS Measures		1,057,628	3,585,434	(80,264)	(328,460)	(80,264)	(328,460)	-7.59%	-9.16%
	Percent Difference			-3.4%	-1.2%	0.0%	0.0%		

Source: LSA 2012. Based on EMFAC2011	Daily VMT	Tons/Day CO2	MTons/Day CO2	MTons/Year CO2 BAU	Tons/Day CO2 (Pavley+LCFS)	MTons/Day CO2 (Pavley+LCFS)	MTons/Year CO2 (Pavley+LCFS)
2008	3,075,131	1,899.8	1,723.5	598,044	1,899.8	1,723.5	598,044
2020	3,913,894	2,567.2	2,328.9	808,137	2,032.4	1,843.8	639,785
2020 w/ECAS	3,585,434	2,351.8	2,133.5	740,327	1,861.9	1,689.1	586,104

*** Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the Climate Change Scoping Plan Measure Documentation Supplement.

Local Water/Wastewater Measures

Local Measures that are Required Pursuant to the model Water Efficient Landscape Ordinance (WELO) or California Building Code
Local Measures that Support EBMUD's Urban Water Management Plan to Achieve 20% Per Capita Water reductions.

The California Department of Water Resources adopted a plan to reduce per capita water use by 20 percent by 2020 in accordance with the Final 20X2020 Water Conservation Plan. New development is required to comply with the new Title 24 California Green Building Code (CALGreen) water efficiency provisions that mandate an improvement over existing plumbing and irrigation water efficiency. This efficiency corresponds with the 20X2020 goal to reduce per-capita water use by 20 percent.
Reductions from these measures are capped at the 20 percent per capita goal.

Measures WW-1A through WW-1G all support the following reduction: 1,452

WW-1	Support the conservation measures outlined in the City's Urban Water Management Plan and implement the City's Water Efficient Landscape requirements through the following sub-measures. Water and wastewater sub-measures WW-1A through WW 1L support measure WW-1 and when combined reduce GHG emissions in Vacaville by 2,850 MTCO2e or 3 percent of the total GHG emission reductions. Therefore, the matrix does not show a quantified percent of total GHG reductions for each sub-measures, and it does not list any as-sumptions.
WW-1A	For all new development, require all water use and efficiency measures to comply with City Codes.
WW-1B	At least every five years, review and update the City's Water Efficient Landscape require-ments with improved conservation programs and incentives for non-residential customers.
WW-1C	Continue to offer conservation programs and incentives to large landscape customers per the Urban Water Management Plar
WW-1D	Implement water efficient residential programs identified in the current Urban Water Man-agement Plan. Continue to coordinate with local water purveyors to achieve consistent standards
WW-1E	Expand the public information and school education program to promote water conservation and its benefits in coordination with efforts of local water purveyors. Con-duct public education and outreach to reduce watering of non-vegetated surfaces and promote the use of pervious paving materials
WW-1F	Encourage the use of non-potable water for irrigation purposes
WW-1G	Continue to meter all new connections and retrofits of existing connections with commodity rates. Continue to provide information to customers about their water use

	2020 w/20% Reduction	2035 w/20% Reduction	2020 w/20% Reduction	2035 w/20% Reduction
	Cubic Feet Per year		Million Gallons Per Year	
Water	778,458,030	884,947,871	5,186	5,823
Wastewater	350,646,547	398,613,545	2,336	2,623

	2020 w/20% Reduction	2035 w/20% Reduction	2020 w/20% Reduction	2035 w/20% Reduction
	Acre-Feet/Year		Liters Per/Year	
Water	17,871	20,316	19,628,974,659	22,041,077,270
Wastewater	8,050	9,151	8,841,622,696	9,928,123,726

Energy

Energy Associated with Water Use	2020	2035
	MwH/Year	
Water	18,151	20,381
Wastewater	4,464	5,013
Total Water/Wastewater	22,615	25,394

Indirect GHG Emissions from Energy Associated with Water Use	2020	2035	Reduction from Adjusted 2020	Reduction 2035
	MTons/Year		MTons/Year	
Water	2,447	2,748	-988	-1,157
Wastewater	602	676	-243	-285
Total Water/Wastewater	3,049	3,424	-1,231	-1,441

Energy

LGOP Version 1.1. Equation 10.9.

N2O = Wastewater x 10^-6 x Nload x EF effluent x 10^3

	2020	2035	Reduction 2020	Reduction 2035
	MTons/Year		MTons/Year	
N2O	1.768	1.986	-0.714	-0.836
CO2e =	548	616	-221	-259

Source: California Air Resources Board (CARB). 2010, May. Local Government Operations Protocol (LGOP), Version 1.1. The LGOP protocol provides default values for all the terms except the Nitrogen Load, which is assumed to be 40 mg of N per Liter of wastewater effluent based on USEPA methodology outlined in the CalEEMod program manual. South Coast Air Quality Management District (SCAQMD). 2011. California Emissions Estimator Model (CalEEMod), Version 2011.1.1. User's Manual. USEPA. 2008. Page 8-12. USEPA cites Metcalf & Eddy, Inc., 1991, "Wastewater Engineering: Treatment Disposal, and Reuse," 3rd Ed. McGraw Hill Publishing.

Total

	2020	2035	Reduction from Adjusted 2020	Reduction 2035
	MTons/Year		MTons/Year	
Total Water/Wastewater	3,597	4,039	-1,452	-1,701