CITY OF ANDERSON

GREENHOUSE GAS REDUCTION MEASURE QUANTIFICATION METHODOLOGY

This appendix summarizes the methodology for quantifying greenhouse gas (GHG) reductions resulting from implementing the Climate Action Plan (CAP) measures. Calculations and/or background information are only shown for horizon year 2020. Energy emissions factors based on an RPS-compliant energy source mix were used to quantify emissions reductions for all measures resulting in electricity savings to avoid double counting.

Measure B-1: Energy Efficiency Retrofits

This measure estimates the reduction in energy-related emissions (i.e., electricity and natural gas) resulting from retrofitting existing residential units and commercial properties. The measure includes retrofitting both single- and multi-family units based on a pre-defined package of energy efficiency retrofits that include installation of programmable thermostats, gas water heater upgrades, installation of high-efficiency light bulbs, gas furnace upgrades, duct sealing, foundation insulation, and building envelope sealing/weatherization.

Baseline electricity and natural gas consumption levels per unit type were identified using CEC's Residential Appliance Saturation Survey data for Forecast Climate Zone 3, which covers 85 to 95 percent of Shasta County. Mitigated energy savings estimates were based on outputs from Lawrence Berkeley Laboratory's Home Energy Saver ^{TM} building energy modeling software. The model-derived energy savings estimates were downscaled in order to be conservative in emissions reduction calculations. Total energy savings were calculated by subtracting the mitigated electricity and natural gas consumption levels from baseline levels. See Table B-1 and B-2 for data used to calculate emissions reductions.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	10% of existing residential units and 10% of existing non-residential square feet perform cost-effective energy efficiency package improvements (e.g., insulation, duct sealing, AC refrigerant recharge)	127 MT CO_2e/yr	*Building Data: Shasta County Assessor's Office parcel data* *Baseline Energy Consumption: Commercial End Use Survey, CEC, 2006* *Energy Savings from Retrofit Packages: AECOM SSIME^{TM} Building Energy Analysis* *Baseline Energy Consumption: Residential Appliance Saturation Survey, CEC, 2010* *Energy Savings from Retrofit Packages: SSIMe Building Energy Model, AECOM 2011* *Participation Rates: City of Anderson, 2012*

Measure BE-2: New Construction

Reductions associated with this measure are described in Statewide Measures Reductions on page B-49.

Table B-1 Residential Retrofits						
Baseline Energy Consumption						
	Total Units	**Participation Rate**	**kWh/unit/year**	**therms/unit/year**	**Total kWhr/year**	**Total therms/year**
Single Family	2,544	10%	8,836	562	2,247,878	142,881
Townhome	201	10%	5,762	327	115,816	6,570
2-4 unit apartment	360	10%	4,595	305	165,420	10,998
5+ unit apartment	687	10%	5,248	199	360,538	13,656
Mobile Home	169	0%	na	na	na	na
Total	**3,961**				**2,889,652**	**174,104**
Mitigated Energy Consumption						
	Total Units	**Participation Rate**	**kWh/unit/year**	**therms/unit/year**	**Total kWhr/year**	**Total therms/year**
Single Family	2,544	10%	8,836	489	2,247,878	124,505
Townhome	201	10%	5,722	305	115,004	6,140
2-4 unit apartment	360	10%	4,566	272	164,385	9,801
5+ unit apartment	687	10%	5,217	189	358,393	12,964
Mobile Home	169	0%	na	na	na	na
Total	**3,961**				**2,885,660**	**153,410**
Energy Savings					**3,992**	**20,694**

Table B-2
Commercial Retrofits

Baseline Energy Consumption

	Total SQFT	Participation Rate	kWh/sqft/year	kBTU/sqft/year	Total kWhr/year	Total kBTU/year
All Warehouse	147,446	10%	22.7	0.0	334,201	0
Health	8,031	10%	15.0	46.6	12,078	37,425
Lodging	18,970	10%	10.1	27.2	19,111	51,526
Restaurant	16,668	10%	33.2	214.0	55,414	356,766
Retail	675,143	10%	10.1	12.8	678,947	863,384
Small Office	1,058	10%	9.4	9.9	995	1,048
Total	**867,316**	-	-	-	**1,100,746**	**1,310,148**

Mitigated Energy Consumption

	Total SQFT	Participation Rate	kWh/sqft/year	kBTU/sqft/year	Total kWhr/year	Total kBTU/year
All Warehouse	147,446	10%	22.6	0.0	333,039	0
Health	8,031	10%	13.9	46.6	11,179	37,425
Lodging	18,970	10%	8.9	27.2	16,792	51,526
Restaurant	16,668	10%	32.2	214.0	53,640	356,766
Retail	675,143	10%	9.3	12.8	629,968	863,384
Small Office	1,058	10%	8.9	9.9	946	1,048
Total	**867,316**	-	-	-	**1,044,619**	**1,309,100**
Energy Savings (Baseline minus Mitigated)					**56,127**	**1,048**

Measure B-3: Commercial Lighting

This measure estimates the reduction in electricity-related emissions resulting from indoor and outdoor light retrofits within commercial land uses. Baseline lighting electricity loads per square foot per non-residential use type were identified using CEC's Commercial End Use Survey data for Forecast Climate Zone 3 (see Table B-3).

The measure assumes that indoor lighting retrofits would occur at a performance level identified within the State's *Database for Energy Efficient Resources*. For 2020, the City assumes that 40% of total community-wide nonresidential square footage would implement a 40% indoor lighting load reduction. It was also assumed that 40% of total community-wide nonresidential square footage would implement a 40% exterior lighting load reduction. All non-residential uses (office, retail, and warehouse) are included in these calculations. Participation rates also reflect the assumption that State and federal light bulb efficiency standards (i.e. Energy Independence and Security Act of 2007) will assist in the implementation of this measure.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	40% of businesses improve interior lighting efficiency by 40%. 40% of businesses improve exterior lighting efficiency by 40%.	183 MT CO_2e/yr	*Baseline Energy Consumption: Commercial End Use Survey, CEC, 2006* *Energy Savings from Retrofit Packages: CEC/CPCU Database for Energy Efficient Resources, 2005* *Participation Rates: City of Anderson, 2011*

Table B-3
Indoor and Exterior Lighting Energy

Commercial Use Type	Baseline (kWh/SF/Year)	Mitigated (kWh/SF/Year)
Grocery	36.27	33.31
Health	15.04	13.54
Lodging	10.07	9.44
Large Office	14.20	12.62
Restaurant	33.25	30.81
Retail	10.06	8.43
School	8.82	7.63
Small Office	9.40	8.26
Warehouse (All)	22.67	21.55

Source: CEC 2006

Measure B-4: Efficient Appliances

This measure estimates the reduction in electricity-related emissions resulting from installing energy-efficient appliances in new and existing residential units. This measure focuses on installation of energy-efficient refrigerators, clothes washers, and dishwashers. The CAPCOA report "*Quantifying Greenhouse Gas Mitigation Measures*" provides a methodology for calculating the electricity reductions associated with the installation of energy-efficient refrigerators, clothes washers, and dishwashers. The City selected participation rates on the assumption that State and utility outreach programs will increase the market share of ENERGY STAR appliances above current levels. Baseline market share values from a *Northwestern Energy Alliance* study indicate that approximately 33% of consumers purchase ENERGY STAR refrigerators, 83% purchase ENERGY STAR dishwashers, and 36% purchase ENERGY STAR clothes washers. The study shows a strong trend of increasing ENERGY STAR appliance market share over the past decade. For 2020, the City assumes that additional outreach and rebates will further increase the ENERGY STAR appliance market share in Anderson. For new residential units, the measure assumes use of energy-efficient refrigerators, dishwashers, and clothes washers will increase to a market share of 70%. The City assumes that 40% of existing residential units will install energy-efficient refrigerators and dishwashers, and 80% of existing residential units will install energy-efficient clothes washers.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	40% of existing homes will replace old model refrigerators and dishwashers	229 MT CO_2e/yr	*Quantification Methodology: Energy Efficient Appliance Reduction: CAPCOA. 2010 (August). Quantifying Greenhouse Gas Mitigation Measures. Available: <http://www.capcoa.org/wp-content/uploads/2010/11/CAPCOA-Quantification-Report-9-14-Final.pdf>.* *Participation Rates: ENERGY STAR Consumer Products Program: Market Progress Evaluation Report. Prepared by KEMA, Inc. July 24, 2007. Prepared for Northwestern Energy Efficiency Alliance.*
	80% of existing homes will replace old clothes washers with new Energy Star models		
	70% of new homes will install Energy Star refrigerators, dishwashers and clothes washers		

Measure B-5: Smart Grid Integration

This measure estimates the reduction in electricity-related emissions resulting from integration of Smart Grid technologies in new and existing residential and commercial land uses. Literature indicates that integration of Smart Grid technologies reduces electricity use by more than 5% in existing residential and commercial buildings and 6% in new residential and commercial buildings. For 2020, the measure assumes that 50% of all new residential buildings and 20% of existing residential and commercial buildings will integrate Smart Grid technologies.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	20% of existing residential units to use Smart Grid technology 50% of new residential units to use Smart Grid technology	711 MT CO_2e/yr	*Smart Grid Reduction: SMART 2020: Enabling the low carbon economy in the information age, The Climate Group on behalf of the Global 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* *Participation Rates: Pacific Northwest National Laboratory , Estimating the Benefits of the GridWise Initiative Phase I Report Walter S. Baer, Brent Fulton, Sergej Mahnovski TR-160-PNNL, May 2004*

Measure B-6: Solar Water Heaters

This measure quantifies natural gas and electricity-related emissions reductions resulting from the installation of solar hot water heaters in residential units and commercial buildings. Baseline water heating-related natural gas consumption levels per residential unit type were identified using CEC's Residential Appliance Saturation Survey data for Forecast Climate Zone 3. In addition, CEC data identifies the energy savings potential of solar hot water heaters for specific climates in California. The measure assumes that 40-67% of water-heating natural gas can be reduced through the use of solar hot water heaters. The measure assumes that 2% of all residential units (i.e., single family and multi-family) and 2% of all commercial buildings will install solar hot water heaters to meet their hot water demands. Care should be taken to avoid double-counting between a solar hot water heater installed to help new residential units achieve the building code-mandated energy efficiency performance and solar hot water heaters installed in excess of that requirement. Table B-4 provides the assumptions used to quantify reductions from solar water heaters.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	2% of residences and commercial buildings installed a solar hot water system.	56 MT CO_2e/yr	*Baseline Hot Water Natural Gas Consumption: Residential Appliance Saturation Survey, CEC, 2010* *Solar Fraction: Solar Water Heating CEC 2013 Title 24 Pre-rulemaking Workshop, California Energy Commission, June 9, 2011*

Table B-4
Solar Water Heaters – 2020

Residential Units

	Units (2020)	Hot Water Heater Energy per Unit (therms/year)	Solar Water Heater Effectiveness	Energy Savings per Unit (therms/year)	Participation Rate (% of units)	Total Savings (therms/year)
Single Family	3,042	196	67%	131.54	2%	8,001
Townhouse	240	170	67%	114.15	2%	549
2-4 unit apartment	430	135	59%	79.65	2%	686
5+ unit apartment	821	84	59%	49.30	2%	810
Total	**4,534**					**10,046**

Commercial Buildings

	SQFT (2020)	Hot Water Heater Energy per SQFT (kBTU/year)	Solar Water Heater Effectiveness	Energy Savings per SQFT (kBTU/year)	Participation Rate (% of sqft)	Total Savings (kBTU/year)
All Warehouse	168,313	0.00	50%	0.00	2%	0
Health	9,168	17.34	50%	8.67	2%	1,589
Lodging	21,655	14.27	50%	7.14	2%	3,090
Restaurant	19,027	29.95	50%	14.97	2%	5,698
Retail	770,690	1.91	50%	0.96	2%	14,757
Small Office	1,208	1.23	50%	0.62	2%	15
Total	**992,079**					**25,149**

Measure SW-1: Enhanced Organic Waste Diversion

An inventory of the community's organic waste was created using Cal Recycle waste volume and characterization data. Using the first-order decay methodology from the 2006 IPCC guidelines, fugitive methane emissions from the organic landfill waste were calculated for base-case and mitigated scenarios. This measure assumes that residential and commercial uses will divert 50% of yard waste (highlighted in green in Tables B-5 and B-6) and construction/demolition waste (highlighted in blue in Tables B-5 and B-6) from landfills by 2020. This measure would apply to GHG emissions associated with new waste generated and would not apply to waste in place disposed prior to CAP implementation.

Calculations for this measure factored in the advanced methane recovery rate described in Measure SW-2 to avoid double counting emissions reductions.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	Community increases diversion of yard and construction and demolition wastes by 50%.	159 MT CO_2e/yr	*CalRecycle Waste Characterization Data, 2011* *IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5 Chapter 3.*

Table B-5
Baseline Degradable Organic Carbon Disposed

Commercial Waste – Baseline Mass of Degradable Organic Carbon Disposed (DDOC mdt)

Year	Newspaper	Office Paper	Corrugated Boxes	Coated Paper	Food	Grass	Leaves	Branches	Lumber	Textiles	Diapers	Construction/ Demolition	Sludge/ Manure	Total
2008	4.4	34.3	63.9	35.1	82.1	3.5	13.5	13.0	96.5	32.4	17.1	7.2	0.0	402.9
2009	4.4	34.5	64.3	35.3	82.6	3.5	13.6	13.1	97.1	32.6	17.2	7.2	0.0	405.2
2010	4.5	34.7	64.6	35.5	83.1	3.5	13.6	13.2	97.7	32.8	17.3	7.3	0.0	407.5
2011	4.5	34.9	65.0	35.7	83.5	3.5	13.7	13.2	98.2	33.0	17.4	7.3	0.0	409.9
2012	4.5	35.1	65.4	35.9	84.0	3.5	13.8	13.3	98.8	33.1	17.5	7.3	0.0	412.2
2013	4.5	35.3	65.7	36.1	84.5	3.6	13.9	13.4	99.3	33.3	17.5	7.4	0.0	414.5
2014	4.6	35.5	66.1	36.3	85.0	3.6	14.0	13.5	99.9	33.5	17.6	7.4	0.0	416.9
2015	4.6	35.7	66.5	36.5	85.5	3.6	14.0	13.5	100.5	33.7	17.8	7.5	0.0	419.3
2016	4.6	35.9	66.9	36.7	85.9	3.6	14.1	13.6	101.0	33.9	17.9	7.5	0.0	421.7
2017	4.6	36.1	67.2	36.9	86.4	3.6	14.2	13.7	101.6	34.1	18.0	7.6	0.0	424.1
2018	4.7	36.3	67.6	37.1	86.9	3.7	14.3	13.8	102.2	34.3	18.1	7.6	0.0	426.5
2019	4.7	36.5	68.0	37.3	87.4	3.7	14.4	13.8	102.8	34.5	18.2	7.6	0.0	428.9
2020	4.7	36.7	68.4	37.5	87.9	3.7	14.4	13.9	103.4	34.7	18.3	7.7	0.0	431.3

Residential Waste – Baseline Mass of Degradable Organic Carbon Disposed (DDOC mdt)

Year	Newspaper	Office Paper	Corrugated Boxes	Coated Paper	Food	Grass	Leaves	Branches	Lumber	Textiles	Diapers	Construction/ Demolition	Sludge/ Manure	Total
2008	6.0	21.5	17.3	27.4	92.4	3.6	8.6	3.6	26.7	25.3	29.5	2.2	0.1	264.2
2009	6.0	21.6	17.4	27.5	92.9	3.6	8.7	3.6	26.9	25.4	29.7	2.2	0.1	265.7
2010	6.1	21.7	17.5	27.7	93.5	3.6	8.7	3.7	27.0	25.6	29.9	2.2	0.1	267.2
2011	6.1	21.9	17.6	27.8	94.0	3.6	8.8	3.7	27.2	25.7	30.1	2.2	0.1	268.7
2012	6.1	22.0	17.7	28.0	94.5	3.6	8.8	3.7	27.3	25.8	30.2	2.2	0.1	270.2
2013	6.2	22.1	17.8	28.2	95.1	3.7	8.9	3.7	27.5	26.0	30.4	2.2	0.1	271.8
2014	6.2	22.2	17.9	28.3	95.6	3.7	8.9	3.8	27.6	26.1	30.6	2.2	0.1	273.3
2015	6.2	22.4	18.0	28.5	96.1	3.7	9.0	3.8	27.8	26.3	30.7	2.3	0.1	274.9
2016	6.3	22.5	18.1	28.6	96.7	3.7	9.0	3.8	28.0	26.4	30.9	2.3	0.1	276.4
2017	6.3	22.6	18.2	28.8	97.2	3.7	9.1	3.8	28.1	26.6	31.1	2.3	0.1	278.0
2018	6.3	22.7	18.3	29.0	97.8	3.8	9.1	3.8	28.3	26.7	31.3	2.3	0.1	279.6
2019	6.4	22.9	18.4	29.1	98.4	3.8	9.2	3.9	28.4	26.9	31.4	2.3	0.1	281.2
2020	6.4	23.0	18.5	29.3	98.9	3.8	9.2	3.9	28.6	27.0	31.6	2.3	0.1	282.8

Table B-6
Mitigated Degradable Organic Carbon Disposed

Commercial Waste – Mitigated Mass of Degradable Organic Carbon Disposed (DDOC mdt)

Year	Newspaper	Office Paper	Corrugated Boxes	Coated Paper	Food	Grass	Leaves	Branches	Lumber	Textiles	Diapers	Construction/ Demolition	Sludge/ Manure	Total
2008	**4.4**	**34.3**	**63.9**	**35.1**	**82.1**	**3.5**	**13.5**	**13.0**	**48.3**	**32.4**	**17.1**	**7.2**	**0.0**	**354.7**
2009	**4.4**	**34.5**	**64.3**	**35.3**	**82.6**	**3.5**	**13.6**	**13.1**	**48.5**	**32.6**	**17.2**	**7.2**	**0.0**	**356.7**
2010	4.5	34.7	64.6	35.5	83.1	3.5	13.6	13.2	48.8	32.8	17.3	7.3	0.0	**358.7**
2011	4.5	34.9	65.0	35.7	83.5	3.5	13.7	13.2	49.1	33.0	17.4	7.3	0.0	**360.8**
2012	4.5	35.1	65.4	35.9	84.0	3.5	13.8	13.3	49.4	33.1	17.5	7.3	0.0	**362.8**
2013	4.5	35.3	65.7	36.1	84.5	3.6	13.9	13.4	49.7	33.3	17.5	7.4	0.0	**364.9**
2014	4.6	35.5	66.1	36.3	85.0	3.6	14.0	13.5	49.9	33.5	17.6	7.4	0.0	**367.0**
2015	4.6	35.7	66.5	36.5	85.5	3.6	14.0	13.5	50.2	33.7	17.8	7.5	0.0	**369.0**
2016	4.6	35.9	66.9	36.7	85.9	3.6	14.1	13.6	50.5	33.9	17.9	7.5	0.0	**371.1**
2017	4.6	36.1	67.2	36.9	86.4	3.6	14.2	13.7	50.8	34.1	18.0	7.6	0.0	**373.3**
2018	4.7	36.3	67.6	37.1	86.9	3.7	14.3	13.8	51.1	34.3	18.1	7.6	0.0	**375.4**
2019	4.7	36.5	68.0	37.3	87.4	3.7	14.4	13.8	51.4	34.5	18.2	7.6	0.0	**377.5**
2020	4.7	36.7	68.4	37.5	87.9	3.7	14.4	13.9	51.7	34.7	18.3	7.7	0.0	**379.7**

Residential Waste – Mitigated Mass of Degradable Organic Carbon Disposed (DDOC mdt)

Year	Newspaper	Office Paper	Corrugated Boxes	Coated Paper	Food	Grass	Leaves	Branches	Lumber	Textiles	Diapers	Construction/ Demolition	Sludge/ Manure	Total
2008	**6.0**	**21.5**	**17.3**	**27.4**	**92.4**	**3.6**	**8.6**	**3.6**	**13.4**	**25.3**	**29.5**	**2.2**	**0.1**	**250.8**
2009	**6.0**	**21.6**	**17.4**	**27.5**	**92.9**	**3.6**	**8.7**	**3.6**	**13.4**	**25.4**	**29.7**	**2.2**	**0.1**	**252.2**
2010	**6.1**	**21.7**	**17.5**	**27.7**	**93.5**	**3.6**	**8.7**	**3.7**	**13.5**	**25.6**	**29.9**	**2.2**	**0.1**	**253.7**
2011	**6.1**	**21.9**	**17.6**	**27.8**	**94.0**	**3.6**	**8.8**	**3.7**	**13.6**	**25.7**	**30.1**	**2.2**	**0.1**	**255.1**
2012	**6.1**	**22.0**	**17.7**	**28.0**	**94.5**	**3.6**	**8.8**	**3.7**	**13.7**	**25.8**	**30.2**	**2.2**	**0.1**	**256.6**
2013	**6.2**	**22.1**	**17.8**	**28.2**	**95.1**	**3.7**	**8.9**	**3.7**	**13.7**	**26.0**	**30.4**	**2.2**	**0.1**	**258.0**
2014	**6.2**	**22.2**	**17.9**	**28.3**	**95.6**	**3.7**	**8.9**	**3.8**	**13.8**	**26.1**	**30.6**	**2.2**	**0.1**	**259.5**
2015	**6.2**	**22.4**	**18.0**	**28.5**	**96.1**	**3.7**	**9.0**	**3.8**	**13.9**	**26.3**	**30.7**	**2.3**	**0.1**	**261.0**
2016	**6.3**	**22.5**	**18.1**	**28.6**	**96.7**	**3.7**	**9.0**	**3.8**	**14.0**	**26.4**	**30.9**	**2.3**	**0.1**	**262.5**
2017	**6.3**	**22.6**	**18.2**	**28.8**	**97.2**	**3.7**	**9.1**	**3.8**	**14.1**	**26.6**	**31.1**	**2.3**	**0.1**	**263.9**
2018	**6.3**	**22.7**	**18.3**	**29.0**	**97.8**	**3.8**	**9.1**	**3.8**	**14.1**	**26.7**	**31.3**	**2.3**	**0.1**	**265.4**
2019	**6.4**	**22.9**	**18.4**	**29.1**	**98.4**	**3.8**	**9.2**	**3.9**	**14.2**	**26.9**	**31.4**	**2.3**	**0.1**	**267.0**
2020	**6.4**	**23.0**	**18.5**	**29.3**	**98.9**	**3.8**	**9.2**	**3.9**	**14.3**	**27.0**	**31.6**	**2.3**	**0.1**	**268.5**

Measure SW-2: Methane Recovery

This measure estimates the reductions resulting from installation of a landfill gas recovery system at the West Central Landfill in order to comply with an adopted ARB regulation described as a discrete early action GHG emissions reduction measure in the AB 32 *Climate Change Scoping Plan.* Two landfills currently accept municipal solid waste (MSW) in Shasta County. The Anderson Landfill already has a landfill gas recovery system in place, and no efficiency upgrades are anticipated at this time. Table B-7 shows the percentage of total waste sent to each landfill that is attributed to Anderson. It also shows the baseline and mitigated methane capture rate scenarios upon which emissions reductions were calculated.

This measure would apply to GHG emissions associated with new waste generated and waste-in-place disposed prior to GGRP implementation.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	West Central Landfill achieves a methane control efficiency of 75%.	3,319 MT CO_2e/yr	*CalRecycle Waste Characterization Data, 2011* *IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5 Chapter 3.*

Table B-7
Waste Contributions per Landfill and Methane Capture Rates

Landfill	Proportion of Total Refuse Received at Landfill from City of Anderson	BAU Scenario – Methane Capture Rates	Mitigated Scenario – Methane Capture Rates
West Central Landfill	5.00%	0%	75%
Anderson Landfill	2.00%	80%	80%
Benton Landfill	0.00%	90%	90%

Source: Ascent Environmental, 2012

Measure T-1: Mixed Use Development

Research demonstrates that households located in areas of mixed use development including commercial retail, employment, and schools generate lower amounts of vehicle miles traveled than households located in single use residential areas. The City of Anderson estimates that 70% of all new residential units will be developed in mixed-use development areas within the City. It is estimated that the households located in these mixed use development areas will generate 5% less VMT than business-as-usual development in the City. See Table B-8 for calculations and assumptions used to quantify VMT reductions.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	70% of all new residential units constructed in mixed-use development.	821 MT CO2e/yr	*Housing Unit Assumptions: Shasta County Forecast Assumptions, Dowling Associates, 2011* *Percent Mixed Use: City of Shasta Lake, 2011* *VMT Reduction Estimate: Travel and the Built Environment, Ewing and Cervero, 2001*

Table B-8
Mixed Use Development VMT Reductions

	Community Vehicle Miles Traveled (miles)	Fuel Consumption (gallons)
Total New Development BAU VMT - 2020		
Gasoline	25,680,339	1,344,520
Diesel	2,695,726	421,207
Total	**28,376,065**	**1,765,728**
New Mixed Use Development VMT - 2020		
Gasoline	24,396,322	1,277,294
Diesel	2,560,940	400,147
Total	**26,957,262**	**1,677,441**
VMT Reductions from Mixed Use Development		
Gasoline	1,284,017	67,226
Diesel	134,786	21,060
Total	**1,418,803**	**88,286**
Building Inventory and Reduction Assumptions		**2020**
Total New Units		775
New Mixed Used Units (70% of total)		543
VMT Reduction Potential from Mixed Use Development		5%

Note: Assumes average fuel efficiency of 19.1 miles/gallon for gasoline vehicles and 6.4 miles/gallon for diesel vehicles

Measure T-2: Bicycle Lane Expansion

This measure quantifies reductions resulting from increasing Anderson's bicycle mode share through expansion of its bicycle infrastructure, primarily Class I and II bicycle facilities. This measure assumes the construction of 20.0 miles of new Class I and II facilities by 2020. Emissions reductions come from VMT differences between a BAU scenario and a mitigated scenario (see Table B-9). The CAPCOA methodology was used to help quantify VMT reductions based on the proposed bicycle infrastructure improvements. A mode share study conducted by Dill and Carr was used to help define assumptions regarding how additional bicycle lanes translate into increased bicycle mode share (see Table B-10). The methodology assumes that the ratio of additional bicycle lane mileage per community area correlates to increased bicycle mode share, above levels reported in the 2010 US Census.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	20 new miles of Class I and II bicycles lanes constructed.	23 MT CO_2e/yr	*CAPCOA. Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emissions Reductions from Greenhouse Gas Mitigation Measures. August, 2010.* *Dill, J and Carr, T. Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them. 2003.*

Table B-9 Communitywide VMT Reductions – Bicycle Infrastructure Improvements		
BAU Scenario – Vehicles Miles Traveled		
	Community Travel (miles)	Fuel Consumption (gallons)
Gasoline	190,022,893	9,948,843
Diesel	19,947,154	3,116,743
Total	209,970,047	13,065,585
Mitigated Scenario – Vehicles Miles Traveled		
	Community Travel (miles)	Fuel Consumption (gallons)
Gasoline	189,987,595	9,946,994
Diesel	19,943,449	3,116,164
Total	209,931,044	13,063,158
BAU minus Mitigated Scenario		
	Community Travel (miles)	Fuel Consumption (gallons)
Gasoline	35,298	1,848
Diesel	3,705	579
Total	**39,003**	**2,427**

Table B-10 Bicycle Infrastructure Assumptions	
Land Area of Community (sq miles)	6.4
Existing Scenario	
Bike Lanes (Class I and II)	10
Bike Lanes/sq mile	1.56
Mitigated Scenario	
Bike Lanes (Class I and II)	20
Bike Lanes/sq mile	3.13
% Increase in Bicycle Commute Mode Share for each Additional Mile of Bike Lane/sq mile	1.0%
Mitigated Bicycle Commute Mode Share	1.6%

Measure T-3: Pedestrian Environment Enhancements

This measure quantifies reductions resulting from pedestrian enhancements based on the EPA's Smart Growth INDEX (SGI) model, and uses a variety of indicators to measure changes in the pedestrian environment, including: sidewalk availability, ease of street crossing, connectivity of street/sidewalk system, terrain, and the pedestrian environment factor. This measure assumes that 50% of intersections within the city are improved to facilitate greater pedestrian crossing and that additional sidewalks are added to improve pedestrian circulation options. Emissions reductions come from VMT differences between a BAU scenario and a mitigated scenario. The SGI model was used to help develop VMT reduction assumptions based on the proposed changes in the measure. Table B-11 shows the VMT reduction assumptions, and Table B-12 shows the VMT reduction calculations for this measure.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	Improve pedestrian infrastructure and conditions in 50% of streets in the community.	781 MT CO_2e/yr	*EPA Pedestrian Smart Growth INDEX model*

Table B-11
Application of Pedestrian Environment Factor Elasticities to VMT

Pedestrian Environment Factors (PEF)	Baseline	Mitigated
Sidewalk Availability	2.0	3.0
Ease of Street Crossing	2.0	2.5
Connectivity of Street/Sidewalk System	2.0	2.0
Terrain	1.0	1.0
PEF Score	**7.0**	**8.5**
Percent Change in PEF	-	0.214
Smart Growth INDEX PEF Elasticity	-	-0.03
Percent Change in VMT	-	-0.0064
Percent of Community Retrofitted		100%

Source: EPA Pedestrian Smart Growth INDEX model, adapted by AECOM, 2012

Table B-12 Communitywide VMT Reductions – Pedestrian Environment Improvements		
	Community Travel (miles)	**Fuel Consumption (gallons)**
BAU Vehicles Miles Traveled Scenario		
Gasoline	190,022,893	9,948,843
Diesel	19,947,154	3,116,743
Total	209,970,047	13,065,585
Mitigated Vehicles Miles Traveled Scenario		
Gasoline	188,801,317	9,884,886
Diesel	19,818,923	3,096,707
Total	208,620,240	12,981,592
VMT and Fuel Reduction from Measure		
Gasoline	610,788	31,978
Diesel	64,116	10,018
Total	**674,904**	**41,997**

Measure T-4: Commute Trip Reduction

This measure estimates the impact of transportation demand management programs in Anderson, based on the assembled research. The estimated vehicle trip reductions apply to commute trips for employees of those businesses covered by the TDM program.

Rideshare promotion – A study conducted by Reid Ewing concluded that ridesharing programs can reduce daily vehicle commute trips to specific worksites by 5-15%, and up to 20% or more if implemented with parking pricing. In this measure we assume 3% of commute trips shifted from SOV to other modes.

Telecommuting/alternative work schedule – A Center for Urban Transportation Research survey found vehicle trips reduced by up to 8% if 50% of employees are participating in alternative work programs, making it among the most effective commute trip reduction strategies considered in that study. A National Association of Regional Councils analysis estimates that compressed work weeks can reduce up to 0.6% of VMT and up to 0.5% of vehicle trips in a region. In this measure we assume telecommuting/compressed work will result in 3% of commute trips shifted from SOV to other modes.

Subsidized transit fares – Various studies of the impact of subsidized transit passes indicate reductions in drive-alone mode share of 4% to 42%, with an average reduction of 19%. For Anderson we estimate that a likely percent reduction in vehicle trips from transit pass subsidies would be 6% for those businesses offering passes.

Table B-13 shows calculations and assumptions used to quantify reductions from this measure.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	10% of employees in Anderson commute via carpool or public transit	20 MT CO_2e/yr	*VMT reduction assumptions: AECOM, 2012.*

Table B-13
TDM Measure Calculations and Assumptions

Percent Reduction in VMT from Implementation of TDM Measures

	VMT Split by Vehicle Fuel Type		Reduction in Total VMT by Vehicle Fuel Type	
	Gasoline	Diesel	Gasoline	Diesel
Reduction in Total VMT	90.5%	9.5%	0.03%	0.003%

2020 Mitigated Scenario – Vehicle Miles Traveled and Emissions

	Community Travel (miles)	Weighted Average Fuel Efficiency (mi/gal)	Fuel Consumption (gallons)	Emission Factors			Total Emissions (MT CO_2e/Year)
				CO_2 (g/gal)	N_2O (g/mi)	CH_4 (g/mi)	
Gasoline VMT (miles)	85,510,406	19.1	4,476,985	8,599	0.0700	0.0620	40,391
Diesel VMT (miles)	8,976,231	6.4	1,402,536	10,092	0.0500	0.0420	14,296
Total	**94,486,637**		**5,879,521**				**54,686**

Calculation of VMT, Fuel Consumption, and GHG Emission Reduction from TDM Measures

	Community Travel (miles)	Fuel Consumption (gallons)	Total Emissions (MT CO2e/Year)
Gasoline VMT (miles)	30,807.6	1,613	14.6
Diesel VMT (miles)	3,233.9	505	5.2
Total	**34,042**	**2,118**	**19.7**

Measure GI-1: Urban Forest

This measure is based on extrapolating the carbon potential of a typical tree planting palette. The City's goal is that 512 new trees will be planted by public and private development by 2020. Carbon sequestration rates specific to the species and age of the planted trees were collected from the Center for Urban Forest Research (CUFR) Tree Carbon Calculator and used to calculate the annual sequestration potential of the trees from 2008 – 2020. For purposes of the calculation it was assumed that an equal number of trees will be planted each year between 2008 and 2020. See Tables B-14 and B-15 for carbon sequestration assumptions used in this measure.

Year	Progress Indicators	GHG Reduction (MT CO_2e/yr)	Sources
2020	512 new shade trees are planted	50 MT CO_2e/yr	The Center for Urban Forest Research (CUFR) Tree Carbon Calculator.

Table B-14
Carbon Sequestration of Trees Planted 2012-2020 in 2020

Year	Trees Planted per Year	Years of Growth	GHG Emissions Reductions (lbs CO_2e in 2020)	Carbon Sequestration (MT CO_2e in 2020)
2012	64	0	25,759	11.7
2013	64	1	21,566	9.8
2014	64	2	17,664	8.0
2015	64	3	14,028	6.4
2016	64	4	10,632	4.8
2017	64	5	7,458	3.4
2018	64	6	4,486	2.0
2019	64	7	2,036	0.9
Cumulative Total in 2020	**512**	NA	103,629	47.0

Note: Assumes age of tree at planting = 4 years

Table B-15
Carbon Sequestration per Species per Year of growth

Species	**Camphor Tree** *Cinnamomum camphora*		**Modesto Ash** *Fraxinus vlutina*		**Sweetgum** *Liquidambar styraciflua*		**Roble Negro** *Quercus ilex*		**Turkish Pine** *Pinus brutia*		***AVERAGE***	
Age	**per year**	**Total**	**per year**	**Total**	**per year**	**Total**	**per year**	**Total**	**per year**	**Total**	**per year**	**Total**
	20%		**20%**		**20%**		**20%**		**20%**			
1	**0.6**	0.6	**1.5**	1.5	**0.2**	0.2	**0.0**	0.0	**0.6**	0.6	0.3	0.6
2	**0.6**	1.2	**13.7**	15.2	**0.2**	0.4	**0.5**	0.5	**0.6**	1.2	1.4	3.7
3	**2.6**	3.8	**30.0**	45.2	**0.2**	0.6	**3.1**	3.6	**4.9**	6.1	3.7	11.9
4	**6.0**	9.8	**43.7**	88.9	**0.7**	1.3	**8.0**	11.6	**12.3**	18.4	6.4	26.0
5	**10.3**	20.1	**54.3**	143.2	**1.7**	3.0	**14.3**	25.9	**21.5**	39.9	9.3	46.4
6	**13.1**	33.2	**58.6**	201.8	**2.5**	5.5	**18.3**	44.2	**27.5**	67.4	10.9	70.4
7	**16.6**	49.8	**63.2**	265.0	**3.7**	9.2	**23.5**	67.7	**35.1**	102.4	12.9	98.8
8	**21.2**	71.0	**68.2**	333.2	**5.4**	14.5	**30.1**	97.9	**44.8**	147.2	15.4	132.8
9	**26.9**	97.9	**73.6**	406.8	**7.9**	22.4	**38.6**	136.5	**57.2**	204.3	18.6	173.6
10	**34.2**	132.1	**79.4**	486.2	**11.6**	34.0	**49.5**	186.0	**73.0**	277.3	22.5	223.1
11	**37.6**	169.7	**80.7**	566.9	**13.7**	47.7	**54.2**	240.2	**78.4**	355.7	24.0	276.0
12	**41.3**	211.0	**81.9**	648.8	**16.1**	63.8	**59.4**	299.6	**84.1**	439.9	25.7	332.6

Source: Center for Urban Forest Research, CUFR Model, USDA, 2008

Statewide Measures Reductions

For climate action planning purposes, baseline GHG emissions are projected under a business-as-usual scenario to a future year, assuming that conditions and consumption rates occurring in the baseline year would continue. However, even without local climate action planning, statewide measures and regulations would affect future business-as-usual GHG emissions.

Estimates of the local effect of statewide reduction measures should be conservative to avoid overestimating GHG reductions. In many cases, the regulation may not have the same effectiveness at a particular local level as it does on a statewide level. Furthermore, some regulations that affect certain industries or practices may occur more frequently in one jurisdiction than another and therefore various levels of statewide reductions would be anticipated in each jurisdiction. Therefore, AECOM has selected the following statewide reduction measures that would create reasonably foreseeable emissions reductions attributable to Shasta Lake at a local level.

Renewable Portfolio Standard

Executive Order S-21-09 established a statewide renewable energy portfolio target of 33% by year 2020. Therefore, California utilities, including PG&E, will increase their renewable portfolio standard (RPS) to at least 33% by year 2020. The GHG reductions associated with the RPS were estimated by evaluating PG&E's RPS increase from baseline year 2008 to year 2020 and 2035. PG&E's year 2008 baseline RPS-eligible electricity sources were determined to be approximately 12%. However, PG&E also maintains other renewable electricity sources that don't qualify for RPS (e.g., large hydroelectric sources); however, would also not generate GHG emissions. These non-RPS eligible sources account for approximately 20% of PG&E's year 2008 baseline electricity portfolio. Therefore, the anticipated change from baseline year 2008 to year 2020 is a 21% increase in RPS sources (i.e., 33% - 12% = 21%). Assuming that PG&E will only focus on RPS-eligible sources, year 2020 renewable portfolio would be approximately 53% (i.e., 33% RPS + 20% non-RPS = 53%). Although it is likely that PG&E would add additional RPS and non-RPS sources between 2020 and 2035, or that new regulations would require an increase in RPS sources, for a conservative analysis, the projections assume the 33% RPS and 20% non-RPS eligible renewable sources remained constant between 2020 and 2035. Table B-16 presents calculations used to estimate GHG emission reductions associated with the RPS.

Table B-16 Communitywide Renewable Portfolio Standard Calculations		
Parameter	**2020**	**2035**
Total Business-As-Usual Electricity Emissions (MT CO2e/yr)	15,389	18,235
Business-As-Usual RPS [1]	12%	12%
Target RPS	33%	33%
Additional RPS Percent Increase	21%	21%
Total Renewable, Non-Carbon Electricity Sources	53%	53%
Total Electricity Emissions with RPS Target (MT CO2e/yr) (Electricity BAU × (1-Additional RPS))	10,636	12,604
Emission Reduction (MT CO2e/yr)	4,752	5,632

Notes: MT CO2e/yr = metric tons of carbon dioxide equivalent per year; BAU = business as usual; RPS = renewable portfolio standard

[1] Business-as-usual renewable portfolio standard (RPS) (year 2008) and non-RPS eligible resources were obtained from Pacific Gas and Electric.

Source: AECOM 2012

Scoping Plan Transportation Measures

The AB 32 Climate Change Scoping Plan (Scoping Plan) has established several statewide measures that will contribute to California achieving its GHG reduction goal. Several statewide measures would affect the transportation-related business-as-usual emissions. In order to account for GHG reductions associated with Pavley I and the Low Carbon Fuel Standard (LCFS), the ARB-approved Pavley I and Low Carbon Fuel Standard Postprocessor Version 1.0 was used to estimate reductions from EMFAC2007 outputs (ARB 2010b). Table B-17 presents GHG emission reductions associated with Pavley I and the LCFS transportation measures.

The AB 32 Scoping Plan includes other transportation measures that would reduce motor vehicle emissions on a statewide level, which are not estimated in any ARB-approved models. AECOM has selected Heavy-Duty Vehicle Aerodynamic Efficiency, Light-Duty Vehicle Tire Pressure, and Pavley II as measures that can be reasonably assumed to be implemented and affect transportation emissions within Anderson. To estimate the local effect of these reductions, AECOM divided the anticipated transportation emission reductions associated with the Scoping Plan transportation measures by the ARB-projected 2020 transportation emissions to estimate the percent reduction in transportation emissions attributed to implementation of the Scoping Plan. The percent reduction achieved by these measures from the state's total transportation sector was applied to the City's business-as-usual transportation emissions. This method assumes that the City will achieve the same relative level of transportation emission reductions associated with transportation measures as the Scoping Plan assumes at the statewide level. Table B-18 presents calculations used to estimate GHG emission reductions associated with the Heavy-Duty Vehicle Aerodynamic Efficiency, Light-Duty Vehicle Tire Pressure, and Pavley II transportation measures.

Table B-17
Pavley I and Low Carbon Fuel Standard Emission Reductions

	Preferred Project ($MT CO_2e/yr$)	
Transportation Measure	**2020**	**2035**
Pavley I	35,421	66,274
Low Carbon Fuel Standard	15,173	16,146
Total	**50,594**	**82,420**

Notes: MT CO_2e/yr = metric tons of carbon dioxide equivalents per year.
Source: AECOM 2012, ARB 2010b

Table B-18
Communitywide Scoping Plan Measures Calculations

Energy Source and Year	Statewide Total Emissions (MMT CO_2e/yr) [1]	AB 32 Scoping Plan Reductions (MMT CO_2e/yr) [2]	Percent Reduction	Shasta Lake Total Emissions (MT CO_2e/yr)	Shasta Lake Total Emissions with Reduction Measure (MT CO_2e/yr)	Emission Reductions (MT CO_2e/yr)
Med- and Heavy-Duty Vehicle Efficiency[3]						
2020	168.10	1.4	0.03%	56,520	56,174	346
2035 [4]	168.10	1.4	0.03%	73,953	73,491	462
Pavley II						
2020	168.10	4.0	2.4%	56,520	55,093	1,427
2035 [4]	168.10	4.0	2.4%	73,953	72,105	1,848
Total Reductions						
2020	-	-	-	-	-	19,153 [5]
2035 [4]	-	-	-	-	-	36,012 [5]

Notes: MMT CO_2e/yr = million metric tons of carbon dioxide equivalent per year; MT CO_2e/yr = metric tons of carbon dioxide equivalent per year.

[1] Obtained from the ARB's 2020 projected inventory.

[2] Obtained from ARB's updated AB 32 Scoping Plan implementation schedule.

[3] Combines two AB 32 Scoping Plan action items: Heavy-Duty Vehicle Aerodynamic Efficiency Program and Medium- and Heavy-Duty Vehicle Hybridization Program

[4] ARB has not projected California statewide emissions or emission reductions associated with the AB 32 Scoping Plan out to year 2035. It is anticipated that additional efficiency could increase the measures reductions; however, the same level of reductions was assumed for both 2020 and 2035.

[5] Total reductions equal the sum of emissions reductions from Pavley I and Low Carbon Fuel Standard (see Table B-15) and the transportation measures described and presented above.

Source: AECOM 2012, ARB 2010c, ARB 2011.

2008 and 2013 California Title-24 Standards

Impact of 2008 Title-24

The first step of this analysis estimates the reduction in energy-related emissions (i.e., electricity and natural gas) associated with new buildings constructed from January 2010 through December 2013. This construction is subject to the current (2008) Title 24 energy code and therefore more efficient than buildings constructed under the 2005 Title 24 energy code requirements. Business-as-usual electricity and natural gas consumption levels for residential and non-residential construction were established using the CEC's Residential Appliance Saturation Survey data and the Commercial End Use Survey data for Forecast Climate Zone 3. The California Energy Commission's (CEC) report entitled *Impact Analysis - 2008 Update to the California Energy Efficiency Standards for Residential and Nonresidential Buildings* provides data on the energy savings potential of construction subject to 2008 requirements compared to construction subject to the 2005 baseline requirements. This savings potential was applied to projected levels of residential and non-residential construction for the jurisdiction (see Table B-19).

Table B-19
Impact of 2008 T-24 on Building Energy Use

Residential - Local Climate Zone		
Title-24 Period	**kWH/unit/year**	**therms/unit/year**
T-24 2005 Residential (SFR) Energy Use	7,514	364
T-24 2008 Residential (SFR) Energy Use	7,410	316
% difference	-1.4%	-13.1%

Non-Residential - Local Climate Zone		
Title-24 Period	**kWH/unit/year**	**kBTU/unit/year**
T-24 2005 Residential (SFR) Energy Use	13.64	29.49
T-24 2008 Residential (SFR) Energy Use	13.04	25.45
% difference	-4.4%	-13.7%

Note:
-Used RASS 'SFR' category for residential.
-Used CEUS 'All Commercial' category for non-residential.

Impact of 2013 Title-24

The second step of this analysis estimates the reduction in energy-related emissions (i.e., electricity and natural gas) associated with new buildings constructed from January 2014 forward. The CAPCOA report "*Quantifying Greenhouse Gas Mitigation Measures*" provides a methodology for calculating the reduction in energy-related emissions (i.e., electricity and natural gas) resulting from new construction built to energy efficiency standards above the current (2008) Title 24 energy code. The methodology

calculates the reduction in electricity and natural gas consumption for each percent increase over current Title 24 standards per residential and non-residential building type and climate zone.

Baseline electricity and natural gas consumption levels per residential unit type were identified using CEC's Residential Appliance Saturation Survey data for Forecast Climate Zone 3. Mitigated levels of electricity and natural gas consumption levels per building type were calculated using the CAPCOA methodology. The measure assumes that all new buildings constructed after January 2014 will exceed 2008 Title 24 energy standards by 25%. This assumption was based on the following CEC press release. http://www.energy.ca.gov/title24/2013standards/rulemaking/documents/2013_Building_Energy_Efficiency_Standards_FAQ.pdf

Building Construction Projections

Projections of new residential development were developed from SCTPA traffic model inputs. Projections for new non-residential development were developed by using existing non-residential building area data from the County Assessors database and assuming the SCTPA traffic model employment growth rate to estimate growth in non-residential building stock.