

APPENDIX B – GHG CALCULATIONS

GHG EMISSIONS REDUCTION SUMMARY			
Town of San Anselmo Climate Action Plan 2030			
	Measure	2020 GHG Emissions Reductions (MTCO ₂ e/yr)	2030 GHG Emissions Reductions (MTCO ₂ e/yr)
Local Actions			
T-1	Zero Emission Vehicles	-468	-5,242
T-2	Bicycling	-34	-192
T-2a	Bicycle Racks & Lockers	-8	-20
T-3	Walking	-15	-30
T-4	Safe Routes to School	-85	-86
T-5	Public Transit	-135	-182
T-6	Employee Trip Reduction	-36	-50
T-7	Parking Requirements	0	-27
T-10	Electric Landscape Equipment	-6	-24
T-11	Low Emission Town Vehicles	-1	-13
T-12	Low Carbon Fuels	0	-1
T-13	Town Employee Commute	-4	-4
E-1	Energy Efficiency Programs	-775	-3,077
E-2	Energy Audits	0	-77
E-3	Cool Pavement and Roofs	0	-34
E-4	Green Building Reach Code	-6	-27
E-6	Streetlights	n/a	n/a
E-7	Energy Efficiency Audit and Retrofits	n/a	-19
E-8	Energy Conservation	-3	-3
R-1	Renewable Energy Generation	-325	-1,686
R-2	GHG-Free Electricity	-3,111	-2,558
R-3	Building and Appliance Electrification	-5	-46
R-5	Solar Energy Systems for Municipal Buildings	n/a	n/a
W-1	Commercial Organic Waste	-140	-216
W-2	Residential Organic Waste	-50	-508
W-3	C&D and Self-Haul Waste	-19	-29
W-4	Mandatory Waste Diversion	-94	-664
W-5	Waste Processing Infrastructure	0	-581
W-8	Public Waste Facilities	-18	-27
W-9	Waste from Town Operations	-39	-58
C-1	Community Water Use	-160	-164
C-2	Municipal Water Use	n/a	n/a
TOTAL - LOCAL ACTIONS		-5,537	-15,648

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State Actions		
RPS	-128	-427
TITLE 24	-24	-351
Lighting Efficiency (AB 1109)	-143	-143
Residential Solar Water Heaters	-7	-7
Light and Heavy Duty Fleet Regulations	-2,631	-8,206
TOTAL - STATE ACTIONS	-2,933	-9,134
Projected Emissions		
Projected BAU Community GHG Emissions	60,624	62,128
Emissions Reduction from Local and State Actions	-8,469	-24,782
Projected Community Emissions with Local and State Actions Implemented	52,155	37,346
Reduction from 2005 Baseline Emissions		
2005 Community GHG Emissions	80,425	80,425
Community Emissions with Local and State Actions Implemented	52,155	37,346
% Reduction from 2005 Emissions	35%	54%
GHG Target to Meet State Goals	68,361	41,017
% Below 1990 Levels	24%	45%
Emissions per Service Population	3.22	2.26

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ZERO EMISSION VEHICLES	
T-1	
<p>Reductions (MTCO₂e)</p> <p style="text-align: right;">-468</p> <p style="text-align: right;">-5,242</p>	<p>2020</p> <p>2030</p>
<p>Targets</p>	<p>3,000 ZEVs registered in San Anselmo in 2030. 162 public charging station at public and private sites by 2030. 25% of passenger vehicles in Marin are ZEVs in 2030 (approximately 50,108 ZEVs). 20% annual growth rate of registered ZEVs in Marin.</p>
<p>Methodology and Assumptions</p>	<p>Marin has approximately 1.5% of all ZEV rebates in California and 198,000 automobiles registered in the County. CARB's proposed strategy is to put 4.2 million ZEVs on the road by 2030, which is approximately 14% of light duty vehicles in California in 2030. In January 2018, Governor Jerry Brown issued Executive Order B-48-18 set a new goal of having a total of 5 million ZEVs in California in 2030.</p> <p>There were 2,795 Clean Vehicle Rebate Project (CVRP) rebates issued to Marin residents through 2016. CARB estimates 69% of eligible Marin vehicle owners participated in the program between Marin 2010 and March 2015. Therefore, we assume there were 4,050 ZEVs in Marin in 2016 and approximately 2% of registered vehicles in Marin. DMV data shows that there were 6,522 ZEVs registered in Marin and 462 ZEVs registered to San Anselmo residents as of 10/1/18.</p> <p>In 2018, approximately 68% of Clean Vehicle Rebate Project rebates are going to BEVs, 31% are going to PHEVs, and 1% to FCEVs. We assume 69% of EVs are BEVs and 31% are PHEVs in 2020 and 2030.</p> <p>74% of the distance PHEVs drive is electric (Smart et al, 2014).</p> <p>EV kWh/mile is 0.32 (US Dept of Energy).</p> <p>Assuming the same share of ZEV ownership in 2030 as in 2016 (1.5%) means there would be approximately 75,000 ZEVs registered in Marin by 2030, or approximately 37% of existing automobile registrations. We conservatively assume 50,100 ZEVs in Marin in 2030, or 25% of ZEVs registered in Marin. This would require an average annual growth rate of 20%. Electric vehicle sales in California grew by 20% in 2016, followed by 29% growth in 2017 (ICCT, 2018), suggesting that an annual growth rate of 20% is reasonable, especially as the number of models expands and battery technology and charging improves.</p> <p>Passenger VMT is adjusted to reflect the fact that approximately 35% of countywide commute VMT originates from workers who live outside Marin County (TAM). Measure does not apply to VMT generated by San Rafael workers and visitors who do not live in Marin.</p> <p>According to the Department of Energy, towns (population 2,500 to 50,000) need 54 public EV plugs per 1,000 PEVs, which would equal about 2,706 public EV plugs countywide for 50,100 PEVs. The analysis assumes 88% of EV charging is done at home.</p>

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Sources	<p>California Air Resources Board, 2017 Scoping Plan.</p> <p>Smart, J., Bradley, T., and Salisbury, S., "Actual Versus Estimated Utility Factor of a Large Set of Privately Owned Chevrolet Volts," SAE Int. J. Alt. Power. 3(1):2014, doi:10.4271/2014-01-1803.</p> <p>U.S, Department of Energy, Alternative Fuels Data Center, https://www.afdc.energy.gov/vehicles/electric_emissions_sources.html. Sales weighted average of 2016 model year vehicles with sales in 2015: 2015 sales from "U.S. Plug-in Electric Vehicle Sales by Model" (https://www.afdc.energy.gov/data/vehicles.html); MPGs from 2016 Fuel Economy Guide (https://www.fueleconomy.gov/feg/)</p> <p>The International Council on Clean Transportation, "California's continued electric vehicle market development," May 2018, https://www.theicct.org/sites/default/files/publications/CA-cityEV-Briefing-20180507.pdf.</p> <p>Clean Vehicle Rebate Program Rebate Statistics, https://cleanvehiclerebate.org/eng/rebate-statistics, accessed May 1, 2018.</p> <p>Center for Sustainable Energy, "Clean Vehicle Project Participation Rates: The First Five Years (March 201-March2015), October 2015, https://cleanvehiclerebate.org/sites/default/files/attachments/2015-10%20CVRP%20Participation.pdf, accessed May 1, 2018.</p> <p>US Department of Energy, "National Plug-In Electric Vehicle Infrastructure Analysis," September 2017. https://www.nrel.gov/docs/fy17osti/69031.pdf</p> <p>Bay Area Air Quality Management District, Vehicle Miles Dataportal, http://capvmt.us-west-2.elasticbeanstalk.com/, accessed 8/23/18.</p> <p>California Department of Transportation, "California County-Level Economic Forecast 2018-2050," September 2018.</p> <p>California Department of Motor Vehicles, Estimated Vehicles Registered by County for the Period January 1 through Decmber 31, 2018" and "Fuel Type by County as of 10/1/2018."</p> <p>Personal communication with Derek McGill, Planning Manager, Transportation Authority of Marin, dmcgill@tam.ca.gov, August 22, 2018.</p>
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Calculation

	2020	2030
Number of registered Marin ZEVs in 2016	4,050	4,050
Projected number of registered passenger vehicles in Marin	198,831	200,429
Percent of Marin ZEVs in target year	4%	25%
Number of Marin ZEVs in target year	8,500	50,108
Increase in ZEVs	4,450	46,058
Additional ZEVs as a percent of Marin vehicles	2.3%	23.3%
San Anselmo passenger VMT	76,119,312 miles	79,241,684 miles
VMT from non-Marin workers and visitors	11,366,466 miles	11,780,731 miles
San Anselmo passenger VMT from Marin-based vehicles	64,752,846 miles	67,460,953 miles
VMT from additional ZEVs	1,458,449 miles	15,726,508 miles
VMT driven with electricity	1,340,898 miles	14,458,952 miles
Emissions without EV program	531.2 MTCO ₂ e	5,798.1 MTCO ₂ e
Tailpipe emissions reduction with EV program	488.4 MTCO ₂ e	5,330.8 MTCO ₂ e
Electricity used by ZEVs	429,087 kWh	4,626,865 kWh
Electricity emissions from ZEVs	21 MTCO ₂ e	88 MTCO ₂ e
Emissions reduction	468 MTCO ₂ e	5,242 MTCO ₂ e

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BICYCLING T-2					
Reductions (MTCO ₂ e)	<table border="0"> <tr> <td style="text-align: right;">-34</td> <td>2020</td> </tr> <tr> <td style="text-align: right;">-192</td> <td>2030</td> </tr> </table>	-34	2020	-192	2030
-34	2020				
-192	2030				
Targets	<p>0.43 miles of Class II bike lanes constructed by 2020.</p> <p>1.78 miles of Class I bike paths and 0.14 miles of Class II bike lanes constructed between 2020 and 2030.</p>				
Methodology and Assumptions	<p>Studies cited by CAPCOA show each additional mile of bike lanes per square mile increases the share of workers commuting by bicycle by 1% (CAPCOA SDT-5). We have applied this to the following population segments:</p> <ul style="list-style-type: none"> • Live in/work in area • Live in/work out of area • Live in area/non-worker • Live out of area/work in area <p>The Town's draft Bicycle Master Plan identifies 1.78 miles of proposed Class I bike facilities and 0.57 miles of proposed Class II facilities. We assume 0.43 miles for 2020 facilities identified in the Plan as "mid-term") and 2.35 for 2030 (facilities identified as "mid-term" and "long-term").</p>				
Sources	<p>Draft City of San Anselmo Bicycle Master Plan</p> <p>Bay Area Air Quality Management District Vehicle Miles Traveled Dataportal, http://capvmt.us-west-2.elasticbeanstalk.com/data.</p> <p>California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, 2010.</p>				

Calculation

VMT generated by targeted population segments	57,671,670 VMT	60,004,139 VMT
Additional Class I/II facilities	0.4 miles	2.4 miles
New bike facilities/sq. mile	0.2	0.9
Reduction in local VMT	92,533 VMT	526,156 VMT
Emissions reductions	34 MTCO ₂ e	191.6 MTCO ₂ e

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BICYCLE RACKS AND LOCKERS	
<i>T-2a</i>	
Reductions (MTCO ₂ e)	
-8	2020
-20	2030
Targets	10 bike racks (6-bike capacity) installed by 2020. 15 bike racks (6-bike capacity) installed between 2020 and 2030.
Methodology and Assumptions	BAAQMD Transportation Fund for Clean Air guidance indicates reduction based on the following: <ul style="list-style-type: none"> • Capacity of lockers x 2 trips per day • Capacity of cages x 0.75 trips per day • Capacity of racks x 0.5 trips per day (assumed 6 bicycle capacity each) • 240 days of use • 3 miles per trip
Sources	BAAQMD Transportation Fund for Clean Air Guidance FYE 2018.

Calculation

	2020	2030
Number of racks	10	25
Reduction in local VMT	21,600 VMT	54,000 VMT
Emissions reductions	8 MTCO ₂ e	20 MTCO ₂ e

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WALKING T-3	
Reductions (MTCO ₂ e)	
-15	2020
-30	2030
Targets	1% reduction in VMT for vehicle trips that start and end in San Anselmo by 2020 2% reduction in VMT for vehicle trips that start and end in San Anselmo by 2030
Methodology and Assumptions	Studies cited by CAPCOA show pedestrian network improvements can reduce VMT 1-2% (CAPCOA SDT-1). We apply this to passenger vehicle trips that start and end in San Anselmo and assume a 1% reduction for 2020 and 2% for 2030.
Sources	California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, 2010. Bay Area Air Quality Management District Vehicle Miles Traveled Data Portal, http://capvmt.us-west-2.elasticbeanstalk.com/data

Calculation

	2020	2030
Passenger vehicle trips starting and ending in San Anselmo	4,154,532 VMT	4,184,327 VMT
% decrease in VMT due to pedestrian improvements	1.0%	2.0%
Annual decrease in VMT	41,545 VMT	83,687 VMT
GHG emissions reductions	15 MTCO ₂ e	30 MTCO ₂ e

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SAFE ROUTES TO SCHOOL	
<i>T-4</i>	
Reductions (MTCO ₂ e)	
-85	2020
-86	2030
Targets	Reduce school trips in family vehicle by 29%, from an average of 47% to 33%.
Methodology and Assumptions	<p>To demonstrate the benefits of providing Safe Routes to Schools, the Marin County Bicycle Coalition recruited nine pilot schools in four different geographic locations. Initial surveys reported that 62% of the students were arriving by car, with only 14% walking, 7% biking to school, 11% carpool, and 6% arriving by bus. Every school in the pilot program held periodic Walk and Bike to School Days and participated in the Frequent Rider Miles contest, which rewarded children who came to school walking, biking, by carpool or bus.</p> <p>At the end of the pilot program, the participating schools experienced a 57% increase in the number of children walking and biking and a 29% decrease in the number of children arriving alone in a car.</p> <p>We assume an elementary school (K-5) age population of 1,123 with an average trip length of 1.7 mile, a middle school (6-8) population of 696 with an average trip length of 1.7 miles, a high school (9-12) population of 700 with an average trip length of 2.3 miles, 180 school days, and an existing share of school trips completed in a family vehicle of 47% according to Safe Routes to School surveys taken at participating schools serving San Anselmo in Fall 2016.</p>
Sources	<p>US Census Bureau, American Community Survey 5-Year Estimates 2012-2016, Table B14001.</p> <p>Safe Routes to School Marin County, http://www.saferoutestoschools.org/sr2s_ross_valley.html</p> <p>Safe Routes to School Marin County, http://www.saferoutestoschools.org/history.html#success</p>

Calculation

	2020	2030
School population miles travelled	1,707,568 miles	1,737,837 miles
Percent of miles driven in a family vehicle	47 %	47 %
Potential percent decrease in students driving to school	29 %	29 %
VMT avoided	232,741 VMT	236,867 VMT
Emissions reductions	85 MTCO ₂ e	86 MTCO ₂ e

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PUBLIC TRANSIT	
<i>T-5</i>	
Reductions (MTCO ₂ e)	
-135	2020
-182	2030
Targets	100% of Marin Transit buses will use renewable diesel by 2020. 50% of Marin Transit buses will be electric by 2030.
Methodology and Assumptions	Marin Transit reports 2,321,290 miles in FY 16/17. Based on data from Marin Transit, we assign 4.2% of the vehicle miles to San Anselmo. We assume 100% of VMT will be driven by buses using renewable diesel in 2020 and 50% will be driven by electric buses utilizing MCE electricity by 2030.
Sources	Derek McGill, Transportation Authority of Marin Robert Betts, Marin Transit

Calculation

	2020	2030
Transit miles, BAU	2,321,290 miles	2,321,290 miles
San Anselmo's share of passenger revenue miles	96,571 miles	96,571 miles
Average fleet average MPG (diesel)	4.3 MPG	4.3 MPG
Emissions, BAU	229 MTCO ₂ e	229 MTCO ₂ e
Renewable diesel VMT	100%	100%
Electric bus VMT	0%	50%
Emissions	94 MTCO ₂ e	47 MTCO ₂ e
GHG emissions reductions	135 MTCO ₂ e	182 MTCO ₂ e

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EMPLOYEE TRIP REDUCTION	
<i>T-6</i>	
Reductions (MTCO ₂ e)	
-36	2020
-50	2030
Targets	75% of covered employers provide an employee trip reduction program. 100% of covered employers provide an employee trip reduction program.
Methodology and Assumptions	CAPCOA TRT-1 indicates VMT reduction of 5.4% for suburban center location. Employer programs include: carpooling, ride matching, preferential carpool parking, flexible work schedules for carpools, a half-time transportation coordinator, vanpool assistance, bicycle parking, showers, and locker facilities. This measure assumes voluntary employee participation. BAAQMD Transportation Fund for Clean Air guidance indicates a reduction of 0.2% of commute VMT for Guaranteed Ride Home Programs. MTC identifies 17 businesses with 50 or more employees. We assume 75% of these employers participate in the program by 2020 and all participate by 2030. We assume 240 work days per year.
Sources	California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, BAAQMD Transportation Fund for Clean Air Guidance FYE 2018.

Calculation

	2020	2030
Number of employees working in companies with 50 or more employees	852	888
Number of employees targeted for program	639	888
Average daily VMT for San Anselmo worker	11.3	11.6
Estimated annual VMT	1,740,658	2,462,089
VMT reduction	5.6%	5.6%
Annual decrease in VMT	97,477	137,877
GHG emissions reductions	36	50

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PARKING REQUIREMENTS					
<i>T-7</i>					
Reductions (MTCO ₂ e)	<table border="0"> <tr> <td style="text-align: center;">0</td> <td>2020</td> </tr> <tr> <td style="text-align: center;">-27</td> <td>2030</td> </tr> </table>	0	2020	-27	2030
0	2020				
-27	2030				
Targets	50 parking spaces eliminated/avoided by 2030.				
Methodology and Assumptions	<p>CAPCOA Measure PDT-1 indicates a VMT reduction range of 2.5% to 12.5%, depending upon the reduction in parking requirement, with 2.5% for a 5% reduction in parking spaces and 12.5% for a 25% reduction in spaces. We assume a 10% reduction in VMT for a 20% reduction in parking spaces.</p> <p>8.4 miles of daily per capita VMT is allocated to San Anselmo's community emissions in 2030. Consistent with the GHG inventory methodology, we apply a PeMS factor of 354.7 to determine annual VMT.</p>				
Sources	<p>California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, 2010. [1]</p> <p>Bay Area Air Quality Management District, Vehicle Miles Traveled Dataportal, http://capvmt.us-west-2.elasticbeanstalk.com/data, accessed 3/14/19.</p>				

Calculation

	2020	2030
Annual VMT per resident, as attributed in GHG Inventory	2,922 VMT	2,968 VMT
Number of parking spaces subject to program	0 spaces	250 spaces
Number of parking spaces reduced through program	0 spaces	50 spaces
VMT generated by project	0 VMT	742,095 VMT
VMT reduced by program	0 VMT	74,210 VMT
Total emissions reductions	0 MTCO ₂ e	27 MTCO ₂ e

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ELECTRIC LANDSCAPE EQUIPMENT	
<i>T-10</i>	
Reductions (MTCO ₂ e)	
-6	2020
-24	2030
Targets	25% of leaf blowers are electric by 2020. 100% of leaf blowers are electric by 2030.
Methodology and Assumptions	Leaf blowers consumed 52,148 gallons of gasoline and 42 gallons of diesel fuel in Marin County in 2016 (OFFROAD2007). Similar to the off-road emissions inventory, we assume 5.1% of emissions are attributable to San Anselmo based on its share of countywide households in 2016. We assume a 25% reduction for 2020 due to the Town's efforts to encourage use of electric leaf blowers and a 100% reduction in 2030 due to the Town's action to ban all gasoline and diesel-powered leaf blowers by 2030.
Sources	OFFROAD2007

Calculation

	2020	2030
Leaf blower gasoline consumption, BAU	2,685 gallons	2,715 gallons
Leaf blower diesel consumption, BAU	2 gallons	2 gallons
Emissions from leaf blowers, BAU	24 MTCO ₂ e	24 MTCO ₂ e
Emissions reductions	6 MTCO ₂ e	24 MTCO ₂ e

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ZERO AND LOW EMISSION TOWN VEHICLES	
<i>T-11</i>	
Reductions (MTCO ₂ e) -1 -13	2020 2030
Targets	5% improvement in fuel efficiency of Town vehicles that use gasoline by 2020. 50% improvement in fuel efficiency of Town vehicles that use gasoline by 2030.
Methodology and Assumptions	As vehicles are replaced, there will be opportunities to purchase/lease electric vehicles or improve vehicle fuel efficiency with similar models. We assume the Town continues to purchase Deep Green electricity for vehicle charging.
Sources	Town of San Anselmo

Calculation

	2020	2030
Town vehicle fleet tailpipe emissions, 2016 (gasoline)	25 MTCO ₂ e	25 MTCO ₂ e
Fuel efficiency improvement for fleet	5 %	50 %
Emissions reductions	1 MTCO ₂ e	13 MTCO ₂ e

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LOW CARBON FUELS <i>T-12</i>					
Reductions (MTCO ₂ e)	<table border="0"> <tr> <td style="padding-right: 20px;">0</td> <td>2020</td> </tr> <tr> <td>-1</td> <td>2030</td> </tr> </table>	0	2020	-1	2030
0	2020				
-1	2030				
Targets	25% of diesel use is replaced with renewable diesel by 2020. 100% of diesel use is replaced with renewable diesel by 2030.				
Methodology and Assumptions	Emission factor for renewable diesel derived from data from Nexgen Fuel.				
Sources	Town of San Anselmo 2016 Greenhouse Gas Emissions Inventory http://www.nexgenfuel.com/fleets-commercial-use/				

Calculation

	2020	2030
Diesel use, BAU	174 gallons	174 gallons
Renewable diesel percentage	25%	100%
Emissions from diesel fuel	0 MTCO ₂ e	2 MTCO ₂ e
Emissions from renewable diesel fuel	0 MTCO ₂ e	1 MTCO ₂ e
Emissions reductions	0 MTCO ₂ e	1 MTCO ₂ e

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TOWN EMPLOYEE COMMUTE	
<i>T-13</i>	
Reductions (MTCO ₂ e)	
-4	2020
-4	2030
Targets	5.6% reduction in employee commute VMT by 2020.
Methodology and Assumptions	CAPCOA Measure TRT-1. VMT reduction is 5.4% for a suburban center location. BAAQMD Transportation Fund for Clean Air guidance indicates a reduction of 0.2% of commute VMT for Guaranteed Ride Home Programs.
Sources	California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, 2010. BAAQMD Transportation Fund for Clean Air Guidance FYE 2018.

Calculation

	2020	2030
Employee commute VMT, BAU	203,479 VMT	203,479 VMT
Reduction in VMT	5.6%	5.6%
VMT avoided	11,395 VMT	11,395 VMT
Emissions reduction	4 MTCO ₂ e	4 MTCO ₂ e

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ENERGY EFFICIENCY PROGRAMS	
<i>E-1</i>	
Reductions (MTCO ₂ e) -775 -3,077	2020 2030
Targets	Electricity and natural gas consumption is reduced an average of 1% per year between 2016 and 2030.
Methodology and Assumptions	<p>We are forecasting an annual electricity savings of 1% and an annual natural gas savings of 1% based on the following:</p> <p>The National Action Plan for Energy Efficiency states among its key findings "consistently funded, well-designed programs are cutting annual savings for a given program year of 0.15 to 1 percent of energy sales."</p> <p>The American Council for an Energy-Efficiency Economy (ACEE) reports for states already operating substantial energy efficiency programs, energy efficiency goals of one percent, as a percentage of energy sales, is a reasonable level to target.</p> <p>MCE Clean Energy's Implementation Plan states "MCE's goal is to increase annual savings through energy efficiency programs to two percent (combined MCE and PG&E programs) of annualized electric sales...by the end of 2018."</p> <p>Electricity consumption declined an average of 1.1% per year in San Anselmo between 2005 and 2016. Natural gas consumption declined an average of 1.2% per year between 2005 and 2016.</p>
Sources	<p>Marin Clean Energy Revised Community Choice Aggregation Implementation Plan and Statement of Intent, July 18, 2014.</p> <p>National Action Plan for Energy Efficiency, July 2006, Section 6: Energy Efficiency Program Best Practices (pages 5-6).</p> <p>Energy Efficiency Resource Standards: Experience and Recommendations, Steve Nadel, March 2006 ACEEE Report E063 (pages 28-30).</p>

Calculation

	2020	2030
Residential and commercial electricity use, 2016	46,054,540 kWh	46,054,540 kWh
Electricity savings less State actions	797,970 kWh	5,403,424 kWh
Residential and commercial natural gas use, 2016	3,123,612 therms	3,123,612 therms
Natural gas savings	124,944 therms	437,306 therms
GHG emissions reductions	775 MTCO ₂ e	3,077 MTCO ₂ e

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ENERGY AUDITS <i>E-2</i>					
Reductions (MTCO ₂ e)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">0</td> <td style="width: 50%;">2020</td> </tr> <tr> <td style="text-align: center;">-77</td> <td>2030</td> </tr> </table>	0	2020	-77	2030
0	2020				
-77	2030				
Targets	75 housing units implement energy efficiency projects between 2020 and 2030 due to ordinance requiring energy audits at time of sale.				
Methodology and Assumptions	<p>Assumes program will be implemented in 2020 and program will require audits at time of sale but energy efficiency projects will be voluntary. Assumes 5% of audited housing units will implement energy efficiency upgrades based on findings from the City of Berkeley's Building Energy Saving Ordinance. Assume 31% Btu energy use reduction based on demonstrated Energy Upgrade California projects completed in Marin County between June 2010 and May 2012.</p> <p>151 housing units sold annually, based on 2005-2018 average (Marin County Assessor).</p>				
Sources	<p>Marin County Assessor, http://www.marincounty.org/depts/ar/divisions/assessor/sales City of Berkeley, "Building Energy Savings Ordinance (BESO) Findings through Nov. 2016," December 7, 2016, https://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Energy%20Commission%20Presentation%20Berkeley.pdf</p> <p>Marin County Energy Watch Partnership, Dana Armanino, Sustainability Planner, County of Marin, darmanino@marincounty.org</p>				

Calculation

	2030
Average household electricity use 2016	5,636 kWh
Average household natural gas use 2016	481 therms
Number of housing units sold annually	151 units
Number of housing units provided energy audits	1,509 units
Percent of participating housing units	5%
Number of housing units implementing energy efficiency projects	75 units
Electricity reduction	31%
Natural gas reduction	31%
Annual electricity savings	131,854 kWh
Natural gas savings	11,244 therms
Electricity emissions reduction	18 MTCO ₂ e
Natural gas emissions reduction	60 MTCO ₂ e
Total GHG emissions reduction	77 MTCO ₂ e

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COOL PAVEMENT AND ROOFS <i>E-3</i>	
Reductions (MTCO ₂ e)	2020 2030
	0 -34
Targets	10% of paved surfaces converted to high-albedo surfaces by 2030.
Methodology and Assumptions	On average, for metropolitan areas studied, vegetation covers about 29-41% of the area, roofs 19-25%, and paved surfaces 29-39% (Akbari, 2008). For San Anselmo, assumed paved surfaces cover 29%. Assume 10% will be replaced with high albedo content by 2030. Pavement has a potential for a 0.15 to 0.25 increase in albedo (Akbari, 2008); we have conservatively assumed a 0.15 change in albedo. $0.29 * 0.15 * 0.15 =$ Net change of 0.006525 for 2020. - a 10K decrease in temperature for a 0.25 increase in albedo (Akbari) - 10 Kelvin = 10 Celsius - Electricity demand in cities increases by 2–4% for each 1 degree Celsius increase. Assume 3% for San Anselmo.
Sources	Akbari, Hashem and Rose, Leanna Shea, "Urban Surfaces and Heat Island Mitigation Potentials," Journal of the Human-Environmental System, Vol. 11; No. 2: 85-101, 2008.

Calculation

	2020	2035
Percent of city covered in pavement	29%	29%
Percent of paved area with high albedo	0%	10%
Albedo change	0.000	0.004
Temperature decrease	0.000 Celsius	0.174 Celsius
Reduction in electricity use	0 kWh	247,410 kWh
Reduction in emissions	0 MTCO ₂ e	34 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

GREEN BUILDING REACH CODE <i>E-4</i>	
Reductions (MTCO ₂ e) -6 -27	Implementation action: 2020 2030
Targets	Ordinance requiring 15% improvement in energy efficiency over base code adopted beginning with 2019 building code cycle.
Methodology	CAPCOA Measure BE-1 used for estimating building energy savings. Assumed ordinance is adopted in 2020.
Sources	California Air Pollution Control Officers Association, "Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures," August, 2010.

Calculation

Residential	2020	2030
Percent over Title 24 Energy Requirements	15 %	15 %
New construction electricity use, BAU	139,779 kWh	597,440 kWh
New construction electricity use, after Title 24	100,641 kWh	0 kWh
Additional reduction in electricity use	1,110 kWh	0 kWh
New construction natural gas use, BAU	11,920 therms	50,949 therms
New construction natural gas use, after Title 24	8,582 therms	25,474 therms
Additional reduction in natural gas use	1,146 therms	3,400 therms
GHG emissions reductions	6 MTCO ₂ e	18 MTCO ₂ e

Commercial	2020	2030
Percent over Title 24 Energy Requirements	15 %	15 %
New construction electricity use, BAU	0 kWh	671,008 kWh
New construction electricity use, after Title 24	0 kWh	335,504 kWh
Additional reduction in electricity use	0 kWh	13,085 kWh
New construction natural gas use, BAU	0 therms	23,384 therms
New construction natural gas use, after Title 24	0 therms	11,692 therms
Additional reduction in natural gas use	0 therms	1,263 therms
GHG emissions reductions	0 MTCO ₂ e	9 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

STREETLIGHTS <i>E-6</i>	
Reductions (MTCO ₂ e)	n/a 2020 n/a 2030
Targets	Complete conversion of remaining streetlights to LED by 2030.
Methodology and Assumptions	The Town had converted 645 of its 670 streetlights by 2016. The action assumes the Town will convert the remaining, mostly lantern-type, fixtures by 2030. We assume the Town continues to purchase Deep Green electricity for Town facilities.
Sources	Town of San Anselmo Public Works Department

Calculation

Electricity savings	4,778 kWh
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APPENDIX B – GHG CALCULATIONS

ENERGY EFFICIENCY AUDIT AND RETROFITS	
<i>E-7</i>	
Reductions (MTCO ₂ e) n/a -19	2020 2030
Targets	Complete lighting and hot water circulating pump upgrades by 2020 and remaining projects by 2030.
Methodology and Assumptions	Projects to be completed are as follows: 1) Install energy-efficient lighting at Town Hall 2) Install energy-efficiency lighting at Community Center 3) Install energy-efficiency lighting at Corporate Yard 4) Replace hot water circulating pump motor at Community Center 5) Modify radiator at Community Center 6) Replace HVAC system at Town Hall Calculation assumes the Town will continue to purchase Deep Green electricity.
Sources	Marin Energy Management reports for the Town of San Anselmo, June 6, 2007, and August 14, 2008.

Calculation

Project	Annual Electricity Savings (kWh)	Annual Natural Gas Savings (therms)
Lighting - Town Hall	9,821	
Lighting - Community Center	24,472	
Lighting - Corporate Yard	342	
Hot water circulating pump motor - Community Center	241	
Radiator - Community Center		110
HVAC system - Town Hall		3,539
Total savings	34,876	3,649
Emissions reductions (MTCO ₂ e) 2020	n/a	19

APPENDIX B – GHG CALCULATIONS

ENERGY CONSERVATION <i>E-8</i>	
Reductions (MTCO ₂ e)	
-3	2020
-3	2030
Targets	Reduce energy use in municipal buildings by 5%.
Methodology and Assumptions	Energy management software is proven to reduce energy consumption by 10% through identifying inefficiencies within operations. A 5% reduction in energy use for miscellaneous behavioral changes by staff and mechanical operations, and upgrading to Energy Star equipment were assumed.
Sources	San Anselmo 2016 GHG Inventory

Calculation

Electricity consumption in municipal buildings, 2016	339,884 kWh
Electricity use in municipal buildings	44 MTCO ₂ e
Natural gas use in municipal buildings	69 MTCO ₂ e
Percent reduction in energy use	5%
Reduction in electricity consumption	16,994 kWh
GHG emissions reductions	3 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

RENEWABLE ENERGY GENERATION	
<i>R-1</i>	
Reductions (MTCO ₂ e)	
-325	2020
-1,686	2030
Targets	Commercial and solar energy installations grow at an average annual rate of 15% through 2020 and then slows until reaching a 30% market penetration in 2030.
Methodology and Assumptions	<p>According to Project Sunroof, 76% of San Anselmo buildings have roofs that are solar-viable. These 3,600 roofs have the capacity for 40.4 MW DC and could generate 55,800,000 kWh per year, which is more than the total electricity usage in San Anselmo in 2016. Project Sunroof estimates there are 273 existing solar installations in San Anselmo.</p> <p>Calculation assumes annual growth rates of 15% for residential systems and 15% for non-residential systems based on California Distributed Generation Statistics data, which shows countywide growth of 13.2% for residential systems and 19.7% for commercial systems, excluding government facilities. Growth continues at an annual 15% rate and then slows until reaching a 30% market penetration in 2030 (after reaching 20-30% market penetration, studies show that the annual growth rate typically slows until it eventually drops to 4% in a mature market). The estimate of PV to be installed is restricted to installations on existing homes and commercial properties, excluding government facilities.</p>
Sources	<p>Solar Electric Power Association, "Utility Solar Market Snapshot: Sustained Growth in 2014," May 2015, https://www.solarelectricpower.org/media/322918/solar-market-snapshot-2014.pdf</p> <p>Project Sunroof, https://www.google.com/get/sunroof/data-explorer/place/ChIJ2cX8c6yXhYARECyKE9Ek1Q/, accessed March 19, 2019.</p> <p>California Distributed Generation Statistics, "NEM Currently Interconnected Data Set," https://www.californiadgstats.ca.gov/downloads/, January 31, 2018.</p>

Calculation

	2020	2030
Estimated residential PV generation, 2016	2,336,702 kWh	2,336,702 kWh
Annual growth rate	15%	12%
Projected residential PV generation	4,086,906 kWh	11,419,723 kWh
Additional residential PV generation	1,750,204 kWh	9,083,022 kWh
Estimated non-residential PV generation, 2016	817,680 kWh	817,680 kWh
Annual growth rate	15%	12%
Projected non-residential PV generation	1,430,128 kWh	3,996,096 kWh
Additional non-residential PV generation	612,448 kWh	3,178,416 kWh
Additional electricity produced by distributed PV	2,362,652 kWh	12,261,437 kWh
GHG emissions reductions	325 MTCO ₂ e	1,686 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

GHG-FREE ELECTRICITY	
<i>R-2</i>	
Reductions (MTCO ₂ e)	
-3,111	2020
-2,558	2030
Targets	MCE electricity is 94% GHG-free by 2020 and 100% GHG-free by 2030.
Methodology and Assumptions	The MCE 2019 Resource Integration Plan states that MCE electricity is projected to be 94% GHG-free in 2020 and 100% GHG-free by 2022. We have conservatively estimated a future GHG emission factor by assuming the remainder will be system power using the current emission factor set by CARB of 943.57736 lbs CO ₂ /MWh. MCE supplied 73.1% of the total electricity load in San Anselmo in 2016. Assumes same percentage of Deep Green electricity as in 2016.
Sources	MCE 2019 Integrated Resource Plan (November 2018). https://www.mcecleanenergy.org/wp-content/uploads/2019/01/MCE-2019-Integrated-Resource-Plan_11-8-2018_V_12-21-18.pdf Personal communication, Justin Kudo, MCE Manager of Account Services, jkudo@marinenergyauthority.org , July 14 and 15, 2016.

Calculation

	2020	2030
Electricity use, BAU	46,387,388 kWh	47,396,569 kWh
Electricity saved through State actions	869,273 kWh	1,802,217 kWh
Less electricity saved through local energy efficiency and renewable energy actions	3,161,731 kWh	18,057,210 kWh
Net electricity use	42,356,384 kWh	27,537,142 kWh
Projected MCE electricity use (73.1% of total)	30,980,103 kWh	20,141,085 kWh
Electricity emissions w/MCE BAU	3,934 MTCO ₂ e	2,558 MTCO ₂ e
Electricity emissions w/MCE	823 MTCO ₂ e	0 MTCO ₂ e
GHG emission reductions	3,111 MTCO ₂ e	2,558 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

BUILDING AND APPLIANCE ELECTRIFICATION	
<i>R-3</i>	
Reductions (MTCO ₂ e)	2020 2030
	-5 -46
Targets	9 cooktops, 14 water heaters and 28 heating systems are replaced with electric versions by 2030 through a Building Decarbonization incentive program.
Methodology and Assumptions	Potential number of appliance replacements is based on a Marin County grant application for a Building Decarbonization Pilot Program, which proposes to provide cash rebates for natural gas appliance swap-outs. The pilot program application estimates the following number of replacements during the pilot program period: stoves and cooktops, 20; water heaters, 30; and furnaces and heating systems, 60. We assume 5.1% of the replacements will take place in San Anselmo homes based on San Anselmo's share of countywide households. We assume the program can grow at an annual rate of 25% with continued rebates and program implementation.
Sources	2009 California Residential Appliance Saturation Study, Volume 2, Page 23. http://www.energy.ca.gov/2010publications/CEC-200-2010-004/CEC-200-2010-004-V2.PDF County of Marin, Marin County Building Decarbonization Pilot Program for BAAQMD Climate Protection Grant Application, May 8, 2018.

Calculation

	2020	2030
Estimated annual natural gas use for stoves and cooktops	31 therms	31 therms
Estimated annual natural gas use for water heaters	188 therms	188 therms
Estimated annual natural gas use for space heating and cooling	213 therms	213 therms
Estimated annual electricity use for stoves and cooktops	71 kWh	71 kWh
Estimated annual electricity use for water heaters	1,382 kWh	1,382 kWh
Estimated annual electricity use for space heating and cooling	3,096 kWh	3,096 kWh
Number of units stoves and cooktops replaced	1 units	9 units
Number of units water heaters replaced	2 units	14 units
Number of furnaces and heating systems replaced	3 units	28 units
Natural gas savings	971 therms	9,044 therms
Electricity consumption	11,661 kWh	108,598 kWh
GHG emissions reduction	5 MTCO ₂ e	46 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

SOLAR ENERGY SYSTEMS FOR MUNICIPAL BUILDINGS	
<i>R-5</i>	
Reductions (MTCO ₂ e)	
n/a	2020
n/a	2030
Targets	Install 65 KW AC solar energy system on a municipal building by 2030.
Methodology and Assumptions	Town staff indicates that a PV system may be feasible at the Isabel Cook Community Center, particularly if the facility is renovated or rebuilt. We assume a 65 KW AC system as analyzed for the Town's 2011 Climate Action Plan. Calculation assumes the Town will continue to purchase Deep Green electricity for municipal operations.
Sources	Town of San Anselmo Climate Action Plan, April 2011. Application for Renewable Clean Energy Bonds dated July 13, 2007.

Calculation

Projected electricity generated by PV system at Community Center	109,656 kWh
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APPENDIX B – GHG CALCULATIONS

COMMERCIAL ORGANIC WASTE <i>W-1</i>	
Reductions (MTCO ₂ e)	2020 2030
-140 -216	
Targets	Outreach to covered and non-compliant business. 30% are compliant.
Methodology and Assumptions	<p>Passed in 2014, AB 1826 requires businesses to recycle their organic waste, depending on the amount of waste they generate per week. Organic waste means food waste, green waste, landscape and pruning waste, nonhazardous wood waste, and food-soiled paper waste that is mixed in with food waste. The law phases in mandatory recycling of commercial organics over time. In 2017, businesses that generate 4 cubic yards of organic waste per week must arrange for organic waste recycling services and divert all organic waste they produce. In 2019, the law extends to businesses that generate 4 cubic yards or more of commercial solid waste. The State law is intended to reduce statewide disposal of organic waste by 50% by 2020. If that target is not met, the law will be extended to cover businesses that generate 2 cubic yards or more of commercial solid waste.</p> <p>The Town can assist Zero Waste Marin (a.k.a., the Marin Hazardous and Solid Waste Joint Powers Authority) and Marin Sanitary Service by conducting outreach, maintaining a registry of all businesses (including self-haulers) to track compliance with AB 1826, and hiring additional MSS or City dedicated to these efforts.</p> <p>According to CalRecycle, 55% of franchised commercial waste is recoverable for compost and mulch and paper recycling.</p> <p>This measure makes the following assumptions: 35% of landfilled waste is generated by commercial uses; 60% of commercial waste will be subject to AB 1826 by 2020; and 90% of commercial waste will be subject to AB 1826 by 2030. Based on current compliance rates, this measure assumes 30% of all businesses that meet the 2019 threshold will be compliant by 2020 and 30% of all business that meet the post-2020 threshold will be compliant by 2030.</p>
Sources	<p>Personal communication with Kim Schieibly, Marin Sanitary Service, Kim.Scheibly@marinsanitary.com</p> <p>CalRecycle, 2014 Disposal-Facility-Based Characterization of Solid Waste in California: Significant Tables and Figures, https://www2.calrecycle.ca.gov/WasteCharacterization/PubExtracts/2014/SigTableFig.pdf</p>

Calculation

	2020	2030
Commercial waste as a percentage of total landfilled waste	35%	35%
Commercial landfilled waste (excluding self-haul, sludge and municipal waste)	3,443 tons	3,525 tons
Waste generated by covered businesses	2,066 tons	3,173 tons
Recoverable organic waste generated by covered businesses (55%)	1,136 tons	1,745 tons
Percent diverted from landfill	30%	30%
Tons diverted from landfill	341 tons	524 tons
GHG emissions reduction	140 MTCO ₂ e	216 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

RESIDENTIAL ORGANIC WASTE	
<i>W-2</i>	
Reductions (MTCO ₂ e)	
-50	2020
-508	2030
Targets	5% diversion of residential organic waste by 2020 and 50% by 2030.
Methodology and Assumptions	This measure continues and expands activities already occurring, including quarterly mailings by Marin Sanitary Service (MSS), tabling at community events, a marketing campaign by Zero Waste Marin, and community education by Resilient Neighborhoods. Under this measure, the Town will utilize its website, communication tools, and social media to promote these activities and expand their reach, and encourage MSS to increase and expand their outreach through other channels such as on-bill and email response messaging. A 2014 Marin Sanitary Service waste characterization study found that 38% of residential solid waste sent to the landfill was compostable organic waste (30% food scraps, 4% food-soiled paper, and 4% plant debris). MSS reports that 9,589 tons of residential waste was collected in 2015 and estimates that approximately 1% of food waste is currently collected and composted. Curbside collection of food waste has been available in San Anselmo since 2010 with weekly service for co-collection of plant debris and food scraps. Based on MSS's experience, this measure assumes an additional 5% of residential organic waste will be diverted by 2020 due to education and outreach activities. Based on the current residential waste diversion rate of 72%, we assume 50% of residential organic waste can be diverted by 2030.
Sources	Personal communication with Kim Schiebly, Marin Sanitary Service, Kim.Scheibly@marinsanitary.com

Calculation

	2020	2030
Residential waste as a percent of total landfilled waste	65%	65%
Residential landfilled waste (excluding self-haul, sludge and municipal waste)	6,505.3 tons	6,660.4 tons
Compostable organic waste generated by residents	2,472.0 tons	2,531.0 tons
Percent diverted from landfill	5%	50%
Tons diverted from landfill	124 tons	1,265 tons
GHG emissions reduction	50 MTCO ₂ e	508 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

CONSTRUCTION AND DEMOLITION DEBRIS AND SELF-HAUL WASTE	
<i>W-3</i>	
Reductions (MTCO ₂ e)	<p style="text-align: right;">-19 2020</p> <p style="text-align: right;">-29 2030</p>
Targets	50% diversion of C&D waste by 2020 and 75% by 2030.
Methodology and Assumptions	<p>San Anselmo currently complies with the State’s Green Building Code (CALGreen) by requiring development projects to direct all construction and demolition (C&D) materials to a certified facility that diverts at least 65% of nonhazardous C&D debris to recycle or salvage. However, recoverable material is still deposited in the landfill, primarily due to self-haul activity (clean-up and loads that are generated from projects not covered by CALGreen), and C&D loads that contain low percentages of recoverable material. The Town can help to maximize the amount of recoverable material by providing outreach and education to waste generators, and by working with the County and CalRecycle to require processing of all loads for recoverable materials at the landfill or processing facility. MSS already processes all loads, but other facilities may not and/or charge a higher fee to do so, which discourages diversion.</p> <p>According to Zero Waste Marin, 357.96 tons of self-haul and debris box waste originating in San Anselmo was landfilled in 2016. According to statewide solid waste characterizations studies, self-haul waste contains approximately 28% lumber, 3% paper, and 10% green waste, all of which could be diverted from the landfill. The measure assumes that 50% of this waste can be diverted by 2020 and 75% can be diverted by 2030, based on State mandates (SB 1383).</p>
Sources	<p>Personal communication with Garth Schultz, R3 Consulting Group, gschultz@r3cgi.com</p> <p>Personal communication with Judith Silver, Zero Waste Marin, jsilver@marincounty.org</p> <p>CalRecycle, "2014 Disposal-Facility-Based Characterization of Solid Waste in California: Significant Tables and Figures," October 6, 2015.</p>

Calculation

	2020	2030
Self-haul landfilled waste	360.6 tons	368.8 tons
Recoverable organic waste (26.4%)	95.2 tons	97.4 tons
Percent organic material diverted from landfill	50%	75%
Tons diverted from landfill	48 tons	73 tons
GHG emissions reduction	19 MTCO ₂ e	29 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

MANDATORY WASTE DIVERSION	
<i>W-4</i>	
Reductions (MTCO ₂ e) -94 -664	2020 2030
Targets	Increase commercial AB1826 compliance rate to 50% and increase residential organic waste diversion rate to 80% by 2030.
Methodology and Assumptions	<p>This measure assumes San Anselmo will adopt a mandatory waste diversion ordinance similar to the one adopted by the City of Palo Alto in January 2016 (Palo Alto Municipal Code Chapter 5.20). Palo Alto requires all residents, visitors, and businesses to place their discards in the appropriate container – recycle, compost, or garbage. There are four stopes to compliance: 1) subscribe to recycle, compost, and garbage service from the city’s contract hauler; 2) set-up color-coded and labeled containers in convenient locations for patrons, employees, and residents; 3) train and educate tenants, residents, contractors and janitors about how to properly sort their waste and to ensure requirements are met; and 4) sort waste into proper containers. Requirements are phased in over time as follows:</p> <p>April 1, 2016: Commercial customers generating 8 cubic yards or more of garbage per week. Multifamily buildings with 5 or more units and shared service. Food service establishments.</p> <p>January 1, 2017: Commercial customers generating 2 cubic yards or more of garbage per week.</p> <p>January 1, 2018: All commercial customers.</p> <p>Drivers perform regular monitoring of contamination in the solid waste, recycle, and compost containers. The City’s waste hauler’s staff may also perform random site visits. Violators are subject to penalties. Residential compliance is based on the honor system.</p> <p>This measure assumes a similar ordinance would require all commercial accounts and multifamily buildings with 5 or more units to comply by 2020. We assume that a mandatory diversion ordinance could increase the AB 1826 compliance rate to 50% by 2030. Assuming that the ordinance is expanded to require residents to comply, we estimate an overall 80% compliance rate for residential compostable organic waste by 2030.</p>
Sources	City of Palo Alto, http://www.cityofpaloalto.org/gov/depts/pwd/zerowaste/projects/ordinance.asp CalRecycle, "2014 Disposal-Facility-Based Characterization of Solid Waste in California: Significant Tables and Figures," October 6, 2015.

Calculation

	2020	2030
Additional commercial organic waste diverted	227.3 tons	872.6 tons
Additional residential organic waste diverted	0.0 tons	759.3 tons
GHG emissions reduction	94 MTCO ₂ e	664 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

WASTE PROCESSING INFRASTRUCTURE	
<i>W-5</i>	
Reductions (MTCO ₂ e) 0 -581	2020 2030
Targets	Increase diversion rate of recoverable organic waste to 95% by 2030.
Methodology and Assumptions	This measure assumes that new solid waste processing infrastructure is procured by 2030, but not 2020. Waste processing infrastructure could ultimately ensure that 95% of all recoverable organic waste collected by the franchised waste hauler is diverted from the landfill by 2030.
Sources	Personal communication with Kim Schiebly, Marin Sanitary Service, Kim Scheibly, Kim.Scheibly@marinsanitary.com CalRecycle, 2014 Disposal-Facility-Based Characterization of Solid Waste in California: Significant Tables and Figures, https://www2.calrecycle.ca.gov/WasteCharacterization/PubExtracts/2014/SigTableFig.pdf

Calculation

	2020	2030
Landfilled waste, excluding self-haul and sludge	10,525 tons	10,762 tons
Tons diverted by other measures		3,637 tons
Diversion target (95% for 2030)		5,112 tons
Remaining tons to be diverted		1,475 tons
Recoverable organic waste (50% of total)	5,262 tons	5,381 tons
GHG emissions reduction	0 MTCO ₂ e	581 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

WASTE FROM PUBLIC WASTE FACILITIES	
<i>W-8</i>	
Reductions (MTCO ₂ e)	
-18	2020
-27	2030
Target	50% of recoverable organic waste currently landfilled is diverted by 2020 and 75% is diverted by 2030.
Methodology and Assumptions	This measure assumes 50% of recoverable organic waste currently landfilled could be diverted by 2020 and 75% could be diverted by 2030.
Sources	Personal communication with Charlie Wicke, Marin Sanitary Service, Charlie.Wicke@marinsanitary.com

Calculation

	2020	2030
Waste collected in public containers	182 tons	182 tons
Recoverable organic waste (50%)	91 tons	91 tons
Percent of organic waste diverted from landfill	50%	75%
Tons organic waste diverted from landfill	45 tons	68 tons
GHG emissions reduction	18 MTCO ₂ e	27 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

WASTE FROM TOWN OPERATIONS	
<i>W-9</i>	
Reductions (MTCO ₂ e)	
-39	2020
-58	2030
Targets	50% of recoverable organic waste currently landfilled is diverted by 2020 and 75% is diverted by 2030.
Methodology and Assumptions	This measure assumes 50% of recoverable organic waste currently landfilled could be diverted by 2020 and 75% could be diverted by 2030.
Sources	Personal communication with Charlie Wicke, Marin Sanitary Service, Charlie.Wicke@marinsanitary.com

Calculation

	2020	2030
Waste generated by Town operations	395 tons	395 tons
Recoverable organic waste (50%)	197 tons	197 tons
Percent diverted from landfill	50%	75%
Tons organic waste diverted from landfill	99 tons	148 tons
GHG emissions reduction	39 MTCO ₂ e	58 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

COMMUNITY WATER USE C-1					
Reductions (MTCO ₂ e)	<table border="0"> <tr> <td style="padding-right: 20px;">-160</td> <td>2020</td> </tr> <tr> <td>-164</td> <td>2030</td> </tr> </table>	-160	2020	-164	2030
-160	2020				
-164	2030				
Targets	1% annual water consumption reduction.				
Methodology and Assumptions	<p>District-wide Marin Municipal Water District (MMWD) water consumption fell 19.6% between 2005 and 2015, or approximately 2% per year. We conservatively assume water consumption will continue to fall an average of 1% per year based on the following legislation and water conservation programs:</p> <ul style="list-style-type: none"> -The Town has adopted CALGreen Tier 1 for residential buildings, which requires additional water conservation actions above the base code. -MMWD's regulations meet or exceed State law that requires single family homes and commercial and multi-family buildings to replace all non-compliant plumbing fixtures when remodeling and upon resale (resale requirement for commercial and multi-family buildings will be in effect on January 1, 2019). -MMWD provides rebates for water-efficient toilets, clothes washers, hot water recirculation systems, turf replacement, pool covers, mulch, graywater systems, and rain barrels. -MMWD provides residential and commercial building and landscape water audits and free-water saving devices (faucet aerators, showerheads, toilet leak test dye tablets, hose nozzles, etc.). -MMWD provides residential and commercial building and landscape water audits and free-water saving devices (faucet aerators, showerheads, toilet leak test dye tablets, hose nozzles, etc.). -MMWD has adopted a landscape water conservation ordinance which applies to all new construction and rehabilitated landscape projects requiring a building permit, plan check, or design review. Irrigation controllers are required under CALGreen. -New commercial and multi-family construction is required to meet CALGreen code. MMWD requires all plumbing installed, replaced, or moved on any new or existing service to have high efficiency fixtures and meet minimum requirements. -MMWD has adopted a Water Waste Ordinance and requires drinking water and linen washing upon request at restaurants and hotels. -MMWD requires applicants for new water service and applicants requesting an enlarged water service for substantial residential or commercial remodels to install a graywater recycling system to reuse the maximum practicable amount of graywater on site. -MMWD conducts outreach and provides water conservation information to water users on its website. -MMWD provides virtual water-friendly garden tours on its website. 				

APPENDIX B – GHG CALCULATIONS

	<p>GHG reduction calculations are based upon the following:</p> <ul style="list-style-type: none"> -The California Energy Commission estimates that it takes 3,500 kWh of electricity per million gallons to convey, treat and distribute water from the water source to the customer in northern California. -MMWD began purchasing 100% renewable electricity in 2017 and Sonoma County Water agency, which provides approximately 25% of water, began purchasing 100% renewable electricity in 2015. We assume the water agencies will continue this practice.
Sources	<p>Personal communication with Carrie Pollard, Sonoma Marin Water Saving Partnership</p> <p>The Climate Registry for Sonoma County Water Agency emission factors</p> <p>Refining Estimates of Water-Related Energy Use in California, California Energy Commission, Dec. 2006</p>

Calculation

	2020	2030
Water consumption, BAU	516 MG	527 MG
Annual water consumption reduction	1 %	1 %
Potential annual water savings	21 MG	74 MG
Electricity saved	72,215 kWh	258,452 kWh
GHG emissions reduction from water conservation	6 MTCO ₂ e	23 MTCO ₂ e
GHG reduction from 100% renewable electricity	154 MTCO ₂ e	141 MTCO ₂ e
GHG emissions reduction	160 MTCO ₂ e	164 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

MUNICIPAL WATER USE	
C-2	
Reductions (MTCO ₂ e) n/a n/a	2020 2030
Targets	20% reduction in electricity used for irrigation and pumping.
Methodology and Assumptions	We assume electricity used for irrigation and pumping systems will be reduced 20% due to water-efficient landscaping and efficiency upgrades. We assume the Town continues to purchase Deep Green electricity for all municipal operations.
Sources	San Anselmo 2016 Greenhouse Gas Inventory

Calculation

	2020	2030
Electricity used for irrigation and pumps	4,462 kWh	4,462 kWh
Reduction in electricity use (20%)	892 kWh	892 kWh

APPENDIX B – GHG CALCULATIONS

LIGHT AND HEAVY DUTY FLEET REGULATIONS					
<i>State Action</i>					
Program Description	Current federal and State regulations and standards will reduce transportation emissions from the light and heavy duty fleet. These include: <ol style="list-style-type: none"> 1. Pavley Standards which increase fuel economy standards for light-duty vehicles for 2009-2016 model years. 2. Advanced Clean Cars Program which will reduce greenhouse gas and smog emissions for light-duty vehicles sold between 2017 and 2025. New automobiles will emit 34 percent fewer GHG emissions and 75 percent fewer smog-forming emissions. 3. ARB Tractor -Trailer Greenhouse Gas Regulations which accelerate the use of low rolling resistance tires and aerodynamic fairing to reduce GHG emissions in the heavy-duty truck fleet. 4. Heavy Duty GHG Emissions Standards (Phase One) which establish GHG and fuel efficiency standards for medium duty and heavy duty engines and vehicles for 2014-2018 model years. 				
Reductions (MTCO ₂ e)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right; padding-right: 10px;">-2,631</td> <td>2020</td> </tr> <tr> <td style="text-align: right; padding-right: 10px;">-8,206</td> <td>2030</td> </tr> </table>	-2,631	2020	-8,206	2030
-2,631	2020				
-8,206	2030				
Methodology and Assumptions	Anticipated emissions reductions resulting from implementation of these light and heavy duty fleet regulations are modeled in EMFAC2017. In order to be consistent with the methodology used in City's Greenhouse Gas Inventory, results are adjusted to reflect the global warming potential of methane and nitrous oxide as reported in the IPCC Fifth Assessment Report.				
Sources	California Air Resources Board, EMFAC2017 v.1.0.2. California Air Resources Board, EMFAC2014 Volume III - Technical Documentation, v1.0.7, May 12, 2015				

Calculation

	2020	2030
Passenger VMT BAU	76,119,312 VMT	79,241,684 VMT
Passenger VMT, net reductions from other measures	74,281,123 VMT	63,658,542 VMT
Commercial VMT BAU	3,489,383 VMT	3,553,391 VMT
Bus VMT BAU	844,251 VMT	720,054 VMT
Emissions, BAU	32,662 MTCO ₂ e	28,651 MTCO ₂ e
Emissions with regulations	30,031 MTCO ₂ e	20,445 MTCO ₂ e
Reduction in emissions	2,631 MTCO ₂ e	8,206 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

RENEWABLE PORTFOLIO STANDARD <i>State Action</i>	
Program Description	Established in 2002 in Senate Bill 1078, the Renewable Portfolio Standard program requires electricity providers to increase the portion of energy that comes from eligible renewable sources, including solar, wind, small hydroelectric, geothermal, biomass and biowaste, to 20 percent by 2010 and to 33 percent by 2020. Senate Bill 350, passed in September of 2015, increases the renewable requirement to 50 percent by the end of 2030. Senate Bill 100, passed in September 2018, accelerated the RPS standard to 60 percent by 2030 and zero-carbon by 2045.
Reductions (MTCO ₂ e) -128 -427	2020 2030
Methodology and Assumptions	<p>This State Action assumes PG&E and Direct Access entities will meet the Renewable Portfolio Standard requirements and that these entities will carry the same share of the community's electricity load as in 2016. GHG reductions related to MCE's GHG reduction policies are quantified separately as a local action.</p> <p>California Public Utilities Code Section 454.52 requires each load-serving to procure at least 50 percent eligible renewable energy resources by 2030 and to meet the economywide reductions of 40% below 1990 levels by 2030.</p> <p>The CPUC calculator version 3c provides projected emission factors for 2020. For 2030, the CPUC has set electric sector GHG reductions at a level that represents a 50% reduction from 2015 levels. We therefore apply a 50% reduction to PG&E and DA 2015 emission factors to forecast 2030 emission factors.</p>
Sources	<p>GHG Calculator, version 3c_Oct2010. https://ethree.com/public_projects/cpuc2.php</p> <p>PG&E, "Greenhouse Gas Emission Factors: Guidance for PG&E Customers," November 2015, https://www.pge.com/includes/docs/pdfs/shared/environment/calculator/pge_ghg_emission_factor_info_sheet.pdf</p> <p>California Public Utilities Commission "CPUC Adopts Groundbreaking Path to Reduce Greenhouse Gases in Electric Sector," Press Release Docket #: R.16-02-007, Feb. 8, 2018.</p>

Calculation

	2020	2030
Electricity use, BAU	46,387,388 kWh	47,396,569 kWh
Electricity saved through other State actions	869,273 kWh	1,802,217 kWh
Electricity saved through local actions	3,161,731 kWh	18,057,210 kWh
Net electricity use (PG&E)	8,777,956 kWh	5,706,810 kWh
Net electricity use (DA)	2,598,324 kWh	1,689,248 kWh
Electricity emissions, BAU	1,802 MTCO ₂ e	1,171 MTCO ₂ e
Electricity emissions w/RPS	1,673 MTCO ₂ e	745 MTCO ₂ e
GHG emission reductions	128 MTCO ₂ e	427 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

TITLE 24 ENERGY EFFICIENCY STANDARDS <i>State Action</i>					
Program Description	The California Energy Commission (CEC) promotes energy efficiency and conservation by setting the State’s building efficiency standards. Title 24 of the California Code of Regulations consists of regulations that cover the structural, electrical, mechanical, and plumbing system of every building constructed or altered after 1978. The building energy efficiency standards are updated on an approximate three-year cycle, and each cycle imposes increasingly higher demands on energy efficiency and conservation. The California Energy Commission's 2007 Integrated Policy Report established the goal that new building standards achieve "net zero energy" levels by 2020 for residences and by 2030 for commercial buildings.				
Reductions (MTCO ₂ e)	<table style="width: 100%; border: none;"> <tr> <td style="text-align: right; padding-right: 20px;">-24</td> <td>2020</td> </tr> <tr> <td style="text-align: right; padding-right: 20px;">-351</td> <td>2030</td> </tr> </table>	-24	2020	-351	2030
-24	2020				
-351	2030				
Methodology	We assume that residential buildings will be zero net electricity by 2020 and all buildings will be zero net energy by 2030.				
Sources	<p>California Energy Commission, http://www.energy.ca.gov/title24/2013standards/background.html</p> <p>California Energy Commission, http://www.energy.ca.gov/title24/2013standards/rulemaking/documents/2012-5-31-Item-05-Adoption_Hearing_Presentation.pdf</p> <p>California Energy Commission, https://www.lgc.org/wordpress/wp-content/uploads/2016/02/2016-Energy-Standards-Overview-California-Energy-Commission.pdf</p>				

APPENDIX B – GHG CALCULATIONS

Calculation

<i>Reductions from Title 24 Upgrades</i>	2016 Reductions from 2013 Standards (assumed for development after 2017)	Projected average reduction 2020-2030 from 2015 baseline	
	Energy Savings	Electricity Savings	Natural Gas Savings
Residential New Construction	28.00%	100%	50%
Non-residential New Construction	5.00%	50%	50%

Projected Residential Development with Title 24 Energy Reductions

	2017-2020	2021-2030	TOTAL through 2020	GHG Reductions through 2020	TOTAL through 2030	GHG Reductions through 2030
New Residential (units)	25	106	31		137	
Electricity Use BAU	139,779	597,440	139,779		737,219	
Electricity Use Savings	39,138	597,440	39,138	5	636,578	85
Natural Gas Use BAU	11,920	50,949	11,920		62,869	
Natural Gas Use Savings	3,338	25,474	3,338	18	28,812	153

Projected Non-Residential Development with Title 24 Energy Reductions

	2017-2020	2021-2030	TOTAL through 2020	GHG Reductions through 2020	TOTAL through 2030	Reductions through 2030
Electricity Use BAU	39,763	671,008	39,763		710,771	
Electricity Use Savings	1,988	335,504	1,988	0	337,492	51
Natural Gas Use BAU	1,386	23,384	1,386		24,770	
Natural Gas Use Savings	69	11,692	69	0	11,761	63

APPENDIX B – GHG CALCULATIONS

LIGHTING EFFICIENCY					
<i>State Action</i>					
Program Description	AB 1109, the Lighting Efficiency and Toxic Reduction Act, tasks the California Energy Commission (CEC) with reducing lighting energy usage in indoor residences by no less than 50% from 2007 levels by 2018, as well as requires a 25% reduction in indoor and outdoor commercial buildings by the same date. To achieve these efficiency levels, the CEC applies its existing appliance efficiency standards to include lighting products, as well as requires minimum lumen/watt standards for different categories of lighting products. The bill also expands existing incentives for energy efficient lighting.				
Reductions (MTCO ₂ e)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right; padding-right: 10px;">-143</td> <td>2020</td> </tr> <tr> <td style="text-align: right; padding-right: 10px;">-143</td> <td>2030</td> </tr> </table>	-143	2020	-143	2030
-143	2020				
-143	2030				
Methodology and Assumptions	<p>5.2% of nonresidential electricity is used for outdoor lighting (California Energy Commission 2006)</p> <p>28.9% of nonresidential electricity is used for indoor lighting (California Energy Commission 2006)</p> <p>Residences use 1,342 kWh for indoor lighting on average (U.S. Department of Energy 2012)</p> <p>The CEC reports that between 2008 and 2010, interior residential lighting electricity dropped 7%, and commercial interior lighting electricity dropped 13%, and commercial outdoor lighting dropped 6 percent. We assume 1/4 of the remaining goal will be achieved between 2016 and 2018.</p>				
Sources	<p>Itron, Inc., "California Commercial End-Use Survey," California Energy Commission, March 2006, Publication Number: CEC-400-2006-005, p. 186. Accessed March 26, 2015. <http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2010-lmc-final-jan-2012.pdf></p> <p>California Lighting Technology Center at UC Davis for the California Energy Commission, "Achieving Energy-Efficient Lighting in California," Sept. 2015, http://www.energy.ca.gov/2015publications/CEC-500-2015-085/CEC-500-2015-085.pdf</p> <p>Navigant Consulting, Inc., "2010 U.S. Lighting Market Characterization," U.S. Department of Energy, January 2012, p. 42. Accessed March 26, 2015. <http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/2010-lmc-final-jan-2012.pdf></p>				

APPENDIX B – GHG CALCULATIONS

Calculation

	2020	2030
Residential electricity indoor lighting use, 2016	7,446,758 kWh	7,446,758 kWh
Commercial electricity use, 2016	15,940,158 kWh	15,940,158 kWh
Commercial indoor lighting use, 2016	828,888 kWh	828,888 kWh
Commercial outdoor lighting use, 2016	4,606,706 kWh	4,606,706 kWh
Reduction in residential electricity use	800,526 kWh	800,526 kWh
Reduction in commercial indoor lighting use	24,867 kWh	24,867 kWh
Reduction in commercial outdoor lighting use	218,819 kWh	218,819 kWh
GHG emission reductions	143 MTCO ₂ e	143 MTCO ₂ e

APPENDIX B – GHG CALCULATIONS

RESIDENTIAL SOLAR WATER HEATERS <i>State Action</i>					
Program Description	The Residential Solar Water Heater Program (AB 1470) created a \$350 million incentive program to encourage the installation of solar water heating systems that offset natural gas and electricity use in homes and businesses throughout the State. The goal is to install 200,000 solar water heaters by 2017.				
Reductions (MTCO ₂ e)	<table border="0"> <tr> <td style="text-align: right;">-7</td> <td>2020</td> </tr> <tr> <td style="text-align: right;">-7</td> <td>2030</td> </tr> </table>	-7	2020	-7	2030
-7	2020				
-7	2030				
Methodology and Assumptions	<p>Natural gas solar water heaters reduce natural gas use by 130 therms (U.S. Department of Energy 2010)</p> <p>Electric solar water heaters reduce electricity use by 2,429 kWh (U.S. Department of Energy 2010)</p> <p>An average of 0.013 water heaters per home will be replaced as a result of the strategy in 2020 (California Air Resources Board 2008)</p> <p>85% of California homes use natural gas for water heating, 4% use propane/LPG, and 11% use electricity (U.S. Energy Information Administration 2009)</p> <p>The program began in 2010. We assume 2/7ths of the energy savings will occur by 2017.</p>				
Sources	<p>U.S. Department of Energy, "ENERGY STAR Water Heater Market Profile," September 2010, p. 15. Accessed March 27, 2015. <https://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/Water_Heater_Market_Profile_2010.pdf></p> <p>U.S. Energy Information Administration, 2009 Residential Energy Consumption Survey, Table HC8.11, "Water Heating in U.S. Homes in West Region, Division, and States, 2009." Accessed March 26, 2015. <http://www.eia.gov/consumption/residential/data/2009/#undefined></p>				

Calculation

	2020	2030
Number of housing units, 2016	5,549	5,549
Number of solar water heaters installed, 2017	10	10
Percent electric water heaters	11%	0
Percent natural gas water heaters	89%	1
Reduction in electricity use	2,753 kWh	2,753 kWh
Reduction in natural gas use	1,192 therms	1,192 therms
GHG emission reductions	7 MTCO ₂ e	7 MTCO ₂ e