APPENDIX A

CITY OF BURLINGAME 2030 CLIMATE ACTION PLAN UPDATE

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City of Burlingame: Community-wide GHG Inventory (2005)

Original spreadsheet developed by DNV GL under contract with the County of San Mateo
Modifications and updates made by MIG, Inc. in 2019 for the City's 2030 Climate Action Plan Update

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Introduction to the 2005 Community-wide Greenhouse Gas Inventory

This workbook serves to document the calculations associated with the 2005 community-wide greenhouse gas inventory completed for the City of Burlingame. The intial spreadsheet was developed by DNV GL under contract with the County of San Mateo as part of the Regionally Integrated Climate Action Planning Suite (RICAPS). The workbook was updated in 2019 by MIG, Inc. to reflect new data sources and GWPs as part of the City's Climate Action Plan Update. This workbook includes raw data, assumptions, and calculations for each of the following sources of community-wide GHG emissions:

1. Energy - natural gas, electricity, and stationary sources
2. Transportation - on-road vehicles, off-road vehicles, passenger rail, and freight rail)
3. Solid Waste - landfills and waste generation within the community
4. Wastewater treatment
5. Energy associated with Water extraction, treatment, and delivery

Version: August 29, 2019

Contents:

Executive Summary: All GHG Emissions

Overall Emissions Summary: 2005 (MT CO2e)

Jurisdiction	Energy	Transportation	Solid Waste	Wastewater	Water	Total
Burlingame	125,587	118,556	9,333	343	1,376	255,195

Emissions Summary by Sector: 2005 (MT CO2e)

Sector	Source		2005
Energy	Residential Energy	Electricity	14,898
		Natural Gas	32,446
	Commercial/Industrial Energy	Electricity	34,876
		Natural Gas	32,499
	Direct Access	Electricity	10,840
	Stationary Sources	Multiple Fuels	28
Transportation	On-Road Vehicle Travel		102,768
	Off-Road Equipment (Residential)	Off-Road Equipment (Residential)	15,788
Solid Waste	Solid Waste Disposal	Landfilled Waste	8,526
		ADC	454
	Solid Waste Landfills	Landfills	354
Wastewater	Wastewater Treatment		343
Water	Water Use		1,376
		Annual Emissions Total	**255,195**

GHG Reduction Targets

2020 Target (1990 levels are considered to be 15% below 2005 levels)	2030 Target (40% below 1990 levels)	2040 Target (60% below 1990 levels)	2050 Target (80% below 1990 levels)
216,916.03	130,149.62	86,766.41	43,383.21

Summary: Energy Emissions

Summary of Methodology Used

This worksheet shows a summary of the emissions from electricity and natural gas usage. The emissions from electricity and natural gas were calculated based on guidance in the Community GHG Protocol, Appendix C: Built Environment Activities and Sources. Emissions from stationary combustion of natural gas were calculated based on method BE1.1, and emissions from electricity were calculated based on method BE.2.2. Emission factors are explained on the worksheets called "Other Energy Emission Factors" and "PG&E Emission Factors".

Table 2-1: Summary of Electricity and Natural Gas Emissions (PG&E and Direct Access)

Jurisdiction	PG&E Residential Electricity Emissions (MT CO2e)	PG&E Non-Residential Electricity Emissions (MT CO2e)	Direct Access Electricity Emissions (MT CO2e)	Residential Natural Gas Emissions (MT CO2e)	Non-residential Natural Gas Emissions (MT CO2e)
Burlingame	14,898	34,876	10,840	32,446	32,499

Table 2-2: Electricity Emission Factors

Electricity Type	CO2 Emission Factor (lbs/kWh)	CH4 Emission Factor (lbs/GWh)	N2O Emission Factor (lbs/GWh)
PG&E Electricity	0.4890	32.63	10.89
Direct Access Electricity	0.821	32.63	10.89

Table 2-3: Natural Gas Emission Factors

CO2 Emission Factor (kg/MMBtu)	CH4 Emission Factor (kg/MMBtu)	N2O Emission Factor (kg/MMBtu)
53.02000	0.00500	0.00010

Table 2-4: IPCC AR5 Global Warming Potentials

CO2	CH4	N2O
1	28	265

Table 2-5: Universal Conversion Factors

MT / lb.	0.00045
GWh / kWh	0.0000010
MMBTU / therm	10.00
MT / kg	0.0010

Summary: Electricity and Natural Gas Use Data

Summary of Methodology Used

The following table shows the summary of electricity and natural gas consumption from utility-supplied energy (provided by PG&E), as well as Direct Access electricity that was not purchased from PG&E. The total Direct Access electricity consumption in the County was provided by the California Energy Commission. Total countywide PG&E-supplied non-residential electricity was added to total county-wide Direct Access electricity to determine total countywide electricity consumption in the commercial and industrial sectors. Next, a ratio of Direct Access electricity to total PG&E-supplied non-residential electricity was found. This ratio was used to estimate total Direct Access electricity for each jurisdiction. See the worksheet called "Energy - Direct Access" for the Direct Access calculations. Also, according to PG&E representatives, all natural gas usage, regardless of whether it was purchased from PG&E or not, is included in the PG&E totals for natural gas.

Table 3-1: Summary of Electricity and Natural Gas Use (PG&E and Direct Access)

Jurisdiction	PG&E Total Electricity Use (kWh)	PG&E Residential Electricity Use (kWh)	PG&E Non-residential Electricity Use (kWh)	Direct Access Electricity Use (kWh)	PG&E Total Natural Gas Use (Therms)	PG&E Residential Natural Gas Use (Therms)	PG&E Non-residential Natural Gas Use (Therms)
Burlingame	222,673,587	66,649,820	156,023,767	28,974,808	12,210,816	6,100,373	6,110,443

Direct Access Electricity Usage

Summary of Methodology Used

This worksheet was used to estimate the consumption of Direct Access electricity in each jurisdiction in San Mateo County. The total county-wide PG&E electricity use in the non-residential sector and total Direct Access electricity consumption in the County, provided by the California Energy Commission, was used in these calculations. The PG&E non-residential data does not include Direct Access customers. Jurisdiction-specific data are not available from the California Energy Commission. As a result, county-wide data was used to estimate jurisdiction-specific Direct Access electricity consumption. Total county-wide PG&E-supplied non-residential electricity use was added to total county-wide Direct Access electricity use to determine total county-wide electricity use in the non-residential sector. Next, a ratio of Direct Access electricity to total PG&E-supplied commercial/industrial electricity was calculated. This ratio was used to estimate total Direct Access electricity for each jurisdiction.

Table 4-1: Summary of County Electricity Use: PG&E vs. Direct Access

County	Sector	Year	PG&E		Direct Access		Total
			Electricity Use (Million kWh)	Percent of Total Utility Electricity Use	Electricity Use (Million kWh)	Percent of Total Utility Electricity Use	Electricity Use (Million kWh)
San Mateo County	Residential	2005	1,396,351.00	34.69%	-		1,396,351
San Mateo County	Non-Residential	2005	2,629,450.00	65.31%	488,309.00	100.00%	3,117,759
Electricity Use (Million kWh):			4,025,801.0		488,309.0		4,514,110
Percent of Total Utility + Direct Access Electricity Use:			89.2%		10.8%		100%
Percent of Residential Utility + Direct Access Electricity Use:			100%		0%		100%
Percent of Non-residential Utility + Direct Access Electricity Use:			84.34%		15.66%		100%

Total Direct Access electricity consumption for San Mateo County was estimated at 488,309 kWh and was provided by the California Energy Commission.
Contact: Steven Mac, Steven.Mac@energy.ca.gov

Table 4-2: Calculating Ratio of Direct Access Electricity: PG&E Non-residential Electricity at County Level

Sector	PG&E Electricity Use (Million kWh)	Ratio of Direct Access Electricity: PG&E Non-residential Electricity	Estimated Direct Access Electricity Use (Million kWh)
Residential	1,396,351	-	-
Non-Residential	2,629,450	18.57%	488,309

Table 4-3: Direct Access Electricity Use at City Level		
Jurisdiction	**Annual Commercial and Industrial kWh from PG&E**	**Annual Direct Access kWh**
Burlingame	156,023,767	28,974,808

Additional Electricity Emission Factors

Summary of Methodology Used

Electricity emission factors for CH_4 and N_2O emissions from all electricity, and for CO_2 from Direct Access electricity are calculated on this worksheet. This methodology uses the total electricity-related GHG emissions in California, (reported by the California Air Resources Board) divided by the total electricity consumption in California (reported by the California Energy Commission), to find appropriate emission factors. The CO_2 emission factor for PG&E-delivered electricity is provided separately by PG&E, and is not calculated in this worksheet. See the worksheet called "PG&E Emission Factors" for that emission factor.

Table 5-1: Total Electricity-Related GHG Emissions in California (CARB)

Type of Electricity	Emissions (MT CO2)	Emissions (MT CH4)	Emissions (MT N2O)
Imported Electricity:	62,504,669	717	947
Generated Electricity:	44,831,731	3,549	477
Totals:	107,336,400	4,266	1,424
Emissions data in table above is from CARB Greenhouse Gas Emissions Inventory - Query Tool for years 2000 - 2015 (10th Edition).			CARB Source

Table 5-2: Total Electricity Consumption in California

Total Annual State Electricity Consumption (GWh):	288,245
Data on consumption from the CEC, Total System Power in Gigawatt Hours.	CEC Source

Table 5-3: Direct Access Electricity Emission Factors

Emission Factor	CO2	CH4	N2O
MT / GWh	372.4	0.01	0.0049
Lbs / GWh	820,955	32.63	10.9
Lbs / kWh	0.8	0.00003	0.0000109

Table 5-4: Universal Conversion Factors

MT / lb.	0.00045
kWh / GWh	0.0000010

PG&E Electricity and Natural Gas Usage Data

Summary of Methodology Used

Utility-supplied electricity and natural gas consumption was pulled from the 2005 data contained under the "Emissions Summary" tab. Emissions associated with energy consumption are calculated on the "Energy Emissions" worksheet.

Table 6-1: PG&E Electricity and Natural Gas Consumption by Sector: 2005

City	Total Electricity Use (kWh)	Residential Electricity Use (kWh)	Non-Residential Electricity Use (kWh)	Total Natural Gas Use (Therms)	Residential Natural Gas Use (Therms)	Non-residential Natural Gas Use (Therms)
Burlingame	222,673,587	66,649,820	156,023,767	12,210,816	6,100,373	6,110,443

PG&E Emission Factors and Other Information

Summary of Methodology Used

PG&E-specific emission factors for CO2 emissions from electricity are provided in this worksheet. Standard natural gas emission factors are also provided.

Table 7-1: PG&E Electricity & Natural Gas Emission Factors

PG&E Electricity Emission Factor (lbs CO2/kWh)	Natural Gas Emission Factor (lbs CO2e / therm)
0.4890	11.70

PG&E electricity emission factor is from The Climate Registry. Once logged in, find PG&E under the "Member Name" drop-down menu and select the appropriate "Emission Year" from the drop-down menu. Select and download the "EPS Protocol Report." The electricity emissions factors can be found at the bottom of the "Additional Optional Information" tab. The "delivered electricity CO2 emission factor" is the relevant number.	TCR Source
The natural gas emission factor is a universal emission factor that is not specific to PG&E.	N/A

BAAQMD Stationary Sources

Summary of Methodology Used

Total stationary source emissions were provided by the Bay Area Air Quality Management District. Facilities only report total biogenic and non-biogenic emissions, in MTCO2e; this data does not include raw fuel use. Total non-biogenic emissions were summed for each jurisdiction. However, stationary source emissions from the Burlingame wastewater treatment plant were subtracted from the total stationary source emissions to avoid double counting, since the wastewater treatment emissions are included in the wastewater sector of this inventory.

Table 8-1: Summary of Stationary Source Emissions

Jurisdiction	Stationary Source Emissions (MT CO2e)	Source of Emissions
Burlingame	4,593.2	All Emissions in City
Burlingame	27.8	City-owned Emissions Only

Table 8-2: Excluded Stationary Source Emissions by Plant

Plant #	Plant Name	Plant Address	City	Non-Biogenic Emissions (MT CO2e)
1351	Burlingame, Waste Water Treatment Plant	1103 Airport Boulevard	Burlingame	5.66

Table 8-3: Included Stationary Source Emissions by Plant

Plant #	Plant Name	Plant Address	City	Non-Biogenic Emissions (MT CO2e)	Biogenic Emissions (MT CO2e)
1632	Guittard Chocolate Company	10 Guittard Road	Burlingame	88.21	
2227	Mills Peninsula Medical Center	1501 Trousdale Drive	Burlingame	2,682.99	
3812	Putnam Mazda	3 California Drive	Burlingame	1.32	
3817	Putnam Buick, Pontiac & GMC	925 Bayswater Street	Burlingame	52.94	
4008	Coen Company, Inc	1510 Rollins Road	Burlingame	1,386.42	
8243	Trade Mark Coffee Corp	1524 Rollins Road	Burlingame	168.88	
9867	Burlingame Collision Repair Center	123 California Drive	Burlingame	6	
10175	DeVincenzi Metal Products	1655 Rollins Road	Burlingame	93.33	
11020	San Mateo County Office of Education	1800 Rollins Road	Burlingame	6.26	
13079	City of Burlingame	1079 Rollins Road	Burlingame	4.07	
13325	Embassy Suites Hotel	150 Anza Boulevard	Burlingame	2.55	
13454	Pacific Bell	1480 Burlingame Avenue	Burlingame	31.76	
14461	City of Burlingame	1399 Rollins Rd Stun 36	Burlingame	0.46	
14462	City of Burlingame	2832 Hillside Dr Stun 35	Burlingame	0.46	
14463	City of Burlingame	799 California Drive	Burlingame	0.72	
14464	City of Burlingame	399 Rollins Road	Burlingame	10.19	
14465	City of Burlingame	1501 Adrian Road	Burlingame	0.97	
14466	City of Burlingame	1616 Gilbreth Road	Burlingame	0.24	
14467	City of Burlingame	2817 Rivera Drive	Burlingame	0.83	
14468	City of Burlingame	425 Carolan Avenue	Burlingame	0.25	
14469	City of Burlingame	710 Airport Boulevard	Burlingame	0.26	
14470	City of Burlingame	842 Cowan Road	Burlingame	1.23	
14471	City of Burlingame	2830 Hillside Drive	Burlingame	1.06	
14472	City of Burlingame	1111 Trousdale Drive	Burlingame	3.06	
14474	City of Burlingame	501 Primrose Road	Burlingame	0.51	
14475	City of Burlingame	1392 Marsten Road	Burlingame	0.51	
14476	City of Burlingame	1740 Rollins Road	Burlingame	1.91	
14850	City of Burlingame Public Works Department	California St & Grove St	Burlingame	1.02	
14910	Putnam Automotive	50 California Drive	Burlingame	2.55	
14911	Putnam Automotive	198 California Drive	Burlingame	2.55	
14912	Putnam Automotive	100 California Drive	Burlingame	5.07	
14913	Putnam Automotive	900 Peninsula Avenue	Burlingame	1.27	
14914	Putnam Automotive	65 California Drive	Burlingame	5.34	
14915	Putnam Automotive	2 California Drive	Burlingame	2.55	
15280	Alexandria Real Estate Equities Inc	863 Mitten	Burlingame	0.41	
16438	Coffee Training Institute/West Coast Specialty Cof	8 Adrian Court	Burlingame	23.99	
16521	Burlingame Long Term Care	1100 Trousdale Drive	Burlingame	1.04	

Summary: Transportation Emissions

Summary of Methodology Used

Transportation emissions are summarized in this worksheet. Transportation emissions in Burlingame are based on the destination-origin method using the same MTC dataset from Plan Bay Area 2040 (PBA 2040). Calculations provided are done separately for gasoline fuel usage & VMT, as well as diesel fuel usage & VMT. the VMT fuel mix is used to determine the portion of VMT that is gasoline, diesel, and electric. Average fuel efficiencies are then applied to estimate the gasoline and diesel fuel consumption. CO2 emission factors are applied to the estimated fuel consumption to calculate CO2 emissions, and CH4 and N2O emission factars are applied to VMT to calculate CH4 and N2O emissions. This methodology has been updated since the 2009 CAP and 2010 Inventory based on two factors:

1) The ICLEI U.S. Community Protocol (July 2013) provides that preference is given to the origin-destination method (using a demand-based allocation model) of vehicle trips by community members, as opposed to emissions from vehicles driving inside the community boundary (page 9); and
2) Recommendation from the BAAQMD.

Table 9-1: Summary of Origin Destination On-road Transportation

Jurisdiction	Annual VMT Emissions in City			
	Gasoline Emissions (MT CO2e)	Diesel Emissions (MT CO2e)	Natural Gas Emissions (MT CO2e)	Total Emissions (MT CO2e)
Burlingame	92,004	10,739	25	102,768

Table 9-2: Emission Factors for On-road Transportation Fuels

Greenhouse Gas	Gasoline		Diesel		Natural Gas	
	Emissions (grams/gallon)	Emissions (grams/mile)	Emissions (grams/gallon)	Emissions (grams/mile)	Emissions (grams/gallon)	Emissions (grams/mile)
CO2	8702.282684		10205.8223		7811.466421	
CH4		0.055052054		0.043909338		14.63718548
N2O		0.040737735		0.194078303		0.700113543

Emission Factors derived from the EMFAC model, specifically using EMFAC2017 (v1.0.2).

Table 9-3: On-road VMT Attributable to Gasoline vs. Diesel Vehicles			
Percent of Total VMT Attributable to Gasoline Vehicles	Percent of Total VMT Attributable to Diesel Vehicles	Percent of Total VMT Attributable to Electric Vehicles	Percent of Total VMT Attributable to Natural Gas Vehicles
96.21%	3.76%	0.03%	0.00%

Percent of VMT attributable to gasoline, diesel, and nautral gas vehicles derived from the EMFAC model, specifically using EMFAC2017 (v1.0.2).

Table 9-4: On-road Fuel Efficiencies of Gasoline & Diesel Vehicles		
Gasoline Vehicles Miles Per Gallon (MPG)	Diesel Vehicles Miles Per Gallon (MPG)	Natural Gas Vehicles Miles Per Diesel Gallon Equivalent (Mi/DGE)
20.74	8.24	2.29

MPG of gasoline and diesel vehicles are based on the EMFAC model, specifically EMFAC2017 (v1.0.2).

Table 9-5: Summary of Origin-Destination On-road Transportation VMT & Fuel Consumption by Fuel						
Jurisdiction	In Burlingame			Gallons of Fuel Consumed		
	Gasoline VMT	Diesel VMT	Natural Gas VMT	Gasoline Fuel Consumption (gal)	Diesel Fuel Consumption (gal)	Natural Gas Fuel Consumption (Mi/DGE)
Burlingame	213,005,053	8,320,518	6,258	10,270,449	1,009,270	2,738

Table 9-6: Summary of In-boundary On-road Transportation Emissions by Fuel Type & Greenhouse Gas									
Jurisdiction	In Burlingame								
	Gasoline Emissions (MT CO2)	Gasoline Emissions (MT CH4)	Gasoline Emissions (MT N2O)	Diesel Emissions (MT CO2)	Diesel Emissions (MT CH4)	Diesel Emissions (MT N2O)	Natural Gas Emissions (MT CO2)	Natural Gas Emissions (MT CH4)	Natural Gas Emissions (MT N2O)
Burlingame	89,376	11.73	8.68	10,300	0.37	1.61	21.4	0.1	0.00

Table 9-7: IPCC AR5 Global Warming		
CO2	CH4	N2O
1	28	265

Table 9-8: Universal	
MT / gram	0.000001

Origin-Destination VMT Data Summary

Summary of Methodology Used

The origin-destination methodology is a methodology used for estimating VMT. The origin-destination methodology was not used in the 2009 CAP or 2010 Inventory, but has been updated here for reasons discussed in the "Transporation Emissions" sheet.

Table 10-1: 2005 Summary of Origin-Destination On-road Transportation VMT

Jurisdiction	2005 Data			
	2005 Days In Year Multiplier	[redacted]	2005 Daily VMT	2005 Annual VMT
[redacted]				
Burlingame	347.00	[redacted]	638,019	221,392,593

Tom Buckley (tbuckley@bayareametro.gov) and Kearey Smith (ksmith@bayareametro.gov) at MTC provided these VMT metrics. This dataset was also used in Plan Bay Area 2040. Multiplier based on CARB's GHG inventory technical support document for LDA.

CARB Technical Support Document

Plan Bay Area 2040 VMT Data

Summary of Methodology Used

Data provided by Tom Buckley (tbuckley@bayareametro.gov) and Kearey Smith (ksmith@bayareametro.gov) at MTC. VMT apportioned to Burlingame as follows:

*100% from the "Entirely_Within" Column
*50% from the "Partiall_Within" Column
* 0% from the "Entirely_Outside" Column.

Table 11-1: 2005 Raw Origin-Destination On-road Transportation VMT Data Supplied by MTC

Population_Segment	persons	model_run	Entirely_Within	Partially_Within	Entirely_Outside
Live in area-Works in area	2245	2005_05_YYY	4928	13913	1405
Live in area-Works out of area	11625	2005_05_YYY	5283	232198	63585
Live in area-Non-worker	15414	2005_05_YYY	10945	130054	19279
Live out of area-Works in area	20178	2005_05_YYY	3911	453013	146421
Live out of area-Works out of area	3186508	2005_05_YYY	1058	202633	77044392
Live out of area-Non-worker	3743013	2005_05_YYY	2271	187435	32921606

Table 11-2: Daily VMT Summary

2005 Daily VMT
638019

Summary: Off-road Emissions

Summary of Methodology Used

Off-road emissions were calculated using the ARB Offroad2007 Model. The EPA NONROAD model was not used, as recommended in the ICLEI Community GHG Protocol, because the ARB model is assumed to be more accurate for California communities. The model was run for the 2005 calendar year, and for all of San Mateo County. Total county-wide emissions are summed below. Emissions are then allocated to each jurisdiction based on population or the number of jobs, by emission type. For the full model data results, see the worksheet called "Transpo_Offroad data." This worksheet includes a summary of the model's data and the allocation methodology for each type of emissions. The table below shows the total allocated emissions.

Table 12-1: Summary of Off-road Emissions in San Mateo County by Emissions Type

Type of Off-road Emissions	Off-road CO2 Emissions (tons CO2/day)	Off-road N2O Emissions (tons N2O/day)	Off-road CH4 Emissions (tons CH4/day)	Allocate Emissions to Jurisdiction by:
Agricultural Equipment	28.2	0.000	0.006	Number of Jobs
Airport Ground Support Equipment	195	0.024	0.053	SFO is located in unincorporated San Mateo County, and the County owns and operates two general aviation airports: the San Carlos Airport and the Half Moon Bay Airport. Thus, 100% of these emissions will be allocated to San Mateo County.
Construction and Mining Equipment	453.5	0.003	0.087	Number of Jobs
Entertainment Equipment	1.4	0	0.00016	Number of Jobs
Industrial Equipment	107.2	0.009	0.096	Number of Jobs
Lawn and Garden Equipment	33.4	0.026	0.066	Population
Light Commercial Equipment	74.9	0.013	0.041	Number of Jobs
Oil Drilling	0.53	0	0	Number of Jobs
Pleasure Craft	19.6	0.005	0.062	Population
Rail yard Operations	0.019	0.000	0.000	Emissions will be evenly allocated to the following 12 jurisdictions with rail lines: Atherton, Belmont, Brisbane, Burlingame, Menlo Park, Millbrae, Redwood City, San Bruno, San Carlos, San Mateo (City), San Mateo (County), South San Francisco.
Recreational Equipment	4.3	0.006	0.037	Population
Transport Refrigeration Units	42.4	0.001	0.019	Number of Jobs
Total:	**960.1**	**0.09**	**0.47**	

Off-road emissions data from ARB Offroad2007 Model.

Table 12-2: Summary of Total Off-road Emissions in Jurisdiction During 2005

Jurisdiction	Jurisdiction Population 2005	Jurisdiction Employment 2005	Percent of Total County Population in Jurisdiction	Percent of Total County Employment in Jurisdiction	Total Off-road CO2 Emissions (tons CO2 / day)	Total Off-road N2O Emissions (tons N2O / day)	Total Off-road CH4 Emissions (tons CH4 / day)	Total Off-road CO2 Emissions (MT CO2 / year)	Total Off-road N2O Emissions (MT N2O / year)	Total Off-road CH4 Emissions (MT CH4 / year)	Total Off-road Emissions (MT CO2e / year)
Burlingame	28,300	22,430	4.0%	6.2%	46.2	0.0031	0.0220	15,311	1.0	7.3	15,788
County Total:	712,806	361,296	100.0%	100.0%	1,114	0.0806	0.3069	368,974	26.7	101.6	380,385

Burlingame population and employment taken from 2010 Community GHG Inventory (page 10).

San Mateo population and employment aggregated using 2000 and 2010 census data:
http://www.bayareacensus.ca.gov/counties/SanMateoCounty.htm

Table 12-3: IPCC 5AR Global Warming

CO2	CH4	N2O
1	28	265

Table 12-4: Universal Conversion Factors

days / year	365
MT / short ton	0.907185

San Mateo County: Offroad Emissions

Summary of Methodology Used

Offroad emissions were calculated using the ARB Offroad2007 Model. The EPA NONROAD model was not used, as recommended in the ICLEI Community GHG Protocol, because the ARB model is assumed to be more accurate for California communities. The model was run for the 2005 calendar year, and for all of San Mateo County. Total county-wide emissions are summed below. Emissions are then allocated to each jurisdiction based on population and jobs, by emission type. For the emission allocation results, see the worksheet called "Transpo_Offroad totals."

Table 13-1: Summary of Off-road Emissions in San Mateo County by Emissions Type

Type of Emissions	Sum of CO2 Exhaust	Sum of N2O Exhaust	Sum of CH4 Exhaust
Agricultural Equipment	28.1506	0.0003	0.0058
Airport Ground Support Equipment	194.6004	0.0239	0.0531
Construction and Mining Equipment	453.4767	0.0031	0.0870
Entertainment Equipment	1.4315	0.0000	0.0002
Industrial Equipment	107.1591	0.0095	0.0960
Lawn and Garden Equipment	33.3750	0.0259	0.0659
Light Commercial Equipment	74.9171	0.0129	0.0410
Oil Drilling	0.5267	0.0000	0.0001
Pleasure Craft	19.6035	0.0053	0.0620
Rail yard Operations	0.0193	0.0000	0.0000
Recreational Equipment	4.3475	0.0060	0.0373
Transport Refrigeration Units	42.4498	0.0006	0.0190
Logging Equipment	0.0000	0.0000	0.0000
Military Tactical Support Equip	0.0000	0.0000	0.0000
Dredging	0.0000	0.0000	0.0000
Other Portable Equipment	0.0000	0.0000	0.0000
Grand Total	**960.06**	**0.09**	**0.47**

Summary: Landfills Emissions

Summary of Methodology Used
Currently, the only open landfill in San Mateo County is located in the unincorporated County area. Therefore, there is little change of double-counting landfill emissions for the jurisdictions in San Mateo County, with the exception of the County of San Mateo. This section of the inventory includes estimated GHG emissions from closed or otherwise inactive landfills in San Mateo County. This analysis uses the methodologies in the Community GHG Protocol, Appendix E, in particular calculation method SW.1.1, which uses the California FOD model. When data are not available to use calculation methodology SW.1.1, this analysis is based on methodologies in the Local Government Operations Protocol. Some GHG emissions from landfills are also provided by the BAAQMD, but their methodologies differ from those in the LGOP and in the Community GHG Protocol, so BAAQMD landfill emissions data are not used in this analysis.

Table 14-1: Included Landfill Emissions

Landfill Name	Landfill Jurisdiction	Activity	Operational Status	Owner	Landfill Emissions (MT CO2e)	Landfill Emissions (MT CH4)	Summary of Methodology for Calculating Landfill Emissions
Burlingame Refuse Disposal Area	Burlingame	Solid Waste Disposal Site	Closed	City of Burlingame	353.87	13	Calculated using LGOP methodology (same methodology used in municipal inventories).

Summary: Waste - Disposal Emissions

Summary of Methodology Used

Emissions were calculated using equation SW.4.1 of the Community GHG Protocol, Appendix E (page 24), as well as emission factors from Table SW.5 from the same document. This equation and the emission factors used to calculate emissions are shown below. In general, waste disposal to the landfill and the amount of Alternative Daily Cover is provided for each jurisdiction in the CalRecycle Disposal Reporting System database. Waste characterization data from the California Waste Characterization Study of 2008 are used to determine what percentages of materials are in the disposed waste stream. For Alternative Daily Cover, the waste characterization is provided in the CalRecycle Disposal Reporting System by jurisdiction. Tonnages of each waste material disposed are summed, and then multiplied by emission factors in the Community GHG Protocol to determine total emissions from disposed waste.

Table 15-1: Summary of Disposed Waste Emissions

Jurisdiction	Disposed Waste Emissions (MT CO2e)	Alternative Daily Cover Emissions (MT CO2e)	Total Solid Waste Disposal Emissions (MT CO2e)
Burlingame	8,526	454	8,979

Table 15-2: Emission Factors for Solid Waste by Waste Type

Corrugated Containers (MT CH4 / wet short ton of waste)	Newspaper (MT CH4 / wet short ton of waste)	Office Paper (MT CH4 / wet short ton of waste)	Magazines/ Third Class Mail (MT CH4 / wet short ton of waste)	Food Scraps (MT CH4 / wet short ton of waste)	Grass (MT CH4 / wet short ton of waste)	Leaves (MT CH4 / wet short ton of waste)	Branches (MT CH4 / wet short ton of waste)	Dimensional Lumber (MT CH4 / wet short ton of waste)
0.120	0.043	0.203	0.049	0.078	0.038	0.013	0.062	0.062

Emission Factors by waste type are from U.S. Community Protocol Table SW.5

Table 15-3: Disposed Waste Emissions Calculation Assumptions	
Equation SW.4.1. Variable	**Value**
GWP_{CH4} =	28
M=	see below for data sources regarding solid waste disposal
P_i=	see below for data sources regarding waste characterization
EF_i=	see box to the right showing Table SW.5
CE=	0.75
OX=	0.10

Table 15-4: Waste Composition

Waste Type	Percentage of All Waste Disposed in the Landfill	Percentage of Average ADC
Corrugated Containers	4.8%	Varies by Jurisdiction. See Waste-ADC worksheet.
Newspaper	1.3%	
Office Paper	1.9%	
Magazines/Third Class Mail	0.7%	
Food Scraps	15.5%	
Grass	1.9%	
Leaves	1.9%	
Branches	0.60%	
Dimensional Lumber	14.5%	

Waste Characterization is based on the California 2008 Statewide Waste Characterization Study. Used Table 7 on page 24 showing the composition of California's Overall Disposed Waste Stream.	Waste Characterization Study Source
Used the subcategory of "Uncoated Corrugated Cardboard" in the Waste Characterization Study for "Corrugated Containers" in the table above.	
Used the subcategory of "Newspaper" in the Waste Characterization Study for "Newspaper" in the table above.	
Used the subcategories of "White Ledger Paper" and "Other Office Paper" in the Waste Characterization Study for "Office Paper" in the table above.	
Used the subcategory of "Magazines and Catalogs "in the Waste Characterization Study for "Magazines/Third Class Mail" in the table above.	
Used the subcategory of "Food" in the Waste Characterization Study for "Food Scraps" in the table above.	
Used half of the subcategory of "Leaves and Grass" for "Grass" in the table above. The other half of the subcategory of "Leaves and Grass" was assigned to "Leaves" in the table above. The subcategory of "Branches and Stumps" was also assigned to "Branches" in the table above.	
Used the subcategory of "Lumber" for "Dimensional Lumber" in the table above.	
ADC Waste Characterization: ADC waste characterization is also provided in the CalRecycle Disposal Reporting System, and is provided by jurisdiction. The totals of ADC by waste type are shown on the "Waste-ADC" worksheet. It is assumed that 50% of the ADC category of "Green Waste" is grass, and 50% of the "Green Waste" category is branches. The total tonnages of grass and branches from ADC is included n the Waste Disposal Tonnages, Alternative Daily Cover table below.	CalRecycle Source

Table 15-5: Waste Disposal and Alternative Daily Cover Tonnages by Waste Type

Total Waste Disposal (short tons)	Total Alternative Daily Cover (short tons)	Total - Waste Disposal and Alternative Daily Cover (short tons)	Corrugated Containers (short tons)	Newspaper (short tons)	Office Paper (short tons)	Magazines/Third Class Mail (short tons)	Food Scraps (short tons)	Grass (short tons)	Leaves (short tons)	Branches (short tons)	Dimensional Lumber (short tons)	Grass (short tons)	Branches (short tons)
41,083	3,190	44,273	1,972	534	781	288	6,368	781	781	246	5,957	720	720

Waste disposal tonnages and ADC tonnages from CalRecycle Jurisdiction Disposal Reports. Detailed results below. CalRecycle Source

Table 15-6: Burlingame Waste Production and Destination

Destination Facility	SWISNo	Qtr	Instate Ton	Transform Ton	Export Ton	Total ADC	Total AIC		
Altamont Landfill & Resource Recv`ry	01-AA-0009		26				95		
Bakersfield Metropolitan (Bena) SLF	15-AA-0273		2						
Corinda Los Trancos Landfill (Ox Mtn)	41-AA-0002		39,035				1,440		
Guadalupe Sanitary Landfill	43-AN-0015		2				1		
Hillside Class III Disposal Site	41-AA-0008		307						
Keller Canyon Landfill	07-AA-0032		51						
Newby Island Sanitary Landfill	43-AN-0003		44						
Potrero Hills Landfill	48-AA-0075		1,065				1,654		
Recology Hay Road	48-AA-0002		7						
Recology Pacheco Pass	43-AA-0004		10						
Redwood Landfill	21-AA-0001		8						
Vasco Road Sanitary Landfill	01-AA-0010		12						
Zanker Material Processing Facility	43-AN-0001		426						
Zanker Road Class III Landfill	43-AN-0007		89						
Yearly Totals:			41,083		..	..	3,191		..

Table 7: Composition of California's Overall Disposed Waste Stream

Material	Est. Percent	+/-	Est. Tons	Material	Est. Percent	+/-	Est. Tons
Paper	17.3%		6,859,121	**Other Organic**	32.4%		12,888,039
Uncoated Corrugated Cardboard	4.8%	0.9%	1,905,897	Food	15.5%	1.9%	6,158,120
Paper Bags	0.4%	0.1%	155,848	Leaves and Grass	3.8%	0.7%	1,512,832
Newspaper	1.3%	0.3%	499,960	Prunings and Trimmings	2.7%	1.5%	1,058,854
White Ledger Paper	0.7%	0.3%	259,151	Branches and Stumps	0.6%	0.4%	245,830
Other Office Paper	1.2%	0.6%	472,147	Manures	0.1%	0.1%	20,373
Magazines and Catalogs	0.7%	0.2%	283,069	Textiles	2.2%	0.3%	886,814
Phone Books and Directories	0.1%	0.0%	24,149	Carpet	3.2%	2.0%	1,285,473
Other Miscellaneous Paper	3.0%	0.4%	1,202,354	Remainder/Composite Organic	4.3%	0.5%	1,719,743
Remainder/Composite Paper	5.2%	0.7%	2,056,546				
				Inerts and Other	29.1%		11,577,768
Glass	1.4%		565,844	Concrete	1.2%	0.4%	483,367
Clear Glass Bottles and Containers	0.5%	0.1%	196,093	Asphalt Paving	0.3%	0.4%	129,834
Green Glass Bottles and Containers	0.2%	0.1%	79,491	Asphalt Roofing	2.8%	1.5%	1,121,945
Brown Glass Bottles and Containers	0.3%	0.1%	108,953	Lumber	14.5%	2.2%	5,765,482
Other Colored Glass Bottles and Containers	0.1%	0.0%	40,570	Gypsum Board	1.6%	0.7%	642,511
Flat Glass	0.1%	0.1%	33,899	Rock, Soil and Fines	3.2%	1.1%	1,259,308
Remainder/Composite Glass	0.3%	0.1%	106,838	Remainder/Composite Inerts and Other	5.5%	1.3%	2,175,322
Metal	4.6%		1,809,684	**Household Hazardous Waste (HHW)**	0.3%		120,752
Tin/Steel Cans	0.6%	0.1%	236,405	Paint	0.1%	0.1%	48,025
Major Appliances	0.0%	0.1%	17,120	Vehicle and Equipment Fluids	0.0%	0.0%	6,424
Used Oil Filters	0.0%	0.0%	3,610	Used Oil	0.0%	0.0%	3,348
Other Ferrous	2.0%	0.4%	801,704	Batteries	0.0%	0.0%	19,082
Aluminum Cans	0.1%	0.0%	47,829	Remainder/Composite Household Hazardous	0.1%	0.1%	43,873
Other Non-Ferrous	0.2%	0.1%	84,268				
Remainder/Composite Metal	1.6%	0.5%	618,747	**Special Waste**	3.9%		1,546,470
				Ash	0.1%	0.1%	40,736
Electronics	0.5%		216,297	Treated Medical Waste	0.0%	0.0%	0
Brown Goods	0.2%	0.1%	76,725	Bulky Items	3.5%	1.2%	1,393,091
Computer-related Electronics	0.1%	0.1%	32,932	Tires	0.2%	0.1%	60,180
Other Small Consumer Electronics	0.1%	0.0%	34,588	Remainder/Composite Special Waste	0.1%	0.1%	52,463
Video Display Devices	0.2%	0.1%	72,053				
				Mixed Residue	0.8%		330,891
Plastic	9.6%		3,807,952	Mixed Residue	0.8%	0.2%	330,891
PETE Containers	0.5%	0.1%	199,644				
HDPE Containers	0.4%	0.1%	157,779				
Miscellaneous Plastic Containers	0.4%	0.1%	163,008				
Plastic Trash Bags	0.9%	0.1%	361,997				
Plastic Grocery and Other Merchandise Bags	0.3%	0.0%	123,405				
Non-Bag Commercial and Industrial Packaging Film	0.5%	0.2%	194,863				
Film Products	0.3%	0.2%	113,566				
Other Film	1.4%	0.3%	554,002				
Durable Plastic Items	2.1%	0.4%	834,970	**Totals**	100.0%		39,722,818
Remainder/Composite Plastic	2.8%	0.7%	1,104,719	**Sample Count**	751		

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.
More detailed composition tables can be found in Appendix D: Expanded Statewide Waste Characterization Tables

Table SW.5 CH_4 Yield for Solid Waste Components		
Waste Component	Emissions Factor, EF_i (mt CH_4/wet short ton waste)	Source
Mixed MSW*	0.060	U.S. EPA AP-42
Newspaper	0.043	WARM
Office Paper	0.203	WARM
Corrugated Containers	0.120	WARM
Magazines/Third-Class Mail	0.049	WARM
Food Scraps	0.078	WARM
Grass	0.038	WARM
Waste Component	Emissions Factor, EF_i (mt CH_4/wet short ton waste)	Source
Leaves	0.013	WARM
Branches	0.062	WARM
Dimensional Lumber	0.062	WARM

* – Mixed MSW factor may be used for entire MSW waste stream if waste composition data is unavailable

U.S. EPA AP-42 – U.S. EPA Emission Factor Database, Chapter 2.4 Municipal Solid Waste Landfills (1998)

WARM—Documentation for Greenhouse Gas Emissions and Energy Factors Used in the Waste Reduction Model (WARM) 2006

Equation SW.4.1 Methane Emissions

$$CH_4\ Emissions = GWP_{CH4} * (1 - CE) * (1 - OX) * M * \sum_i P_i * EF_i$$

Where:

Term	Description	Value
CH_4 emissions	= Community generated waste emissions from waste M ($mtCO_2e$)	Result
GWP_{CH4}	= CH_4 global warming potential	
M	= Total mass of waste entering landfill (wet short ton)	User Input
P_i	= Mass fraction of waste component i	User Input
EF_i	= Emission factor for material i ($mtCH_4$/wet short ton)	Table SW.5
CE	= Default LFG Collection Efficiency	No Collection, 0 Collection, 0.75
OX	= Oxidation rate	0.10

Source: As developed by ICLEI staff and Solid Waste Technical Advisory Committee. Emissions factors from U.S. EPA Municipal Solid Waste Publication (2008) available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw2008data.pdf

Waste - Disposal Data (ADC)

Summary of Methodology Used

Alternative Daily Cover (ADC) waste tonnages and the waste characterization of ADC is provided in the CalRecycle Disposal Reporting System by jurisdiction. Results are shown in this worksheet. ADC data is from CalRecycle Disposal Reporting System: Alternative Daily Cover by Jurisdiction of Origin and Material Type.

Table 16-1: ADC by ADC Type and Composition of ADC Green Waste

	ADC by ADC Type											Composition of ADC Green Waste		
Jurisdiction of Origin	**Auto Shred ADC (short tons)**	**C & D ADC (short tons)**	**Green Waste ADC (short tons)**	**Cont. Sedimt ADC (short tons)**	**Compost ADC (short tons)**	**Mixed ADC (short tons)**	**Sludge ADC (short tons)**	**Tires ADC (short tons)**	**Ash ADC (short tons)**	**Other ADC (short tons)**	**Total ADC (short tons)**	**Total Percentage of ADC that is Green Waste**	**Percentage of ADC Green Waste that is Grass**	**Percentage of ADC Green Waste that is Stumps**
Burlingame	0.0	207.1	1,440.4	0.0	0.0	0.0	1,543.1	0.0	0.0	0.0	3,190.6	45%	23%	23%

ADC data is from CalRecycle Disposal Reporting System: Alternative Daily Cover by Jurisdiction of Origin and Material Type.

CalRecycle Source

Table 16-2: Composition of Green Waste

Percentage of Green Waste that is Grass:	50%
Percentage of Green Waste that is Branches:	50%

Summary: Wastewater Emissions

Summary of Methodology Used

Wastewater Treatment Plant emissions are calculated based on the methodologies in the Community GHG Protocol, Appendix F - Wastewater and Water Emissions Activities and Sources. The wastewater treatment emissions include methane and nitrous oxide, which are considered process and fugitive emissions sources, as well as stationary sources. Process and fugitive emissions are calculated and typically included in the municipal operations inventory of the city that contains the wastewater treatment plant; this inventory uses existing emissions information from the municipal operations inventories for process and fugitive emissions, which use the calculation methodologies in the Local Government Operations Protocol. These methodologies are very similar to those in the Community GHG Protocol, Appendix F.

The BAAQMD provides a list of stationary source emissions from wastewater treatment plants; these emissions are from stationary combustion sources such as diesel turbines or generators, and are added to each plant's emissions total. If the combustion sources are known to be fired by natural gas, they are excluded from this portion of the inventory to avoid double counting, since natural gas combustion sources are included in the Energy sector of this inventory. The use of electricity at wastewater plants is also excluded from this sector to avoid double-counting, as electricity use is also included in the Energy sector of this inventory.

In most cases, wastewater treatment plants serve more than one jurisdiction. Thus, emissions from each plant are allocated to the jurisdictions that are served by each plant, using the population of the jurisdictions multiplied by the average emissions per capita of the plants. Reported GHG emissions for all sources are available for some plants, but are not available for all plants in San Mateo County. To estimate the wastewater-related emissions for each jurisdiction, the following methodology was used. The average emissions per capita, in metric tons CO2e/person is calculated for the plants for which data are available, and this average emissions per capita rate is used to estimate the emissions associated with wastewater treatment for the cities that are served or partially served by those plants. Emissions are estimated by multiplying each jurisdiction's population by the average emissions per capita.

As noted above, data are not available for some of the treatment plants. For the cities served by these plants, a total average emissions per capita is calculated for all the plants in San Mateo County that have reported GHG emissions data. This county wide average emissions per capita is used to estimate emissions from wastewater treatment for the cities served by a plant or plants that do not have data available.

Table 17-1: Summary of Wastewater Treatment Emissions

Jurisdiction	Population (2005)	Apportioned Emissions (MT CO2e)	Notes on Methodology
Burlingame	28,300	343	Used the average emission factor for the City of Burlingame Wastewater Treatment Plant

Table 17-2: Wastewater Treatment Plant Population Served, Emissions & Emissions per Capita

Wastewater Treatment Plant	Total Emissions	Population Served by Plant	Per Capita Emissions (MT CO2e/person)
Burlingame Wastewater Treatment Plant	**437**	36,000	0.0121

Source: See Municipal Operations Inventory for estimated emissions assciated with Burlingame WWTP process and digester.

Table 17-3: Detailed Methodology Explanation of Wastewater Treatment Plant Emissions Calculations

Wastewater Treatment Plant	Notes on Methodology
Burlingame Wastewater Treatment Plant	The 2010 Community GHG Inventory used data from the 2010 Burlingame Municipal GHG Inventory for process + fugitive emissions and data from BAAQMD for stationary emissions. Process emissions, fugitive emissions, and population served data was gathered by Sigalle Michael of Burlingame (smichael@burlingame.org) and provided by William Toci (william.toci@veolia.com).
	Burlingame population taken from 2010 Community GHG Inventory (page 10).

Wastewater Treatment Emissions from Combustion Sources

Summary of Methodology Used

Data was provided by Sukarn Claire at the BAAQMD (SClaire@baaqmd.gov). Ms. Claire noted: "We are providing the 2005 emissions information that is readily available in our database for historical years. The Air District prepared its very first point source GHG emissions inventory for the year 2007. So, emissions for year 2005 (historical year) are estimated emissions data."

Table 18-1: Wastewater Treatment Emissions from Combustion Sources

Plant No.	Name	Address	City	Zip Code	Total Non-biogenic Emissions (MT CO2e)
1351	City of Burlingame, Waste Water Treatment Plant	1103 Airport Boulevard	Burlingame	94010	6

Summary: Water Emissions

Summary of Methodology Used

As per the Community GHG Protocol, this inventory includes energy-related emissions associated with water delivery and treatment. Some of these emissions may occur within the community boundaries; as explained in the Community GHG Protocol, there is risk of some double-counting in this emissions sector.

Water emissions are based on the total estimated embedded electricity use associated with each jurisdiction's water use. See the worksheet called "Water" for calculations to determine jurisdictional water use and associated embedded electricity use. All embedded electricity related to water use is assumed to come from PG&E, since most water is sourced from areas within the PG&E service area. The emissions are calculated using the PG&E emission factor for CO2 and state grid-average emission factors for CH4 and N2O. For more explanation of the CH4 and N2O emission factors, see the worksheet called "Other Energy Emission Factors."

Table 19-1: Summary of Water Embedded Electricity Use & Emissions

Jurisdiction	Embedded Energy Usage in Water Consumed (kWh)	Total Emissions from Electricity Use (MTCO2e)
Burlingame	6,157,550	1,376

Table 19-2: PG&E Electricity Emission Factors

CO2 Emission Factor (lbs CO2/kWh)	CH4 Emission Factor (lbs CH4/GWh)	N2O Emission Factor (lbs N2O/GWh)
0.49	32.63	10.89

Table 19-3: IPCC SAR Global Warming Potentials

CO2	CH4	N2O
1	28	265

Table 19-4: Universal Conversion Factors

GWh / kWh	0.000001
MT / lb.	0.000454

Summary: Water Treatment and Delivery Emissions

Summary of Methodology Used
As per the Community GHG Protocol, this inventory includes energy-related emissions associated with water delivery and treatment. Some of these emissions may occur within the community boundaries; as explained in the Community GHG Protocol, there is risk of some double-counting in this emissions sector. The water consumption data used for this inventory was obtained from the Burlingame 2005 Urban Water Management Plan, dated 11/30/2005. The water use factor used is gross, million gallons per capita per day, which includes both residential and nonresidential water usage. Once the water use for the jurisdiction is estimated, the total water use is multiplied by an energy emissions factor to estimate the energy usage associated with water extraction, treatment, and delivery.

Table 20-1: Summary of Water Use & Water Embedded Electricity Use

Jurisdiction	Water Use (gal/year)	Embedded Energy Usage in Water Consumed (kWh)
Burlingame	1,759,300,000	6,157,550

Table 20-2: Water Use by Water Delivery Agency

Water Agency	Historic Total Water Demand - 2005 (gal/day)	Jurisdictions Served
Burlingame	4,820,000.00	Burlingame
Urban Water Management Plan: Historic Total Water Demand for the City of Burlingame Service Area (Table 6; page 92 of PDF)		Urban Water Management Plan

Table 20-3: Water Assumptions Used

Days per Year	365	
Emissions Factor for Water Consumed (kWh / million gal)	3500	
Emissions Factor for Water Consumed (kWh / gal)	0.003500	
Note: The emissions factor for water consumed is taken from the CEC 2006 report "Refining estimates of Water-Related Energy Use in California". The emissions factor for Northern California was used. The 3500 summed total accounts for 2117 kWhr/MG for water supply, 111 kWhr/MG for treatment, and 1272 kWhr/MG for distributon.		CEC Source

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City of Burlingame: Community-wide GHG Inventory (2015)

Original spreadsheet developed by DNV GL under contract with the County of San Mateo

Modifications and updates made by MIG, Inc. in 2019 for the City's 2030 Climate Action Plan Update

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Introduction to the 2015 Community-wide Greenhouse Gas Inventory

This workbook serves to document the calculations associated with the 2015 community-wide greenhouse gas inventory completed for the City of Burlingame. The intial spreadsheet was developed by DNV GL under contract with the County of San Mateo as part of the Regionally Integrated Climate Action Planning Suite (RICAPS). The workbook was updated in 2019 by MIG, Inc. to reflect new data sources and GWPs as part of the City's Climate Action Plan Update. This workbook includes raw data, assumptions, and calculations for each of the following sources of community-wide GHG emissions:

1. Energy - natural gas, electricity, and stationary sources
2. Transportation - on-road vehicles, off-road vehicles, passenger rail, and freight rail)
3. Solid Waste - landfills and waste generation within the community
4. Wastewater treatment
5. Energy associated with Water extraction, treatment, and delivery

Version: August 29, 2019

Contents:

Executive Summary: All GHG Emissions

Overall Emissions Summary: 2015 (MT CO2e)

Jurisdiction	Energy	Transportation	Solid Waste	Wastewater	Water	Total
Burlingame	105,924	129,041	6,321	497	707	242,489

Emissions Summary by Sector: 2015 (MT CO2e)

Sector	Source		2015
Energy	Residential Energy	Electricity	11,343
		Natural Gas	26,906
	Commercial/Industrial Energy	Electricity	29,478
		Natural Gas	29,353
	Direct Access	Electricity	8,837
	Stationary Sources	Multiple Fuels	6
Transportation	On-Road Vehicle Travel		102,465
	Off-Road Equipment (Residential)	Off-Road Equipment (Residential)	24,105
	Rail	CalTrain	2,471
Solid Waste	Solid Waste Disposal	Landfilled Waste	5,773
		ADC	271
	Solid Waste Landfills	Landfills	277
Wastewater	Wastewater Treatment		497
Water	Water Use		707
		Annual Emissions Total	**242,489.3**

Summary: Energy Emissions

Summary of Methodology Used

This worksheet shows a summary of the emissions from electricity and natural gas usage. The emissions from electricity and natural gas were calculated based on guidance in the Community GHG Protocol, Appendix C: Built Environment Activities and Sources. Emissions from stationary combustion of natural gas were calculated based on method BE1.1, and emissions from electricity were calculated based on method BE.2.2. Emission factors are explained on the worksheets called "Other Energy Emission Factors" and "PG&E Emission Factors".

Table 2-1: Summary of Electricity and Natural Gas Emissions (PG&E and Direct Access)

Jurisdiction	PG&E Residential Electricity Emissions (MT CO2e)	PG&E Non-Residential Electricity Emissions (MT CO2e)	Direct Access Electricity Emissions (MT CO2e)	Residential Natural Gas Emissions (MT CO2e)	Non-residential Natural Gas Emissions (MT CO2e)
Burlingame	11,343	29,478	8,837	26,906	29,353

Table 2-2: Electricity Emission Factors

Electricity Type	CO2 Emission Factor (lbs/kWh)	CH4 Emission Factor (lbs/GWh)	N2O Emission Factor (lbs/GWh)
PG&E Electricity	0.4045	70.66	8.41
Direct Access Electricity	0.620	70.66	8.41

Table 2-3: Natural Gas Emission Factors

CO2 Emission Factor (kg/MMBtu)	CH4 Emission Factor (kg/MMBtu)	N2O Emission Factor (kg/MMBtu)
53.02000	0.00500	0.00010

Table 2-4: IPCC AR5 Global Warming Potentials

CO2	CH4	N2O
1	28	265

Table 2-5: Universal Conversion

MT / lb.	0.00045
GWh / kWh	0.0000010
MMBTU / therm	10.00
MT / kg	0.0010

Summary: Electricity and Natural Gas Use Data

Summary of Methodology Used

The following table shows the summary of electricity and natural gas consumption from utility-supplied energy (provided by PG&E), as well as Direct Access electricity that was not purchased from PG&E. The total Direct Access electricity consumption in the County was provided by the California Energy Commission. Total countywide PG&E-supplied non-residential electricity was added to total county-wide Direct Access electricity to determine total countywide electricity consumption in the commercial and industrial sectors. Next, a ratio of Direct Access electricity to total PG&E-supplied non-residential electricity was found. This ratio was used to estimate total Direct Access electricity for each jurisdiction. See the worksheet called "Energy - Direct Access" for the Direct Access calculations. Also, according to PG&E representatives, all natural gas usage, regardless of whether it was purchased from PG&E or not, is included in the PG&E totals for natural gas.

Table 3-1: Summary of Electricity and Natural Gas Use (PG&E and Direct Access)

Jurisdiction	PG&E Total Electricity Use (kWh)	PG&E Residential Electricity Use (kWh)	PG&E Non-residential Electricity Use (kWh)	Direct Access Electricity Use (kWh)	PG&E Total Natural Gas Use (Therms)	PG&E Residential Natural Gas Use (Therms)	PG&E Non-residential Natural Gas Use (Therms)
Burlingame	220,193,089	61,186,049	159,007,040	31,201,861	10,577,760	5,058,785	5,518,975

Direct Access Electricity Usage

Summary of Methodology Used

This worksheet was used to estimate the consumption of Direct Access electricity in each jurisdiction in San Mateo County. The total county-wide PG&E electricity use in the non-residential sector and total Direct Access electricity consumption in the County, provided by the California Energy Commission, was used in these calculations. The PG&E non-residential data does not include Direct Access customers. Jurisdiction-specific data are not available from the California Energy Commission. As a result, county-wide data was used to estimate jurisdiction-specific Direct Access electricity consumption. Total county-wide PG&E-supplied non-residential electricity use was added to total county-wide Direct Access electricity use to determine total county-wide electricity use in the non-residential sector. Next, a ratio of Direct Access electricity to total PG&E-supplied commercial/industrial electricity was calculated. This ratio was used to estimate total Direct Access electricity for each jurisdiction.

Table 4-1: Summary of County Electricity Use: PG&E vs. Direct Access

County	Sector	Year	PG&E		Direct Access		Total
			Electricity Use (Million kWh)	Percent of Total Utility Electricity Use	Electricity Use (Million kWh)	Percent of Total Utility Electricity Use	Electricity Use (Million kWh)
San Mateo County	Residential	2015	1,436.89	37.73%	-		1,437
San Mateo County	Non-Residential	2015	2,371.67	62.27%	465.39	100.00%	2,837
Electricity Use (Million kWh):			3,808.6		465.4		4,274
Percent of Total Utility + Direct Access Electricity Use:			89.1%		10.9%		100%
Percent of Residential Utility + Direct Access Electricity Use:			100%		0%		100%
Percent of Non-residential Utility + Direct Access Electricity Use:			83.60%		16.40%		100%

Total Direct Access electricity consumption for San Mateo County was estimated at 465,391,151 kWh and was provided by the California Energy Commission. Contact: Steven Mac, Steven.Mac@energy.ca.gov

Table 4-2: Calculating Ratio of Direct Access Electricity: PG&E Non-residential Electricity at County Level

Sector	PG&E Electricity Use (Million kWh)	Ratio of Direct Access Electricity: PG&E Non-residential Electricity	Estimated Direct Access Electricity Use (Million kWh)
Residential	1,437	-	-
Non-Residential	2,372	19.62%	465.39

Table 4-3: Direct Access Electricity Use at City Level

Jurisdiction	Annual Commercial and Industrial kWh from PG&E	Annual Direct Access kWh
Burlingame	159,007,040	31,201,861

Additional Electricity Emission Factors

Summary of Methodology Used

Electricity emission factors for CH4 and N2O emissions from all electricity, and for CO2 from Direct Access electricity are calculated on this worksheet. This methodology uses the total electricity-related GHG emissions in California, (reported by the California Air Resources Board) divided by the total electricity consumption in California (reported by the California Energy Commission), to find appropriate emission factors. This methodology was also used to calculate emission factors for the 2005 baseline inventory. The CO2 emission factor for PG&E-delivered electricity is provided separately by PG&E, and is not calculated in this worksheet. See the worksheet called "PG&E Emission Factors" for that emission factor.

Table 5-1: Total Electricity-Related GHG Emissions in California (CARB)

Type of Electricity	Emissions (MT CO2)	Emissions (MT CH4)	Emissions (MT N2O)
Imported Electricity:	33,599,221	1,029	377
Generated Electricity:	49,499,244	8,439	750
Totals:	83,098,465	9,468	1,127
Emissions data in table above is from CARB Greenhouse Gas Emissions Inventory - Query Tool for years 2000 - 2015 (10th Edition). Note: 2010 inventory used 6th edition of same tool (slightly different numbers)			CARB Source

Table 5-2: Total Electricity Consumption in California

Total Annual State Electricity Consumption (GWh):	295,405
Data on consumption from the CEC, Total System Power in Gigawatt Hours.	CEC Source

Table 5-3: Direct Access Electricity Emission Factors

Emission Factor	CO2	CH4	N2O
MT / GWh	281.3	0.03	0.0038
Lbs / GWh	620,168	70.66	8.4
Lbs / kWh	0.6	0.00007	0.0000084

Table 5-4: Universal Conversion Factors

MT / lb.	0.00045
kWh / GWh	0.0000010

PG&E Electricity and Natural Gas Usage Data

Summary of Methodology Used

Utility-supplied electricity and natural gas consumption was provided by PG&E in the format shown below. Emissions associated with energy consumption are calculated on the "Energy Emissions" worksheet.

Table 6-1: PG&E Electricity and Natural Gas Consumption by Sector: 2015

City	Total Electricity Use (kWh)	Residential Electricity Use (kWh)	Non-Residential Electricity Use (kWh)	Total Natural Gas Use (Therms)	Residential Natural Gas Use (Therms)	Non-residential Natural Gas Use (Therms)
Burlingame	220,193,089	61,186,049	159,007,040	10,577,760	5,058,785	5,518,975

PG&E Emission Factors and Other Information

Summary of Methodology Used
PG&E-specific emission factors for CO2 emissions from electricity are provided in this worksheet. Standard natural gas emission factors are also provided.

Table 7-1: PG&E Electricity & Natural Gas Emission Factors

PG&E Electricity Emission Factor (lbs CO2/kWh)	Natural Gas Emission Factor (lbs CO2 / therm)
0.4045	11.70

PG&E electricity emission factor is from The Climate Registry. Once logged in, find PG&E under the "Member Name" drop-down menu and select the appropriate "Emission Year" from the drop-down menu. Select and download the "EPS Protocol Report." The electricity emissions factors can be found at the bottom of the "Additional Optional Information" tab. The "delivered electricity CO2 emission factor" is the relevant number.	TCR Source
The natural gas emission factor is a universal emission factor that is not specific to PG&E.	N/A

BAAQMD Stationary Sources

Summary of Methodology Used

Total stationary source emissions were provided by the Bay Area Air Quality Management District. Facilities only report total biogenic and non-biogenic emissions, in MTCO2e; this data does not include raw fuel use. Total non-biogenic emissions were summed for each jurisdiction. However, stationary source emissions from wastewater treatment plants were subtracted from the total stationary source emissions to avoid double counting, since the wastewater treatment emissions are included in the wastewater sector of this inventory. Emissions from landfills are also subtracted from the stationary source totals in this section to avoid double counting, since those emissions are included in the landfill sector of this inventory.

Table 8-1: Summary of Stationary Source Emissions

Jurisdiction	Stationary Source Emissions (MT CO2e)	Source of Emissions
Burlingame	31,967.0	All Emissions in City
Burlingame	6.1	City-owned Emissions Only

Table 8-2: Excluded Stationary Source Emissions by Plant

Plant #	Plant Name	Plant Address	City	Non-Biogenic Emissions (MT CO2e)	Biogenic Emissions (MT CO2e)
1351	Burlingame, Waste Water Treatment Plant	1103 Airport Boulevard	Burlingame	196.94	2,029.09

Table 8-3: Included Stationary Source Emissions by Plant					
Plant #	Plant Name	Plant Address	City	Non-Biogenic Emissions (MT CO2e)	Biogenic Emissions (MT CO2e)
1632	Guittard Chocolate Company	10 Guittard Road	Burlingame	121.79	
2227	Mills Peninsula Medical Center	1501 Trousdale Drive	Burlingame	31,491.78	
3812	Putnam Mazda	3 California Drive	Burlingame	0.02	
9867	Burlingame Collision Repair Center	123 California Drive	Burlingame	6.75	
10175	DeVincenzi Metal Products	1655 Rollins Road	Burlingame	97.33	
11020	San Mateo County Office of Education	1800 Rollins Road	Burlingame	6.88	
13079	City of Burlingame	1079 Rollins Road	Burlingame	3.30	
13325	Embassy Suites Hotel	150 Anza Boulevard	Burlingame	1.10	
13454	Pacific Bell	1480 Burlingame Avenue	Burlingame	5.25	
14464	City of Burlingame	399 Rollins Road	Burlingame	0.04	
14467	City of Burlingame	2817 Rivera Drive	Burlingame	0.61	
14468	City of Burlingame	425 Carolan Avenue	Burlingame	0.14	
14469	City of Burlingame	710 Airport Boulevard	Burlingame	0.12	
14470	City of Burlingame	842 Cowan Road	Burlingame	0.20	
14472	City of Burlingame	1111 Trousdale Drive	Burlingame	0.10	
14474	City of Burlingame	501 Primrose Road	Burlingame	0.11	
14476	City of Burlingame	1740 Rollins Road	Burlingame	0.20	
14850	City of Burlingame Public Works Department	California St & Grove St	Burlingame	0.15	
14910	Putnam Automotive	50 California Drive	Burlingame	0.02	
14911	Putnam Automotive	198 California Drive	Burlingame	0.10	
15280	Alexandria Real Estate Equities Inc	863 Mitten	Burlingame	1.61	
15703	City of Burlingame	1361 N Carolan Avenue	Burlingame	0.91	
16377	City of Burlingame, Hyatt Pump Station	1301 Bayshore Boulevard	Burlingame	0.08	
16542	\-Bay Park Plaza LP,a Delaware Limited Prtnrs	555 Airport Boulevard	Burlingame	0.21	
16543	\-Bay Park Plaza LP,a Delaware Limited Prtnrs	577 Airport Boulevard	Burlingame	0.47	
16626	Anza Park & Sky	615 Airport Boulevard	Burlingame	0.12	
16705	Hilton San Francisco Airport Hotel	600 Airport Boulevard	Burlingame	1.42	
16844	SPRINT	1 Adrian Court	Burlingame	83.08	
17695	Virgin America	555 Airport Boulevard	Burlingame	2.03	
17719	Sisters of Mercy	2300 Adeline Drive	Burlingame	0.53	
18537	City of Burlingame	Trousdale Drive	Burlingame	0.16	
18931	Verizon Wireless (Ecr Trousdale)	1801 Murchison Drive	Burlingame	0.75	
19544	Alexandria Real Estate Equities, Inc	863A Mitten Road	Burlingame	0.40	
19643	AMR West Burlingame	1510 Rollins Road	Burlingame	0.30	
20064	CA-One Bay Plaza LP	1350 Old Bayshore Hwy	Burlingame	0.90	
20512	ECC (Environmental Chemical Corp)	1240 Bayshore Highway	Burlingame	0.58	

20652	Peninsula Humane Society and SPCA	1450 Rollins Road	Burlingame	0.20	
21124	ARE-819/863 Mitten Road, LLC	866 Malcom Road, Ste 110	Burlingame	0.59	
21169	CalBay	1009 Rollins Road	Burlingame	0.02	
21393	5 Fifteen Auto Body	1221 Rollins Road	Burlingame	13.22	
21473	Alvins of San Francisco	389 Beach Road	Burlingame	72.53	
22057	Burlingame Long Term Care Center	1100 Trousdale Drive	Burlingame	1.83	
22369	Chilton Auto Body (South)	925 Bayswater Street	Burlingame	46.88	
22604	Bay Area Vein & Vascular Center	1850 El Camino Real	Burlingame	2.18	

Summary: Transportation Emissions

Summary of Methodology Used

Transportation emissions are summarized in this worksheet. Transportation emissions in Burlingame are based on the destination-origin method using the same MTC dataset from Plan Bay Area 2040 (PBA 2040). Calculations provided are done separately for gasoline fuel usage & VMT, as well as diesel fuel usage & VMT. the VMT fuel mix is used to determine the portion of VMT that is gasoline, diesel, and electric. Average fuel efficiencies are then applied to estimate the gasoline and diesel fuel consumption. CO_2 emission factors are applied to the estimated fuel consumption to calculate CO_2 emissions, and CH_4 and N_2O emission factars are applied to VMT to calculate CH_4 and N_2O emissions. This methodology has been updated since the 2009 CAP and 2010 Inventory based on two factors:

1) The ICLEI U.S. Community Protocol (July 2013) provides that preference is given to the origin-destination method (using a demand-based allocation model) of vehicle trips by community members, as opposed to emissions from vehicles driving inside the community boundary (page 9); and
2) Recommendation from the BAAQMD.

Table 9-1: Summary of Origin Destination On-road Transportation

Jurisdiction	Annual VMT Emissions in City			
	Gasoline Emissions (MT CO_2e)	Diesel Emissions (MT CO_2e)	Natural Gas Emissions (MT CO_2e)	Total Emissions (MT CO_2e)
Burlingame	91,481	10,885	99	102,465

Table 9-2: Emission Factors for On-road Transportation Fuels

	Gasoline		Diesel		Natural Gas	
Greenhouse Gas	Emissions (grams/gallon)	Emissions (grams/mile)	Emissions (grams/gallon)	Emissions (grams/mile)	Emissions (grams/gallon)	Emissions (grams/mile)
CO_2	8,595		10,179		7848.654391	
CH_4		0.024557273		0.026694083		4.163352435
N_2O		0.02		0.16		0.730993021

Emission Factors derived from the EMFAC model, specifically using EMFAC2017 (v1.0.2).

Table 9-3: On-road VMT Attributable to Gasoline vs. Diesel Vehicles			
Percent of Total VMT Attributable to Gasoline Vehicles	Percent of Total VMT Attributable to Diesel Vehicles	Percent of Total VMT Attributable to Electric Vehicles	Percent of Total VMT Attributable to Natural Gas Vehicles
95.30%	3.95%	0.73%	0.01%

Percent of VMT attributable to gasoline, diesel, and nautral gas vehicles derived from the EMFAC model, specifically using EMFAC2017 (v1.0.2).

Table 9-4: On-road Fuel Efficiencies of Gasoline, Diesel, and Natural Gas Vehicles		
Gasoline Vehicles Miles Per Gallon (MPG)	Diesel Vehicles Miles Per Gallon (MPG)	Natural Gas Vehicles Miles Per Diesel Gallon Equivalent (Mi/DGE)
23.13	9.81	2.19

MPG of gasoline and diesel vehicles are based on the EMFAC model, specifically EMFAC2017 (v1.0.2).

Table 9-5: Summary of Origin-Destination On-road Transportation VMT & Fuel Consumption by Fuel						
Jurisdiction	In Burlingame			Gallons of Fuel Consumed		
	Gasoline VMT	Diesel VMT	Natural Gas VMT	Gasoline Fuel Consumption (gal)	Diesel Fuel Consumption (gal)	Natural Gas Fuel Consumption (Mi/DGE)
Burlingame	242,818,630	10,064,361	25,479	10,497,995	1,025,929	11,634

Table 9-6: Summary of In-boundary On-road Transportation Emissions by Fuel Type & Greenhouse Gas									
	In Burlingame								
Jurisdiction	Gasoline Emissions (MT CO2)	Gasoline Emissions (MT CH4)	Gasoline Emissions (MT N2O)	Diesel Emissions (MT CO2)	Diesel Emissions (MT CH4)	Diesel Emissions (MT N2O)	Natural Gas Emissions (MT CO2)	Natural Gas Emissions (MT CH4)	Natural Gas Emissions (MT N2O)
Burlingame	90,226	5.96	4.11	10,443	0.27	1.64	91.3	0.1	0.02

Table 9-7: IPCC AR5 Global Warming		
CO2	CH4	N2O
1	28	265

Table 9-8: Universal	
MT / gram	0.000001

Origin-Destination VMT Data Summary

Summary of Methodology Used

The origin-destination methodology is a methodology used for estimating VMT. The origin-destination methodology was not used in the 2009 CAP or 2010 Inventory, but has been updated here for reasons discussed in the "Transporation Emissions" sheet.

Table 10-1: 2015 Summary of Origin-Destination On-road Transportation VMT

Jurisdiction	2015 Data			
	2015 Days In Year Multiplier	[redacted]	2015 Daily VMT	2015 Annual VMT
[redacted]				
Burlingame	347.00	[redacted]	734,277	254,793,946

Tom Buckley (tbuckley@bayareametro.gov) and Kearey Smith (ksmith@bayareametro.gov) at MTC provided these VMT metrics. This dataset was also used in Plan Bay Area 2040. Multiplier based on CARB's GHG inventory rechnical support document for LDA (conservative).

CARB Technical Support Document

Plan Bay Area 2040 VMT Data

Summary of Methodology Used

Data provided by Tom Buckley (tbuckley@bayareametro.gov) and Kearey Smith (ksmith@bayareametro.gov) at MTC. VMT apportioned to Burlingame as follows:

*100% from the "Entirely_Within" Column
*50% from the "Partiall_Within" Column
* 0% from the "Entirely_Outside" Column.

Table 11-1: 2015 Raw Origin-Destination On-road Transportation VMT Data Supplied by MTC

Population_Segment	persons	model_run	Entirely_Within	Partially_Within	Entirely_Outside
Live in area-Works in area	2852	2015_06_YYY	6321	16899	1770
Live in area-Works out of area	12214	2015_06_YYY	6628	227621	60676
Live in area-Non-worker	15012	2015_06_YYY	11838	117307	16932
Live out of area-Works in area	30446	2015_06_YYY	6039	642452	208988
Live out of area-Works out of area	3973450	2015_06_YYY	1546	233206	85764160
Live out of area-Non-worker	3536548	2015_06_YYY	2382	161560	28014216

Table 11-2: Daily VMT Summary

2015 Daily VMT
734276.5

Summary: Caltrain Diesel Emissions

Summary of Methodology Used

Caltrain is a commuter rail service that operates on diesel fuel, and runs from Gilroy to San Jose to San Francisco. Caltrain passes through 12 jurisdictions in San Mateo County on the portion of the rail line that goes from San Jose to San Francisco; of these 12 jurisdictions, 11 of them have one or more Caltrain stations. Caltrain track passes through portions of unincorporated San Mateo County, but these portions of the Caltrain track do not have a station. However, the portion that runs from Gilroy to San Jose only includes limited operations. Thus, this analysis includes a weighting of the total track-miles in San Mateo County based on the number of trains that operate between Gilroy and San Jose, as well as the number of trains that operate from San Jose to San Francisco. (The methodology for this weighting, or attribution, in consistent with equation TR.4.D.1 in the Community GHG Protocol, Appendix D.) The overall methodology used to calculate Caltrain diesel emissions is from the ICLEI Community GHG Protocol, Appendix D, Transportation. Specifically, sections TR.4.A and TR.4.B and equations TR.4.A.2 and TR.4.B.2. As directed in the ICLEI Community GHG Protocol, emission factors for diesel fuel use in locomotives were taken from Chapter 13 of The Climate Registry's General Reporting Protocol.

Total diesel fuel usage by Caltrain was found in the 2015 National Transit Database, and then is allocated to each of the San Mateo County jurisdictions based the weighted track distance in San Mateo County, and also based on the estimated track mileage in each jurisdiction. The track mileage in each jurisdiction was estimated using maps of each jurisdiction. Emission factors for diesel fuel combustion were used to calculate emissions in each jurisdiction. Caltrain also reported gasoline and diesel use in buses for 2015 in the National Transit Database, but this fuel consumption and associated emissions are not calculated in this worksheet, but instead are included in the on-road vehicle emissions included elsewhere in this inventory.

Table 12-1: Key Caltrain Assumptions

Data Description	Data
Total Length of Track in Caltrain System (track miles)	77.00
Total Annual Diesel Fuel Consumption in Caltrain System (gal)	4,335,189
CO2 Diesel Emission Factor (MT CO2 / gal)	0.01
CH4 Diesel Emission Factor (MT CH4 / gal)	0.0000008
N2O Diesel Emission Factor (MT N2O / gal)	0.0000003
Total Annual Diesel Emissions in Caltrain System (MT CO2e)	44,658
Trains per year in 25-mile San Jose to Gilroy portion of Caltrain System (trains / year)	1,560
Trains per year in 51-mile San Francisco to San Jose portion of Caltrain System (trains / year)	41,610
Weighted total length of track in Caltrain system accounting for reduced service along 25-mile San Jose to Gilroy portion of Caltrain System (weighted track miles)	51.94
Total Length of Track in Caltrain System (track miles) is from Caltrain's Final Environmental Assessment and EIR (p. 1-3).	
CO2, CH4 and N2O diesel emission factors are from The Climate Registry General Reporting Protocol, Default Emission Factors and standard GWPs.	
The total annual diesel fuel consumption in Caltrain system is from the National Transit Database (Energy Consumption table).	National Transit Database Source

Table 12-2: Caltrain Track Length, Fuel Use and Emissions

Jurisdiction	Track Length in Jurisdiction (Meters)	Track Length in Jurisdiction (Miles)	Ratio of Track Length in Jurisdiction / Weighted Total Length of Track in Caltrain System	Caltrain Emissions (MT CO2e)	Caltrain Diesel Fuel Use (gal)
Burlingame	4,625	2.9	0.06	2,471	239,879

Track distances in meters found using Google Maps estimates.

Table 12-3: IPCC 5AR Global Warming Potentials

CO2	CH4	N2O
1	28	265

Table 12-4: Universal Conversion Factors	
miles / meter	0.0006214

Summary: Freight Train Emissions

Summary of Methodology Used

The methodology for estimating freight train emissions is taken from the Community GHG Protocol, Appendix D, section TR.3. Specifically, the equation used to estimate emissions is TR.3.1. This methodology suggests finding the tonnage of freight moved and multiplying by the miles of track to estimate the ton miles of goods moved. The tonnages of goods moved is unavailable, so this analysis uses an estimate of ton miles per mile of track from the California State Rail Plan, and then multiplies the ton miles per mile of track by the miles of track in San Mateo County to find the ton miles in San Mateo County. The total ton miles are then used to estimate diesel fuel consumption. As directed in the ICLEI Community GHG Protocol, emission factors for diesel fuel use in locomotives were taken from Chapter 13 of The Climate Registry's General Reporting Protocol. The train track passes through 12 jurisdictions in San Mateo County; emissions from diesel fuel consumption in San Mateo County are then allocated to each jurisdiction based on their portion of the track in their boundaries.

Freight trains are operated on the Caltrain track line at night, after the Caltrain operations have ended. According to the 2013 California State Rail Plan, the volume of freight trains operating on the Caltrain track is unknown. (See Exhibit 6.8 on page 138). Webpage: http://californiastaterailplan.dot.ca.gov/docs/Final_Copy_2013_CSRP.pdf

According to one observer, freight trains make up less than 5% of train traffic on the Caltrain track. (source: http://caltrain-hsr.blogspot.com/2009/08/effect-of-heavy-freight.html). At the current 92 Caltrain trains per weekday, 5% would equal 4.6 trains/day, which is used in this analysis as a conservative estimate of freight trains operating on the line. Thus, this analysis estimates that 4.9 million gross ton-miles per mile of freight are carried on the Caltrain tracks each year. This is the smallest number category in the 2013 California State Rail Plan and reflects a light amount of freight operations on the Caltrain line, at an estimated 4.6 trains/day. It is unknown whether there are switching yards in San Mateo County; thus, the emissions from switching yards are excluded from this analysis.

Table 13-1: Freight Trains Key Assumptions	
Data Description	**Data**
Caltrain Trains per Day on Weekdays (trains/day)	92
Percent of Total Rail Traffic Attributable to Freight Trains	5%
Freight Trains per Day (trains/day)	4.6
Days in Year	365
Freight Trains per Year (trains/year)	1,679
Million Gross Ton Miles per Mile of Track per Year (gross ton miles/mile track/year)	4.9
Total Miles of Track in San Mateo County (track miles)	23.3
Fright Train Ton Miles Per Year in San Mateo County (ton miles/year)	114,333,333
Freight Train Ton Miles per Gallon of Diesel (ton mile/gal)	457
Freight Train Diesel Consumption per Year in San Mateo County (gal/year)	250,182
CO2 Diesel Emission Factor (MT CO2 / gal)	0.010
CH4 Diesel Emission Factor (MT CH4 / gal)	0.00000080
N2O Diesel Emission Factor (MT N2O / gal)	0.00000026
Total Length of Track in Caltrain System (track miles) is from Caltrain's Final Environmental Assessment and EIR (p. 1-3).	
Fright train ton miles per gallon of diesel is from ICLEI Community Protocol, Appendix D, page 33 (equation TR.3.1).	
CO2, CH4 and N2O diesel emission factors are from The Climate Registry General Reporting Protocol, Default Emission Factors and standard GWPs.	

Table 13-2: Emissions from Freight Trains in San Mateo County			
Freight Train Diesel CO2 Emissions (MT CO2)	**Freight Train Diesel CH4 Emissions (MT CH4)**	**Freight Train Diesel N2O Emissions (MT N2O)**	**Total Freight Train Diesel Emissions (MT CO2e)**
2,554	0.20	0.07	2,577

Table 13-3: Freight Train Track Length, Fuel Use and Emissions				
Jurisdiction	**Track Length in Jurisdiction (Miles)**	**Percentage of Total Caltrain System Track Length in Jurisdiction**	**Freight Train Emissions (MT CO2e)**	**Freight Trains Diesel Fuel Use (gal)**
Burlingame	2.9	12.3%	317	30,820
County Total:	23.3			

Track distances in meters found using Google Maps estimates.

Table 13-4: IPCC 5AR Global Warming Potentials		
CO2	**CH4**	**N2O**
1	28	265

Summary: Off-road Emissions

Summary of Methodology Used

Off-road emissions were calculated using the ARB Offroad2007 Model. The EPA NONROAD model was not used, as recommended in the ICLEI Community GHG Protocol, because the ARB model is assumed to be more accurate for California communities. The model was run for the 2015 calendar year, and for all of San Mateo County. Total county-wide emissions are summed below. Emissions are then allocated to each jurisdiction based on population or the number of jobs, by emission type. For the full model data results, see the worksheet called "Transpo_Offroad data." This worksheet includes a summary of the model's data and the allocation methodology for each type of emissions. The table below shows the total allocated emissions.

Table 14-1: Summary of Off-road Emissions in San Mateo County by Emissions Type

Type of Off-road Emissions	CO2 Emissions (tons CO2/day)	N2O Emissions (tons N2O/day)	CH4 Emissions (tons CH4/day)	Allocate Emissions to Jurisdiction by:
Agricultural Equipment	26.8	0.0	0.0	Number of Jobs
Airport Ground Support Equipment	222.7	0.0	0.0	SFO is located in unincorporated San Mateo County, and the County owns and operates two general aviation airports: the San Carlos Airport and the Half Moon Bay Airport. Thus, 100% of these emissions will be allocated to San Mateo County.
Construction and Mining Equipment	531.0	0.0	0.1	Number of Jobs
Entertainment Equipment	1.4	0.0	0.0	Number of Jobs
Industrial Equipment	122.4	0.0	0.0	Number of Jobs
Lawn and Garden Equipment	36.5	0.0	0.1	Population
Light Commercial Equipment	85.5	0.0	0.0	Number of Jobs
Oil Drilling	0.5	0.0	0.0	Number of Jobs
Pleasure Craft	29.8	0.0	0.0	Population
Rail yard Operations	0.0	0.0	0.0	Emissions will be evenly allocated to the following 12 jurisdictions with rail lines: Atherton, Belmont, Brisbane, Burlingame, Menlo Park, Millbrae, Redwood City, San Bruno, San Carlos, San Mateo (City), San Mateo (County), South San Francisco.
Recreational Equipment	6.1	0.0	0.0	Population
Transport Refrigeration Units	69.8	0.0	0.0	Number of Jobs
Total:	**1,132.4**	**0.08**	**0.30**	

Off-road emissions data from ARB Offroad2007 Model.

Table 14-2: Summary of Total Off-road Emissions in Jurisdiction

Jurisdiction	Jurisdiction Population	Jurisdiction Employment	Percent of Total County Population in Jurisdiction	Percent of Total County Employment in Jurisdiction	Total Off-road CO2 Emissions (tons CO2/day)	Total Off-road N2O Emissions (tons N2O/day)	Total Off-road CH4 Emissions (tons CH4/year)	Total Off-road CO2 Emissions (MT CO2/year)	Total Off-road N2O Emissions (MT N2O/year)	Total Off-road CH4 Emissions (MT CH4/year)	Total Off-road Emissions (MT CO2e/year)
Burlingame	29,724	29,879	3.9%	8.2%	71.40372	0.0036	0.0159	23,643	1.2	5.2	24,105
County Total:	765,135	364,767	100.0%	100.0%	1,114	0.0806	0.3069	368,974	26.7	101.6	380,385

Jurisdiction population and employment used is the same as that presented in Table CX-1 of the Community Context Element. Although these metrics are for 2016, it is the most detailed data availble and was obtained from a DOF report. County total is from the US Census Source identified in Table 3, below.

Table 14-3: San Mateo County Population: 2010-2015

Year	Estimated Population	Growth Rate
2010	718,451	
2011	728,288	1.37%
2012	738,681	1.43%
2013	747,373	1.18%
2014	758,581	1.50%
2015	765,135	0.86%

Data on 2010-2015 San Mateo County population estimates are form the US Census. US Census Source

Table 14-4: Jurisdiction Population and Employment Projections: 2010-2015

Jurisdiction	2010 Population	2010 % of Countywide Population	2010 Employment	2040 Estimated Employment	Estimated 2011 Population	Estimated 2011 Employment	Estimated 2012 Population	Estimated 2012 Employment	Estimated 2013 Population	Estimated 2013 Employment	Estimated 2014 Population
Burlingame	28,806	4.0%	29,540	37,780	29,200	29,815	29,617	30,089	29,966	30,364	30,415
County Total:	718,451	100.0%	345,190	445,070	728,288	348,519	738,681	351,849	747,373	355,178	758,581

Data on 2010-2015 San Mateo County employment estimates are from Plan Bay Area (2040) Plan Bay Area Source

Table 5: IPCC 5AR Global Warming		
CO2	**CH4**	**N2O**
1	28	265

Table 6: Universal Conversion Factors	
days / year	365
MT / short ton	0.907185

San Mateo County: Offroad Emissions

Summary of Methodology Used

Offroad emissions were calculated using the ARB Offroad2007 Model. The EPA NONROAD model was not used, as recommended in the ICLEI Community GHG Protocol, because the ARB model is assumed to be more accurate for California communities. The model was run for the 2015 calendar year, and for all of San Mateo County. Total county-wide emissions are summed below. Emissions are then allocated to each jurisdiction based on population and jobs, by emission type. For the emission allocation results, see the worksheet called "Transpo_Offroad totals."

Table 15-1: Summary of Off-road Emissions in San Mateo County by Emissions Type

Type of Emissions	Sum of CO2 Exhaust	Sum of N2O Exhaust	Sum of CH4 Exhaust
Agricultural Equipment	26.8	0.0	0.0
Airport Ground Support Equipment	222.7	0.0	0.0
Construction and Mining Equipment	531.0	0.0	0.1
Entertainment Equipment	1.4	0.0	0.0
Industrial Equipment	122.4	0.0	0.0
Lawn and Garden Equipment	36.5	0.0	0.1
Light Commercial Equipment	85.5	0.0	0.0
Oil Drilling	0.5	0.0	0.0
Pleasure Craft	29.8	0.0	0.0
Rail yard Operations	0.0	0.0	0.0
Recreational Equipment	6.1	0.0	0.0
Transport Refrigeration Units	69.8	0.0	0.0
Grand Total	**1,132.44**	**0.08**	**0.30**

Off-road emissions data from ARB Offroad2007 Model.

Summary: Landfills Emissions

Summary of Methodology Used

Currently, the only open landfill in San Mateo County is located in the unincorporated County area. Therefore, there is little change of double-counting landfill emissions for the jurisdictions in San Mateo County, with the exception of the County of San Mateo. This section of the inventory includes estimated GHG emissions from closed or otherwise inactive landfills in San Mateo County.

This analysis uses the methodologies in the Community GHG Protocol, Appendix E, in particular calculation method SW.1.1, which uses the California FOD model. When data are not available to use calculation methodology SW.1.1, this analysis is based on methodologies in the Local Government Operations Protocol. Some GHG emissions from landfills are also provided by the BAAQMD, but their methodologies differ from those in the LGOP and in the Community GHG Protocol, so BAAQMD landfill emissions data are not used in this analysis.

Table 16-1: Included Landfill Emissions

Landfill Name	Landfill Jurisdiction	Activity	Operational Status	Owner	Landfill Emissions (MT CO2e)	Landfill Emissions (MT CH4)	Summary of Methodology for Calculating Landfill Emissions
Burlingame Refuse Disposal Area	Burlingame	Solid Waste Disposal Site	Closed	City of Burlingame	277	10	Calculated using LGOP methodology (same methodology used in municipal inventories). Inputs provided by Sigalle Michael - Sustainability Coordinator for Burlingame.

Summary: Waste - Disposal Emissions

Summary of Methodology Used

Emissions were calculated using equation SW.4.1 of the Community GHG Protocol, Appendix E (page 24), as well as emission factors from Table SW.5 from the same document. This equation and the emission factors used to calculate emissions are shown below. In general, waste disposal to the landfill and the amount of Alternative Daily Cover is provided for each jurisdiction in the CalRecycle Disposal Reporting System database. Waste characterization data from the 2014 Disposal-Facility-Based Characterization of Solid Waste in California study are used to determine what percentages of materials are in the disposed waste stream. For Alternative Daily Cover, the waste characterization is provided in the CalRecycle Disposal Reporting System by jurisdiction. Tonnages of each waste material disposed are summed, and then multiplied by emission factors in the Community GHG Protocol to determine total emissions from disposed waste.

Table 17-1: Summary of Disposed Waste Emissions

Jurisdiction	Disposed Waste Emissions (MT CO2e)	Alternative Daily Cover Emissions (MT CO2e)	Total Solid Waste Disposal Emissions (MT CO2e)
Burlingame	5,773	271	6,043

Table 17-2: Emission Factors for Solid Waste by Waste Type

Corrugated Containers (MT CH4 / wet short ton of waste)	Newspaper (MT CH4 / wet short ton of waste)	Office Paper (MT CH4 / wet short ton of waste)	Magazines/ Third Class Mail (MT CH4 / wet short ton of waste)	Food Scraps (MT CH4 / wet short ton of waste)	Grass (MT CH4 / wet short ton of waste)	Leaves (MT CH4 / wet short ton of waste)	Branches (MT CH4 / wet short ton of waste)	Dimensional Lumber (MT CH4 / wet short ton of waste)
0.120	0.043	0.203	0.049	0.078	0.038	0.013	0.062	0.062

Emission Factors by waste type are from U.S. Community Protocol Table SW.5

Table 17-3: Disposed Waste Emissions Calculation Assumptions	
Equation SW.4.1. Variable	**Value**
GWP_{CH4} =	28
M=	see below for data sources regarding solid waste disposal
P_i=	see below for data sources regarding waste characterization
EF_i=	see box to the right showing Table SW.5
CE=	0.75
OX=	0.10

Table 17-4: Waste Composition

Waste Type	Percentage of All Waste	Percentage of Average ADC
Corrugated Containers	3.1%	Varies by Jurisdiction. See Waste-ADC worksheet.
Newspaper	1.2%	
Office Paper	0.7%	
Magazines/Third Class Mai	0.6%	
Food Scraps	18.1%	
Grass	1.9%	
Leaves	1.9%	
Branches	1.70%	
Dimensional Lumber	11.9%	

Waste Characterization is based on the California 2008 Statewide Waste Characterization Study. Used Table 7 on page 24 showing the composition of California's Overall Disposed Waste Stream.	Waste Characterization Study Source
Used the subcategory of "Uncoated Corrugated Cardboard" in the Waste Characterization Study for "Corrugated Containers" in the table above.	
Used the subcategory of "Newspaper" in the Waste Characterization Study for "Newspaper" in the table above.	
Used the subcategories of "White Ledger Paper" and "Other Office Paper" in the Waste Characterization Study for "Office Paper" in the table above.	
Used the subcategory of "Magazines and Catalogs "in the Waste Characterization Study for "Magazines/Third Class Mail" in the table above.	
Used the subcategory of "Food" in the Waste Characterization Study for "Food Scraps" in the table above.	
Used half of the subcategory of "Leaves and Grass" for "Grass" in the table above. The other half of the subcategory of "Leaves and Grass" was assigned to "Leaves" in the table above. The subcategory of "Branches and Stumps" was also assigned to "Branches" in the table above.	
Used the subcategory of "Lumber" for "Dimensional Lumber" in the table above.	
ADC Waste Characterization: ADC waste characterization is also provided in the CalRecycle Disposal Reporting System, and is provided by jurisdiction. The totals of ADC by waste type are shown on the "Waste-ADC" worksheet. It is assumed that 50% of the ADC category of "Green Waste" is grass, and 50% of the "Green Waste" category is branches. The total tonnages of grass and branches from ADC is included n the Waste Disposal Tonnages, Alternative Daily Cover table below.	CalRecycle Source

Table 17-5: Waste Disposal and Alternative Daily Cover Tonnages by Waste Type

Total Waste Disposal (short tons)	Total Alternative Daily Cover (short tons)	Total - Waste Disposal and Alternative Daily Cover (short tons)	Corrugated Containers (short tons)	Newspaper (short tons)	Office Paper (short tons)	Magazines/Third Class Mail (short tons)	Food Scraps (short tons)	Grass (short tons)	Leaves (short tons)	Branches (short tons)	Dimensional Lumber (short tons)	Grass (short tons)	Branches (short tons)
31,093	2,006	33,099	964	373	218	187	5,628	591	591	529	3,700	430	430

Waste disposal tonnages and ADC tonnages from CalRecycle Jurisdiction Disposal Reports. Detailed results below. CalRecycle Source

Table 15-6: Burlingame Waste Production and Destination

Destination Facility	SWISNo	Qtr	Instate Ton	Transform Ton	Export Ton	Total ADC	Total AIC		
Altamont Landfill & Resource Recv`ry	01-AA-0009		56		0	38.94	0		
Azusa Land Reclamation Co. Landfill	19-AA-0013		10		0	0	0		
Corinda Los Trancos Landfill (Ox Mtn)	41-AA-0002		28968		0	978.19	0		
Foothill Sanitary Landfill	39-AA-0004		2		0	0	0		
Forward Landfill, Inc.	39-AA-0015		90		0	0	0		
Guadalupe Sanitary Landfill	43-AN-0015		9		0	0	0		
Keller Canyon Landfill	07-AA-0032		79		0	0	0		
Monterey Peninsula Landfill	27-AA-0010		998		0	0	0		
Newby Island Sanitary Landfill	43-AN-0003		5		0	0	0		
Potrero Hills Landfill	48-AA-0075		39		0	811.57	0		
Recology Hay Road	48-AA-0002		604	0	0	0	0		
Redwood Landfill	21-AA-0001		0.17		0	0.12	0		
Vasco Road Sanitary Landfill	01-AA-0010		6		0	0	0		
Zanker Material Processing Facility	43-AN-0001		222		0	177.25	0		
Zanker Road Class III Landfill	43-AN-0007		3		0	0.01	0		
Yearly Totals:			**31092.73**	**0**	**0**	**2006.08**	**0**		

Table ES-3: Composition of California's Overall Disposed Waste Stream by Material Type

	Est. Using 2014 Sector Percentages			Est. Using 2008 Sector Percentages		
Material	**Estimated Percent**	**+ / -**	**Estimated Tons**	**Estimated Percent**	**+ / -**	**Estimated Tons**
Paper	**17.4%**		**5,367,734**	**16.8%**		**5,176,996**
Uncoated Corrugated Cardboard	3.1%	0.6%	964,942	3.7%	0.8%	1,152,480
Paper Bags	0.2%	0.0%	70,627	0.2%	0.0%	62,259
Newspaper	1.2%	0.4%	372,966	0.9%	0.3%	285,517
White Ledger Paper	0.4%	0.1%	121,637	0.4%	0.2%	132,219
Other Office Paper	0.3%	0.1%	103,845	0.3%	0.1%	89,177
Magazines and Catalogs	0.6%	0.1%	178,166	0.5%	0.1%	158,407
Phone Books and Directories	0.0%	0.0%	14,583	0.0%	0.0%	13,590
Other Miscellaneous Paper	3.9%	0.4%	1,215,919	3.8%	0.5%	1,164,676
Remainder/Composite Paper	7.5%	0.6%	2,325,048	6.9%	0.6%	2,118,672
Glass	**2.5%**		**764,162**	**2.5%**		**770,530**
Clear Glass Bottles and Containers	0.9%	0.1%	263,439	0.7%	0.1%	225,563
Green Glass Bottles and Containers	0.2%	0.1%	71,382	0.2%	0.1%	57,935
Brown Glass Bottles and Containers	0.4%	0.1%	111,432	0.3%	0.1%	104,175
Other Glass Colored Bottles and Containers	0.0%	0.0%	12,185	0.0%	0.0%	11,843
Flat Glass	0.1%	0.1%	42,481	0.2%	0.2%	56,510
Remainder/Composite Glass	0.9%	1.0%	263,243	1.0%	1.3%	314,504
Metal	**3.1%**		**957,027**	**3.1%**		**964,502**
Tin/Steel Cans	0.7%	0.1%	204,449	0.6%	0.2%	186,422
Major Appliances	0.2%	0.2%	50,251	0.1%	0.1%	29,000
Used Oil Filters	0.0%	0.0%	1,255	0.0%	0.0%	1,098
Other Ferrous	0.8%	0.2%	248,593	0.9%	0.3%	267,932
Aluminum Cans	0.2%	0.0%	47,233	0.1%	0.0%	42,696
Other Non-Ferrous	0.5%	0.2%	157,478	0.6%	0.3%	181,009
Remainder/Composite Metal	0.8%	0.2%	247,768	0.8%	0.3%	256,344
Electronics	**0.9%**		**273,878**	**0.7%**		**230,498**
Brown Goods	0.3%	0.2%	84,415	0.2%	0.1%	75,142
Computer-related Electronics	0.1%	0.1%	45,648	0.1%	0.1%	41,339
Other Small Consumer Electronics	0.2%	0.1%	68,932	0.2%	0.1%	54,457
Video Display Devices	0.2%	0.1%	74,883	0.2%	0.1%	59,560
Plastic	**10.4%**		**3,215,943**	**10.4%**		**3,203,542**
PETE Containers	0.6%	0.1%	197,202	0.6%	0.1%	179,529
HDPE Containers	0.5%	0.1%	139,189	0.4%	0.1%	136,693
Miscellaneous Plastic Containers	0.6%	0.1%	173,738	0.5%	0.1%	165,343
Plastic Trash Bags	1.2%	0.1%	383,130	1.2%	0.2%	379,315
Plastic Grocery and Other Merchandise Bags	0.5%	0.1%	157,395	0.4%	0.0%	128,298
Non-Bag Commercial and Industrial Packaging Film	0.3%	0.1%	83,192	0.3%	0.1%	102,661
Film Products	0.2%	0.3%	73,394	0.4%	0.5%	118,895
Other Film	1.8%	0.2%	543,476	1.7%	0.2%	523,211
Durable Plastic Items	2.2%	0.5%	682,812	2.2%	0.5%	671,213
Remainder/Composite Plastic	2.5%	0.3%	782,415	2.6%	0.5%	798,384

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.
More detailed composition tables can be found in Appendix D: Expanded Statewide Waste Characterization Tables

The above table presents the 2014 sector percentages applied to the 2014 waste composition data and, for comparison, the sector percentages obtained in the 2008 Statewide Waste Characterization Study applied to the 2014 waste composition data. See *Special Note Regarding Sector Percentages* on Page 3 for a further explanation of the sector percentage issues.

Table SW.5 CH_4 Yield for Solid Waste Components		
Waste Component	Emissions Factor, EF_i (mt CH_4/wet short ton waste)	Source
Mixed MSW*	0.060	U.S. EPA AP-42
Newspaper	0.043	WARM
Office Paper	0.203	WARM
Corrugated Containers	0.120	WARM
Magazines/Third-Class Mail	0.049	WARM
Food Scraps	0.078	WARM
Grass	0.038	WARM
Waste Component	Emissions Factor, EF_i (mt CH_4/wet short ton waste)	Source
Leaves	0.013	WARM
Branches	0.062	WARM
Dimensional Lumber	0.062	WARM

* – Mixed MSW factor may be used for entire MSW waste stream if waste composition data is unavailable

U.S. EPA AP-42 – U.S. EPA Emission Factor Database, Chapter 2.4 Municipal Solid Waste Landfills (1998)

WARM—Documentation for Greenhouse Gas Emissions and Energy Factors Used in the Waste Reduction Model (WARM) 2006

Equation SW.4.1 Methane Emissions

$$CH_4\ Emissions = GWP_{CH4} * (1 - CE) * (1 - OX) * M * \sum_i P_i * EF_i$$

Where:

Term	Description	Value
CH_4 emissions	= Community generated waste emissions from waste M ($mtCO_2e$)	Result
GWP_{CH4}	= CH_4 global warming potential	
M	= Total mass of waste entering landfill (wet short ton)	User Input
P_i	= Mass fraction of waste component i	User Input
EF_i	= Emission factor for material i ($mtCH_4$/wet short ton)	Table SW.5
CE	= Default LFG Collection Efficiency	No Collection, 0 Collection, 0.75
OX	= Oxidation rate	0.10

Source: As developed by ICLEI staff and Solid Waste Technical Advisory Committee. Emissions factors from U.S. EPA Municipal Solid Waste Publication (2008) available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw2008data.pdf

Waste - Disposal Data (ADC)

Summary of Methodology Used

Alternative Daily Cover (ADC) waste tonnages and the waste characterization of ADC is provided in the CalRecycle Disposal Reporting System by jurisdiction. Results are shown in this worksheet. ADC data is from CalRecycle Disposal Reporting System: Alternative Daily Cover by Jurisdiction of Origin and Material Type.

Table 18-1: ADC by ADC Type and Composition of ADC Green Waste

Jurisdiction of Origin	ADC by ADC Type											Composition of ADC Green Waste		
	Auto Shred ADC (short tons)	C & D ADC (short tons)	Green Waste ADC (short tons)	Cont. Sedimt ADC (short tons)	Compost ADC (short tons)	Mixed ADC (short tons)	Sludge ADC (short tons)	Tires ADC (short tons)	Ash ADC (short tons)	Other ADC (short tons)	Total ADC (short tons)	Total Percentage of ADC that is Green Waste	Percentage of ADC Green Waste that is Grass	Percentage of ADC Green Waste that is Stumps
Burlingame	0.0	537.3	859.0	0.0		0.0	609.7	0.0	0.0	0.1	2,006.1	43%	21%	21%

ADC data is from CalRecycle Disposal Reporting System: Alternative Daily Cover by Jurisdiction of Origin and Material Type. CalRecycle Source

Table 18-2: Composition of Green Waste

Percentage of Green Waste that is Grass:	50%
Percentage of Green Waste that is Branches:	50%

Summary: Wastewater Emissions

Summary of Methodology Used

Wastewater Treatment Plant emissions are calculated based on the methodologies in the Community GHG Protocol, Appendix F - Wastewater and Water Emissions Activities and Sources. The wastewater treatment emissions include methane and nitrous oxide, which are considered process and fugitive emissions sources, as well as stationary sources. Process and fugitive emissions are calculated and typically included in the municipal operations inventory of the city that contains the wastewater treatment plant; this inventory uses existing emissions information from the municipal operations inventories for process and fugitive emissions, which use the calculation methodologies in the Local Government Operations Protocol. These methodologies are very similar to those in the Community GHG Protocol, Appendix F.

The BAAQMD provides a list of stationary source emissions from wastewater treatment plants; these emissions are from stationary combustion sources such as diesel turbines or generators, and are added to each plant's emissions total. If the combustion sources are known to be fired by natural gas, they are excluded from this portion of the inventory to avoid double counting, since natural gas combustion sources are included in the Energy sector of this inventory. The use of electricity at wastewater plants is also excluded from this sector to avoid double-counting, as electricity use is also included in the Energy sector of this inventory.

In most cases, wastewater treatment plants serve more than one jurisdiction. Thus, emissions from each plant are allocated to the jurisdictions that are served by each plant, using the population of the jurisdictions multiplied by the average emissions per capita of the plants. Reported GHG emissions for all sources are available for some plants, but are not available for all plants in San Mateo County. To estimate the wastewater-related emissions for each jurisdiction, the following methodology was used. The average emissions per capita, in metric tons CO2e/person is calculated for the plants for which data are available, and this average emissions per capita rate is used to estimate the emissions associated with wastewater treatment for the cities that are served or partially served by those plants. Emissions are estimated by multiplying each jurisdiction's population by the average emissions per capita.

As noted above, data are not available for some of the treatment plants. For the cities served by these plants, a total average emissions per capita is calculated for all the plants in San Mateo County that have reported GHG emissions data. This county wide average emissions per capita is used to estimate emissions from wastewater treatment for the cities served by a plant or plants that do not have data available.

Table 19-1: Summary of Wastewater Treatment Emissions

Jurisdiction	Population (2015)	Apportioned Emissions (MT CO2e)	Notes on Methodology
Burlingame	29,724	497	Used the average emission factor for the City of Burlingame Wastewater Treatment Plant

Table 19-2: Wastewater Treatment Plant Population Served, Emissions & Emissions per Capita			
Wastewater Treatment Plant	**Total Emissions**	**Population Served by Plant**	**Per Capita Emissions (MT CO2e/person)**
Burlingame Wastewater Treatment Plant	**602**	36,000	0.0167

Table 19-3: Detailed Methodology Explanation of Wastewater Treatment Plant Emissions Calculations	
Wastewater Treatment Plant	**Notes on Methodology**
Burlingame Wastewater Treatment Plant	The 2010 Community GHG Inventory used data from the 2010 Burlingame Municipal GHG Inventory for process + fugitive emissions and data from BAAQMD for stationary emissions. Process emissions, fugitive emissions, and population served data for 2015 was gathered by Sigalle Michael of Burlingame (smichael@burlingame.org) and provided by William Toci (william.toci@veolia.com).
	Jurisdiction population used is the same as that presented in Table CX-1 of the Community Context Element. Although the population was estimated for 2016, it is the most detailed data availble and was obtained from a DOF report.
	Jurisdictions served: Burlingame, portions of Hillsborough, portions of San Mateo County

Wastewater Treatment Emissions from Combustion Sources

Summary of Methodology Used

Data was provided by Stuart Schulz of the Bay Area Air Quality Management District. (Sschulz@baaqmd.gov). Publicly-owned treatment works (POTW) facilities within the BAAQMD are permitted by the District's Engineering Division staff. The greenhouse gas (GHG) emissions, namely CO2, Biogenic CO2, CH4, and N2O, from the permitted POTW facilities are from combustion sources only.

Table 20-1: Wastewater Treatment Emissions from Combustion Sources

Plant No.	Name	Address	Zip Code	Description	Source No.	Emissions					
						Emissions from CO2 (MT CO2)	Emissions from CH4 (MT CH4)	Emissions from N2O (MT N2O)	Biogenic Emissions (MT CO2)	Total Non-biogenic Emissions (MT CO2e)	Total Non-biogenic Emissions in Jurisdiction (MT CO2e)
1351	City of Burlingame, Waste Water Treatment Plant	1103 Airport Blvd	94010	Waste Gas Flare	-192	0.00	1.514	0.008847	801	35	196.94000
1351			94011	Burlingame Landfill (closed) with Active Gas	9	0.00	0.750	0.003725	189	17	
1351			94012	Boiler #1 equipment #1124	10	0.00	0.248	0.000086	38	5	
1351			94013	Standby Generator - Emergency Power	12	2.67	0.000	0.000021	0	3	
1351			94014	Digester gas fueled IC Engine Generator	14	0.00	6.518	0.002249	1,001	138	

Summary: Water Emissions

Summary of Methodology Used

As per the Community GHG Protocol, this inventory includes energy-related emissions associated with water delivery and treatment. Some of these emissions may occur within the community boundaries; as explained in the Community GHG Protocol, there is risk of some double-counting in this emissions sector.

Water emissions are based on the total estimated embedded electricity use associated with each jurisdiction's water use. See the worksheet called "Water" for calculations to determine jurisdictional water use and associated embedded electricity use. All embedded electricity related to water use is assumed to come from PG&E, since most water is sourced from areas within the PG&E service area. The emissions are calculated using the PG&E emission factor for CO2 and state grid-average emission factors for CH4 and N2O. For more explanation of the CH4 and N2O emission factors, see the worksheet called "Other Energy Emission Factors."

Table 21-1: Summary of Water Embedded Electricity Use & Emissions

Jurisdiction	Embedded Energy Usage in Water Consumed (kWh)	Total Emissions from Electricity Use (MTCO2e)
Burlingame	3,812,033	707

Table 21-2: PG&E Electricity Emission Factors

CO2 Emission Factor (lbs CO2/kWh)	CH4 Emission Factor (lbs CH4/GWh)	N2O Emission Factor (lbs N2O/GWh)
0.40	70.66	8.41

Table 21-3: IPCC SAR Global Warming Potentials

CO2	CH4	N2O
1	28	256

Table 21-4: Universal Conversion Factors

GWh / kWh	0.000001
MT / lb.	0.000454

Summary: Water Treatment and Delivery Emissions

Summary of Methodology Used

As per the Community GHG Protocol, this inventory includes energy-related emissions associated with water delivery and treatment. Some of these emissions may occur within the community boundaries; as explained in the Community GHG Protocol, there is risk of some double-counting in this emissions sector.

Water consumption data in Burlingame was found by looking at the amount of water billed by the City from January 2015 - December 2015, and subtracting out the amount of water billed to single family homes in Hillsborough.

Table 22-1: Summary of Water Use & Water Embedded Electricity Use

Jurisdiction	Jurisdiction Population	Water Use (gal/year)	Embedded Energy Usage in Water Consumed (kWh)
Burlingame	29,724	1,089,152,291	3,812,033

Note: The emissions factor for water consumed is taken from the Community GHG Protocol, Appendix F, Table WW.16.1. The emissions factor for Northern California was used. This emissions factor was adapted from California's Water Energy Relationship, Final Staff Report, California Energy Commission, 2005 (Table 1-3).

Jurisdiction population used is the same as that presented in Table CX-1 of the Community Context Element. Although the population was estimated for 2016, it is the most detailed data availble and was obtained from a DOF report.

CEC Source

Table 22-2: Water Assumptions Used	
Days per Year	365
Emissions Factor for Water Consumed (kWh / million gal)	3500
Emissions Factor for Water Consumed (kWh / gal)	0.003500
Note: The emissions factor for water consumed is taken from the CEC 2006 report "Refining estimates of Water-Related Energy Use in California". The emissions factor for Northern California was used. The 3500 summed total accounts for 2117 kWhr/MG for water supply, 111 kWhr/MG for treatment, and 1272 kWhr/MG for distributon.	CEC Source

City of Burlingame: Municipal Operations GHG Inventory (2005)

Original spreadsheet developed by DNV GL under contract with the County of San Mateo
Modifications and updates made by MIG, Inc. in 2019 for the City's 2030 Climate Action Plan Update

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Introduction to the 2005 Municipal Operations Inventory

This workbook serves to document the calculations associated with the 2005 local government operations greenhouse gas inventory completed for the City of Burlingame. The initial spreadsheet was developed by DNV GL under contract with the County of San Mateo as part of the Regionally Integrated Climate Action Planning Suite (RICAPS). The workbook was updated in 2019 by MIG, Inc. to reflect new data sources and GWPs as part of the City's Climate Action Plan Update. This workbook includes raw data, assumptions, and calculations for each of the following sources of municipal operation GHG emissions:

1. Energy
2. Vehicle Fleet
3. Landfill
4. Wastewater Treatment
5. Solid Waste Generation
6. Employee Commute
7. Generators
8. Refrigerants

Version: August 29, 2019

DNV GL & MIG, Inc.

Contents:

Executive Summary

Table 1-1: Total Emissions by Sector

Sector	Emissions (MT CO2e)
Energy	1,563
Vehicle Fleet	604
Landfill	354
Wastewater Treatment	431
Solid Waste Generation	39
Employee Commute	537
Generators	11
Refrigerants	0
Totals	**3,539**

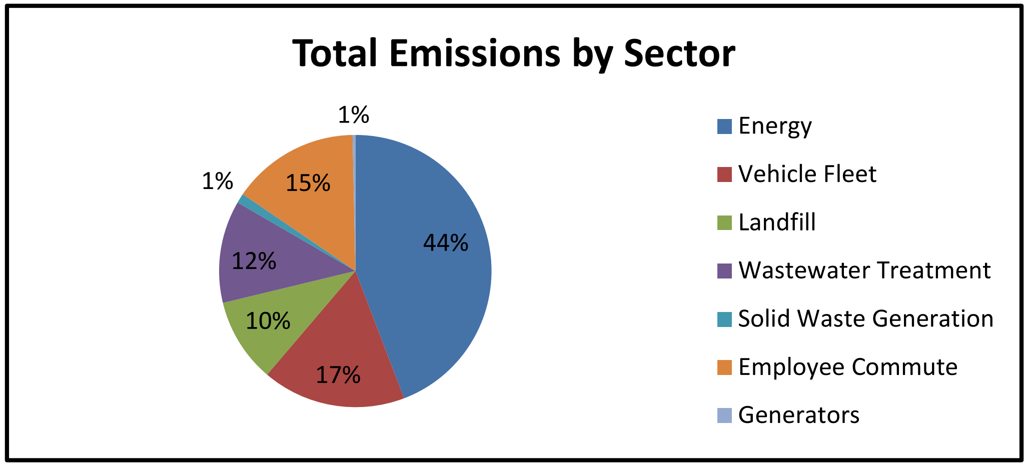


Table 1-2: Total Emissions by Source

Source	Emissions (MT CO2e)
Electricity	1,088.4
Natural Gas	474.7
Diesel	255.6
Gasoline	827.7
Biodiesel	0.0
Ethanol: E-85	0.0
Refrigerants + Fire Suppressants	0.0
Landfill	353.9
Solid Waste	39.3
Wastewater Treatment Plant	431.0
Totals	**3,471**

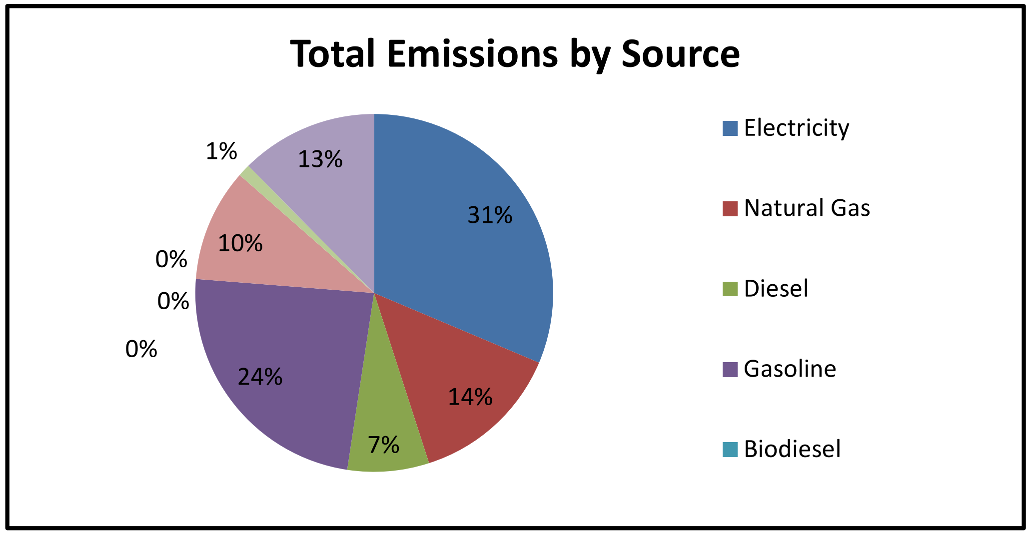
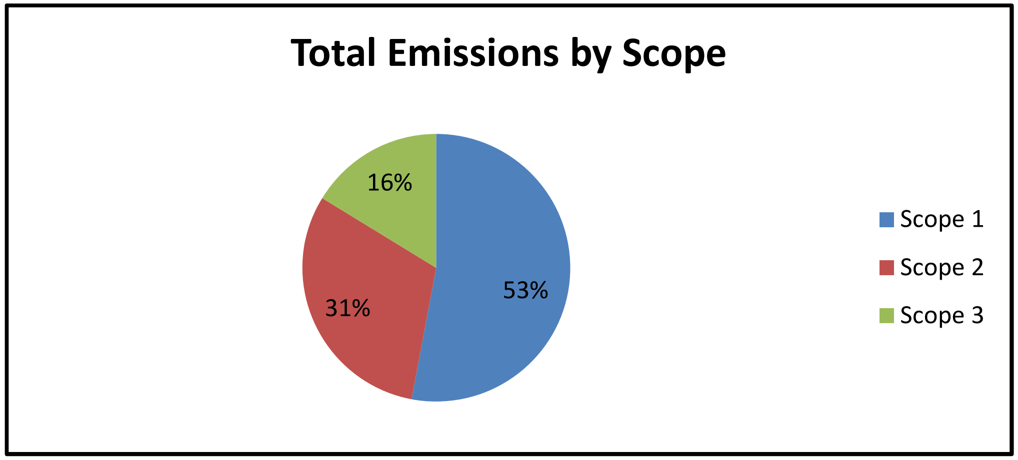


Table 1-3: Total Emissions by Scope	
Scope	**Emissions (MT CO2e)**
Scope 1	1,874.8
Scope 2	1,088.4
Scope 3	575.8
Total	**3,539**



Inventory Results: Energy Breakdown

Table 1-4: Buildings & Facilities: Emissions by Source	
Source	**Emissions (MT CO2e)**
Electricity	425.0
Natural Gas	403.6
Diesel	11.2
Refrigerants + Fire Suppressants	0.0
Totals	**840**

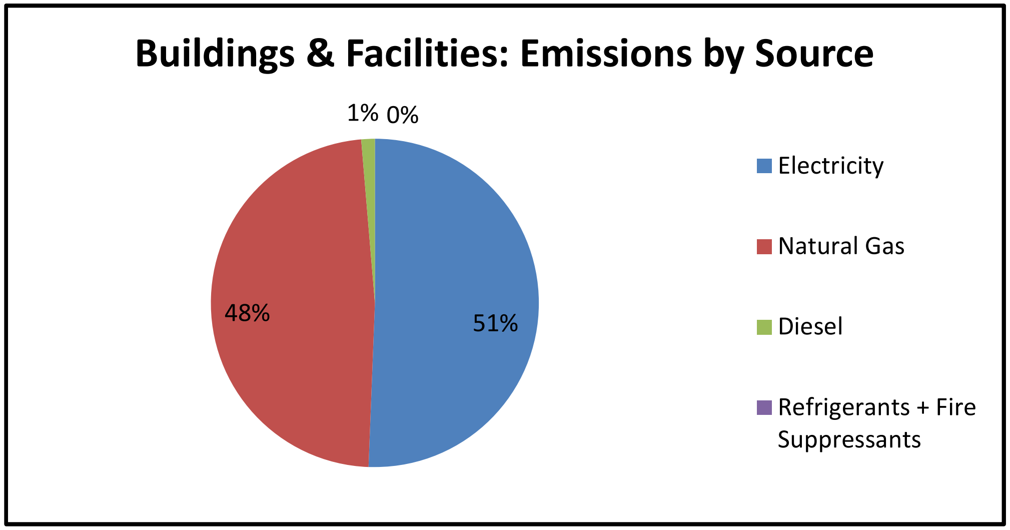
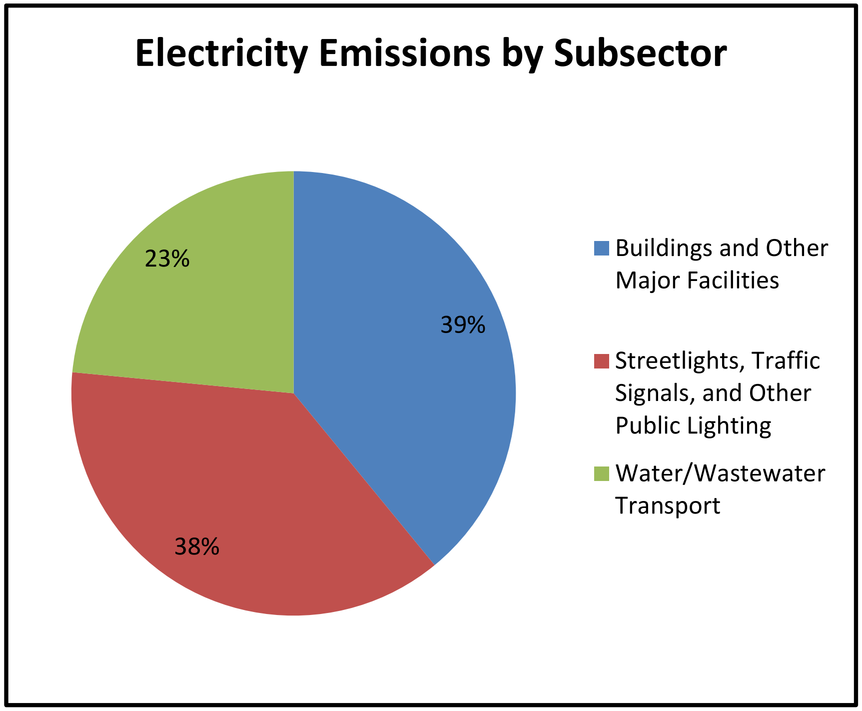
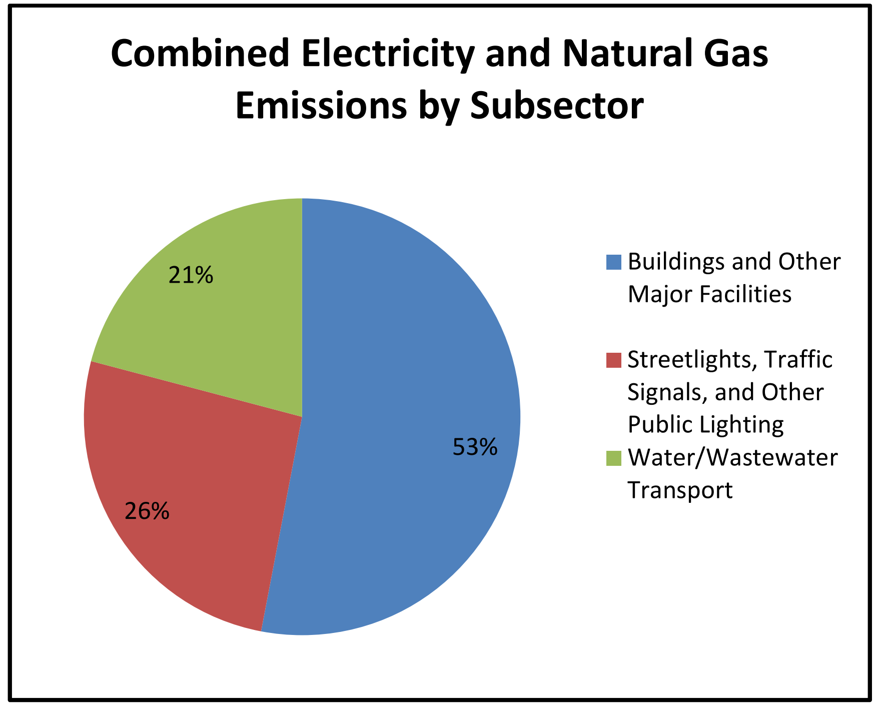


Table 1-5: Energy Emissions by Subsector

Subsector	Electricity Consumption (kWh)	Electricity Emissions (MT CO2e)	Natural Gas Consumption (Therms)	Natural Gas Emissions (MT CO2e)	Combined Electricity and Natural Gas Emissions (MT CO2e)
Buildings and Other Major Facilities	1,901,208.0	425.0	76,046.0	403.6	828.6
Streetlights, Traffic Signals, and Other Public Lighting	1,825,036.0	408.0	0.0	0.0	408.0
Water/Wastewater Transport	1,142,804.0	255.5	13,410.0	71.2	326.6
Totals	**4,869,048**	**1,088**	**89,456**	**475**	**1,563**





Energy Use - PG&E

Summary of Methodology Used

The following tables summarize the emissions generated from electricity and natural gas consumption in City-owned buildings, transportation/lighting infrastructure, and water/wastewater transport. The activity data (e.g., kWh of electricity) is summed, and then multiplied through by its respective emissiosn factor provided in the "Emissions Factors" worksheet.

Table 2-1: PG&E Energy & Emissions Summary Data by Subsector

Subsector	Electricity Consumption (kWh)	Electricity Emissions (MT CO2e)	Natural Gas Consumption (Therms)	Natural Gas Emissions (MT CO2e)	Combined Electricity and Natural Gas Emissions (MT CO2e)
Buildings and Other Major Facilities	1,901,208	425.0	76,046	403.6	828.6
Streetlights, Traffic Signals, and Other Public Lighting	1,825,036	408.0	0	0.0	408.0
Water/Wastewater Transport	1,142,804	255.5	13,410	71.2	326.6
Total	**4,869,048**	**1,088.4**	**89,456**	**474.7**	**1,563.1**

Energy Use - Generators

Summary of Methodology Used

The following tables summarize the amount of fuel and associated emissions generated by operation of City-owned generators. The fuel consumption is first summed, and then multiplied through by its respective emissions factor provided in the "Emissions Factors" worksheet.

Table 3-1: Generator Energy & Emissions Summary Data

Fuel Type	Consumption (Gallons)	Emissions (MT CO2e)
Diesel	1085.81	11.17
Propane	0	0.00
	Total Generator Emissions	11.17

Table 3-2: Generator Energy Use Raw Data

Generator Description*	Generator Size (kW)	Generator Run Time (Hours)	Fuel Type	Annual Fuel Consumption (Gallons)
Hillside	125		Diesel	
Donnelly	300		Diesel	
Washington Well	34		Diesel	
Marsten	180	11.4	Diesel	46.7
Cowan	350	19	Diesel	150.1
Adrian	50	39.2	Diesel	70.6
California / Grove	135	35.1	Diesel	115.8
Str & Sewer Pmp	550	13.5	Diesel	163.4
Sewer Pmp	63	8.8	Diesel	15.8
Mitten	No Gen.	N/A	Diesel	
Gilbreth	60	26.2	Diesel	47.2
Hyatt	55	6.4	Diesel	11.5
Airport	60	12.1	Diesel	21.8
City Hall	200	6	Diesel	28.2
Portable	175	N/A	Diesel	
F.S. 34	125	37.9	Diesel	117.5
F.S. 35	33	39.7	Diesel	51.6
F.S. 36	33	24.2	Diesel	31.5
PW Corp Yard	410	3.8	Diesel	33.8
Police Station	125	46.2	Diesel	143.2
Cogeneration system	200	7.9	Diesel	37.1

Generator description, generator size, and generator run time contained in 2005 Burlingame GovOps Inventory transmitted to PTG @ MIG on 2/8 by Benjamin Butterworth @ DNV GL.

Table 3-3: Diesel Generator "Approximate Fuel Consumption Chart"	
Generator Size (kW)	**1/4 Load (gal/hr)**
20	0.6
30	1.3
40	1.6
60	1.8
75	2.4
100	2.6
125	3.1
135	3.3
150	3.6
175	4.1
200	4.7
300	6.8
350	7.9
400	8.9
500	11
550 (Interpolated)	12.1
600	13.2

Approximate Fuel Consumption Chart Source

Transportation - Vehicle Fleet

Summary of Methodology Used
The following tables summarize the amount of fuel and associated emissions generated by operation of City-owned vehciles. The fuel consumption is first summed, and then multiplied through by its respective emissions factor provided in the "Emissions Factors" worksheet.

Table 4-1: Vehicle Fleet Energy & Emissions Summary Data

Fuel Type	Fuel Consumption Units	Fuel Consumption	Emissions (MT CO2E)
Biodiesel: B-10	Gallons	0	0
Biodiesel: B-100	Gallons	0	0
Biodiesel: B-2	Gallons	0	0
Biodiesel: B-20	Gallons	0	0
Biodiesel: B-5	Gallons	0	0.0
Diesel	Gallons	22,182	228.3
Electricity	kWh	0	0
Ethanol: E-10	Gallons	0	0
Ethanol: E-100	Gallons	0	0
Ethanol: E-85	Gallons	0	0
Gasoline	Gallons	31,682	285
Natural Gas	Gallons	0	0
		Total Vehicle Fleet Emissions:	514

Table 4-2: Vehicle Fleet Energy Raw Data

Vehicle or Group of Vehicles Description	Department	Fuel Type	Annual Fuel Consumed Non-electric Vehicles (Gallons)	Annual Fuel Consumed Electric Vehicles (kWh)
All Gasoline Vehicles	All	Gasoline	30,889	
All Biodiesel Vehicles	All	Biodiesel: B-5		
All Diesel Vehicles	All	Diesel	21,529	
Gasoline Police Vehicles	Police Department	Gasoline		
Small Equipment	All	Gasoline	793	
Small Equipment	All	Diesel	653	

Transportation - Public Transit

Summary of Methodology Used

The following tables summarize the amount of fuel and associated emissions generated by public transit vehicles operated by funds from the City. The fuel consumption is first summed, and then multiplied through by its respective emissions factor provided in the "Emissions Factors" worksheet.

Table 5-1: Public Transportation Energy & Emissions Summary Data

Fuel Type	Fuel Consumption Units	Fuel Consumption	Emissions (MT CO2E)
Biodiesel: B-10	Gallons	0	0.0
Biodiesel: B-100	Gallons	0	0.0
Biodiesel: B-2	Gallons	0	0.0
Biodiesel: B-20	Gallons	0	0.0
Biodiesel: B-5	Gallons	0	0.0
Diesel	Gallons	6648	68.4
Electricity	kWh	0	0.0
Ethanol: E-10	Gallons	0	0.0
Ethanol: E-100	Gallons	0	0.0
Ethanol: E-85	Gallons	0	0.0
Gasoline	Gallons	2448	22.0
Natural Gas	Gallons	0	0.0
		Total Vehicle Fleet Emissions:	90.5

Table 5-2: Public Transportation Energy Raw Data

Vehicle or Group of Vehicles Description	Agency	Fuel Type	Annual Fuel Consumed Non-electric Vehicles (Gallons)	Annual Fuel Consumed Electric Vehicles (kWh)
North Burlingame Shuttle	Commute.org	Gasoline	2448	
Burlingame Bayside Shuttle	Commute.org	Diesel	4480	
Burlingame Trolley	Mateo Convention Ce	Diesel	2168	

Transportation - Employee Commute

Summary of Methodology Used

The following tables summarize the amount of fuel and associated emissions generated by employees commuting to an from their jobs. As detailed on the following sheets, these estimations are based on an employee survey and then extrapolated out based on total City employment. Trip distances are used in conjunction with reported fuel economy to estimate annual fuel consumption. After the fuel consumption is summed, it is then multiplied through by its respective emissions factor provided in the "Emissions Factors" worksheet.

Table 6-1: Employee Commute Energy & Emissions Summary Data

Fuel Type	Fuel Consumption Units	Surveyed Fuel Consumption	Surveyed Emissions (MT CO2E)	Total Fuel Consumption	Total Emissions (MT CO2E)
Diesel	Gallons	446	4.6	1,570	16.2
Gasoline	Gallons	16,412	147.8	57,789	520.4
	Totals:	16,857.7	152.4	59,358	**536.5**

Table 6-2: Survey Information

Total Employees Surveyed	71
Total Employees	250

Notes: Although 72 responses were received, only 71 responses provided information for calculating emissions.
Data obtained on employee commute was extracted from the 2005 Government Operations Inventory prepared in the original (2009) CAP and transferred to this spreadsheet.

Transportation: Employee Commute Emissions Calculations Final Data

Table 7-1: Survey Representation	
Emissions Inventory Year	2005
Total Employees	250
Number of Respondents	72
Overall Response Rate	29%

Table 7-2: Survey Summary	
Responses Available for Calculating Emissions	71
Emissions Calculations Response Rate	28.4%

Table 7-3: Fuel Consumption for CO_2 Calculations		
Fuel Type	Responding Employees	All Employees
	Fuel	Fuel
Gasoline	16,412	57,789
Diesel	446	1,570
Biodiesel-B100	0	0
Ethanol-E85	0	0
Total All Fuels	**16,858**	**59,358**

Transportation: Employee Commute Survey Final Data

Table 8-1: Survey Representation	
Emissions Inventory Year	2005
Total Employees	250
Number of Respondents	72
Response Rate	29%

Table 8-2: Mode of Travel	
Most Common Mode of Travel	Number of Responding Employees
Drive Alone	52
Carpool/Vanpool	10
Transit	3
Biking	2
Walking	2
Split Modes	2

Table 8-3: Commute Distance	
Miles from Work	Number of Employees
0-5	20
6-10	16
11-15	12
15-20	3
21-25	4
26-30	1
31-35	1
36-40	1
41-45	0
46-50	1
50-75	0
76-100	0
Over 100	1

Table 8-4: Alternative Commute Option Interest	
Mode	Percent of Responding Employees Interested
Carpooling	37.5%
Vanpooling	9.7%
Public Transit	26.4%
Biking	27.8%
Walking	12.5%
Other	0.0%

Table 8-5: Access to Transit

Transit Availability?	Percent of Responding Employees
Yes	41.7%
No	58.3%

Table 8-6: VMT Reduction Interest

Mode	Percent of Responding Employees Interested
Vanpool/Carpool Incentives	22.2%
Parking Cash-Out	12.5%
Telecommuting	18.1%
Free/ Inexpensive Shuttle	27.8%
Free Public Transit Benefit	26.4%
Pre-tax Transit Checks	9.7%
Improved Transit Options	16.7%
Subsidized Bicycle Purchase	11.1%
Improved Biking Conditions	12.5%
Better Information About Commute Options	12.5%
Improved Walking Conditions/Routes	1.4%
Other	0.0%

Solid Waste

Summary of Methodology Used

Emissions associated with solid waste disposal were calculated by taking into account the number of dumpster / containers at City-owned facilities and calculating the volume of waste that would be generated if they were completely full. The volumes are then converted to weight and - using an emission factor derived in the community-wide inventory - multipled through to determine the emissions that would result from their disposal.

Table 9-1: Solid Waste Disposal & Emissions Summary Data

Annual Weight of Waste Sent to Landfill (US tons)	Annual Emissions from Waste Sent to Landfill (MT CO2e)
192.376	39.3

Table 9-2: Solid Waste Assumptions/Calculation Inputs

Estimated Percentage of Dumpsters/ Containers Filled	100%
Weeks in Year	52.14
Convert Pounds to US Tons	0.0005
Convert Gallons to Cubic Yards	0.00495
Percent of Waste in Garbage Bins Sent to Landfill	100%
Pounds per cubic yard of waste	129.00

Note: data from Allied Waste reported containers filled 100% and 129 lbs/cubic yard

Table 9-3: Solid Waste Disposal Raw Data

Facility Name	Department	Number of Dumpsters / Containers	Dumpster / Container Size (Cubic Yards)	Estimated Percentage of Dumpster / Container Filled	Number of Trash Pick-ups per Week	Annual Volume of Waste Generated (cubic yards)	Type of Waste	Pounds Per Cubic Yard of Waste	Annual Weight of Waste Generated (US tons)	Percent of Waste Landfilled	Annual Weight of Waste Sent to Landfill (US tons)
City Hall	City Manager, Community Development, HR, Finance	1	1	100%	2	104.3	Government Operations	129.00	6.7	100%	6.7
Fire Department (1399 Rollins)	Fire	1	2	100%	1	104.3	Government Operations	129.00	6.7	100%	6.7
Fire Department (1399 Rollins)	Fire	1	6.00	100%	1	312.9	Government Operations	129.00	20.2	100%	20.2
Fire Department (2832 Hillside)	Fire	1	1	100%	1	52.1	Government Operations	129.00	3.4	100%	3.4
Fire Department (799 California)	Fire	1	2.00	100%	1	104.3	Government Operations	129.00	6.7	100%	6.7
Fire Department (799 California)	Fire	1	6	100%	1	312.9	Government Operations	129.00	20.2	100%	20.2
Library	Public Works	1	0.20	100%	1	10.4	Government Operations	129.00	0.7	100%	0.7
Police	Police	1	3	100%	2	312.9	Government Operations	129.00	20.2	100%	20.2
Library	Public Works	2	2	100%	5	1042.9	Government Operations	129.00	67.3	100%	67.3
Rec Center	Public Works	2	3	100%	2	625.7	Government Operations	129.00	40.4	100%	40.4

Solid Waste Landfills: Fugitive Emissions from Government Owned/Operated Landfills

Table 10-1: Partial and Comprehensive LFG Collection Data Inputs

Description	Enter Data Here	Data Source	Notes	Default Value
Total Landfill Gas Collected (million standard cubic feet)	37.75	BAAQMD Rule 8-34 Annual Report (SCS, 2008a); Operation, Monitoring and Maintenance Report of the Landfill Gas (LFG) Migration Control Facilities at the Burlingame Landfill, Burlingame, California (SCS, 2008b)	derived from measured LFG system flow rates and downtime for calendary year 2008	user input - no default value
Percentage of Methane in Collected LFG	0.22	BAAQMD Rule 8-34 Annual Report (SCS, 2008a); Operation, Monitoring and Maintenance Report of the Landfill Gas (LFG) Migration Control Facilities at the Burlingame Landfill, Burlingame, California (SCS, 2008b)	averaged from monthly field measurements of LFG collection system performance.	0.5
Destruction Efficiency of Methane Based upon system	1.00	Current MSW Industry Position and State-of-the-Practice on LFG Collection Efficiency, Methane Oxidation, and Carbon Sequestration in Landfills (SWICS 2009)	Solid Waste Industry Climate Solution (SWICS) flare default 99.96%	0.99 (or user input)
Collection Efficiency of LFG Collection System	0.90	Current MSW Industry Position and State-of-the-Practice on LFG Collection Efficiency, Methane Oxidation, and Carbon Sequestration in Landfills (SWICS 2009)	final cover, not enough monitoring data to support medium or high SWICS collection efficiency	0.75
Methane Soil Oxidation Factor	0.30	Current MSW Industry Position and State-of-the-Practice on LFG Collection Efficiency, Methane Oxidation, and Carbon Sequestration in Landfills (SWICS 2009)	mixed cover types classified as "other" using SWICS methodology	0.1
Surface <u>not</u> covered by Landfill Gas Collection System (square feet)	0.00	Corrective Action Cost Estimate for Known or Reasonably Foreseeable Releases (SCS 2008c)		User input - no default value. Only needs to be filled out if
Surface covered by Landfill Gas Collection System (square feet)	2,176,908.00	Corrective Action Cost Estimate for Known or Reasonably Foreseeable Releases (SCS 2008c)		User input - no default value. Required field.

Table 10-2 Emissions Outputs

CH_4 emitted (metric tons)	12.64
CO2e (metric tons)	353.87

Refrigerants and Fire Suppression

Summary of Methodology Used

The total amounts of refrigerants / fire suppression materials are multiplied through by their GWPs to determine how much GHG was emitted in terms of MT CO2e.

Table 11-1: Refrigerant & Fire Suppression HFCs Use Raw Data

Building / Department	Equipment Name	Description & Purpose	Equipment Location	Manufacturer	Model	Serial #	HFC Compound	HFC Compound Used (lbs)	HFC Compound Used (kg)
Police Station	AC3	HVAC/Cooling	Roof				R-410A	0	0.0
City Hall	Chiller	HVAC/Cooling	Basement				R-22		9.0

Note: According to the Local Government Operations Protocol, R-22 use does not impact reported emissions, so included as an informational item only.

Wastewater: Process N_20 Emissions from Centralized Wastewater Treatment

Step 1. Answer the following questions about your wastewater treatment plant. Your responses will be used to determine the appropriate formulas to calculate your greenhouse gas emissions from wastewater water treatment.

Question 1

Does your wastewater treatment plant use nitrification/denitrification processes to treat effluent? Select one from the menu below

No

Question 2

Does the wastewater treatment plant use aerobic or anaerobic processes to treat effluent? Select one from the menu below

Aerobic

Question 3

Does your jurisdiction record site-specific measurements for the average daily nitrogen load from treated effluent discharged from the wastewater treatment plant? Select one from the menu below. If you answer "No", be sure to fill out Step 2 on population served.

Yes   Sampled for 1X/Month

Question 4

If you answered "Yes" in question 3 above, enter the average total nitrogen discharged by your wastewater treatment plant (kg N / day) in the grey box below.

409 kg N / day   Assumed by discharge average of total nitrogen at 30 mg/L

Step 2. Add the population served by your municipal wastewater treatment plant and any if there is additional industrial/commercial co-discharge. Input your municipality's information in the grey boxes below.		
Information needed	**Units**	**Input Data Here**
Total domestic population served by your wastewater treatment plant	# people	36000.00

Question 1

Does your jurisdiction contain commercial and/or industrial facilities? Please select one from the menu below.

No

Process emissions from your wastewater treatment plant			
Units	**N2O Process Emissions**		
Metric Tons of N20		0.1152	

Process emissions from effluent discharge to rivers and estuaries			
Units	**N2O Process Emissions**		
Metric Tons of N2O		1.1727	

Total N2O Emissions from your wastewater treatment plant	
Units	**Total N2O Process Emissions**
Metric Tons of N2O	1.2879

Total Wastewater CO2e:	430.9590438

Data Sources and Notes for this Worksheet:

Note: Data contained in this spreadsheet was extracted from the 2005 Government Operations Inventory. GWPs were updated consistent with the methodology and information update approach used for the 2030 CAP Update (2019).

Population data from Burlingame.org web site. Add population served in Hillsbourgh and part of San Mateo County. Aerobic system is an activated sludge facility with a design flow capacity of 5.5 MGD. Peak wet weather flow design of 12.5 MGD. Kg nitrogen/day assumed by discharge average of total nitrogen at 30mg/L

Wastewater: Stationary CH_4 Emissions from an Anaerobic Digester

Step 1. Anaerobic digesters are used to treat excess biosolids produced during wastewater treatment. If your municipality operates an anaerobic digester, answer the following question about your facility:

Question 1

Do you have site-specific measurements for (1) the volume of digester gas produced at your facility and (2) the fraction of methane in the digester gas? Select one from the drop down menu

Yes

NOTE: If significant industrial contributions of BOD5 are discharged to you municipal treatment system, it is recommended that you collect site-specific measurements for (1) the volume of digester gas produced at your facility and (2) the fraction of methane in the digester gas. This information allows the calculator to more accurately reflect the contribution of industry to your anaerobic digester's methane emissions.

Step 2. Input the following information about your anarobic digester in the grey boxes below.

Information needed	Units	Input Data Here
Digester gas produced	Cubic feet/day	72,000.00
Percent of methane in digester gas	Percent	65.00

Calculated CH4 emissions from your anaerobic digester			
Units	**CH4 Process Emissions**		
Metric Tons of CH4		3.2024	

Data Sources and Notes for this Worksheet:

Note: Data contained in this spreadsheet was extracted from the 2005 Government Operations Inventory. GWPs were updated consistent with the methodology and information update approach used for the CAP update (2018).

Digester gas flow meter located in sewage gas booster room used to determine amount of biogas collected. Operators perform methane content of gas via a hand held fyrite tool that measures CO2 with the balance of gas being recorded as methane.

Emission Factors

About
This page summarizes the various emission factors used to estimate GHG emissions throughout the inventory.

Table 14-1: Emission Factors

Category	Type of Emission	Emission Factor	Units	Source
Fuel Combustion	Biodiesel: B-10	0.00926	MT CO2e/gallon	Calculated using EIA
Fuel Combustion	Biodiesel: B-100	0.00000	MT CO2e/gallon	Calculated using EIA
Fuel Combustion	Biodiesel: B-2	0.01008	MT CO2e/gallon	Calculated using EIA
Fuel Combustion	Biodiesel: B-20	0.00823	MT CO2e/gallon	Calculated using EIA
Fuel Combustion	Biodiesel: B-5	0.00978	MT CO2e/gallon	Calculated using EIA
Fuel Combustion	Diesel	0.01029	MT CO2e/gallon	EIA
Waste Disposal	Disposed Waste	0.20422	MT CO2e/short ton	Community GHG Inventory
Electricity	Electricity	0.00022	MT CO2e/kWh	Calculated from Community GHG Inventory
Fuel Combustion	Ethanol: E-10	0.00802	MT CO2e/gallon	EIA
Fuel Combustion	Ethanol: E-100	0.00000	MT CO2e/gallon	EIA
Fuel Combustion	Ethanol: E-85	0.00134	MT CO2e/gallon	EIA
Fuel Combustion	Gasoline	0.00900	MT CO2e/gallon	EIA
Fuel Combustion	Hybrid Gasoline	0.00889	MT CO2e/gallon	EIA
Fuel Combustion	Natural Gas	0.00531	MT CO2e/therm	PG&E
Fuel Combustion	Propane	0.00576	MT CO2e/gallon	EIA

Note: Emissions factors for biodiesel have been pulled from the website sourced.

Table 14-2: Diesel & Gasoline Emission Factors (CO2)

Type of Emission	Emission Factor	Units	Source
Diesel	0.0102	MT CO2/gallon	EIA
Gasoline	0.0089	MT CO2/gallon	EIA

Table 14-3: CH4 and N20 Emission Factors for Gasoline and Diesel Vehicles

GHG	MT GHG per MT of CO2	100-year GWP	MT CO2e Per MT of Carbon Emissions	MT CO2e Per Gallon of Diesel	MT CO2e Per Gallon of Gasoline	Source
CH4	6.49E-05	28	0.0018	0.000018	0.000016	TCR
N2O	4.17E-05	265	0.0111	0.000112	0.000098	TCR

Table 14-4: Conversion Factors

Conversion From:	Conversion To:	Conversion Factor
Pounds (lbs)	Metric Tons (MT)	0.000453592
Kilograms (kg)	Metric Tons (MT)	0.001

Table 14-5: Calcuations - Emission Factor for Disposed Waste

Category	Annual Waste (short tons)	Annual MT CO2e	MT CO2e/Short Ton	Percent of Total Waste
Landfilled Waste	41,083.0	8,525.6	0.208	94.9%
ADC	3,190.0	453.7	0.142	5.1%
Weighted Waste Average	-	-	**0.204**	

Table 14-6: Jurisdiction-specific Disposed Waste Data from Community GHG Inventory

Jurisdiction	2005 Landfilled Waste (Short Tons)	2005 Landfilled Waste Emisseions (MT CO2e)	2005 Alternative Daily Cover (Short Tons)	2005 Alternative Daily Cover Emissions (MT CO2e)
Burlingame	41,083	8,525.6	3,190	453.7

Table 14-7: IPCC AR5 Global Warming Potentials

CO2	CH4	N2O
1	28	265

Table 14-8: Universal Conversion Factors

MT / lb.	0.00045
GWh / kWh	0.0000010
MMBTU / therm	0.10
MT / kg	0.0010

City of Burlingame: Municipal Operations GHG Inventory (2015)

Original spreadsheet developed by DNV GL under contract with the County of San Mateo

Modifications and updates made by MIG, Inc. in 2019 for the City's 2030 Climate Action Plan Update

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Introduction to the 2015 Municipal Operations Inventory

This workbook serves to document the calculations associated with the 2015 local government operations greenhouse gas inventory completed for the City of Burlingame. The initial spreadsheet was developed by DNV GL under contract with the County of San Mateo as part of the Regionally Integrated Climate Action Planning Suite (RICAPS). The workbook was updated in 2019 by MIG, Inc. to reflect new data sources and GWPs as part of the City's Climate Action Plan Update. This workbook includes raw data, assumptions, and calculations for each of the following sources of municipal operation GHG emissions:

1. Energy
2. Vehicle Fleet
3. Landfill
4. Wastewater Treatment
5. Solid Waste Generation
6. Employee Commute
7. Generators
8. Refrigerants

Version: August 29, 2019

DNV GL & MIG, Inc.

Contents:

Executive Summary

Table 1-1: Total Emissions by Sector

Sector	Emissions (MT CO2e)
Energy	1,250
Vehicle Fleet	703
Landfill	277
Wastewater Treatment	405
Solid Waste Generation	0
Employee Commute	475
Generators	4
Refrigerants	3
Totals	**3,117**

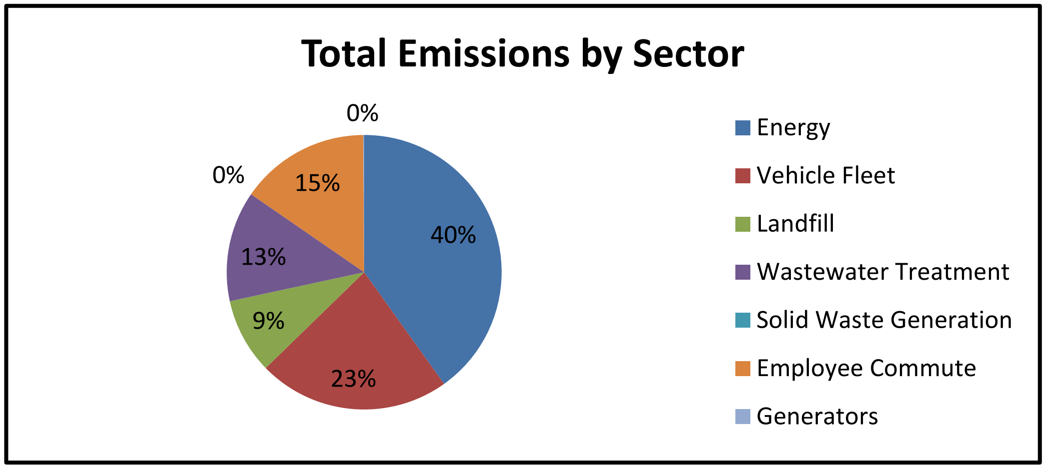


Table 1-2: Total Emissions by Source

Source	Emissions (MT CO2e)
Electricity	1,041.1
Natural Gas	208.9
Diesel	337.0
Gasoline	821.8
Biodiesel	23.1
Ethanol: E-85	0.2
Refrigerants + Fire Suppressants	2.6
Landfill	277.4
Solid Waste	0.0
Wastewater Treatment Plant	405.1
Totals	**3,117**

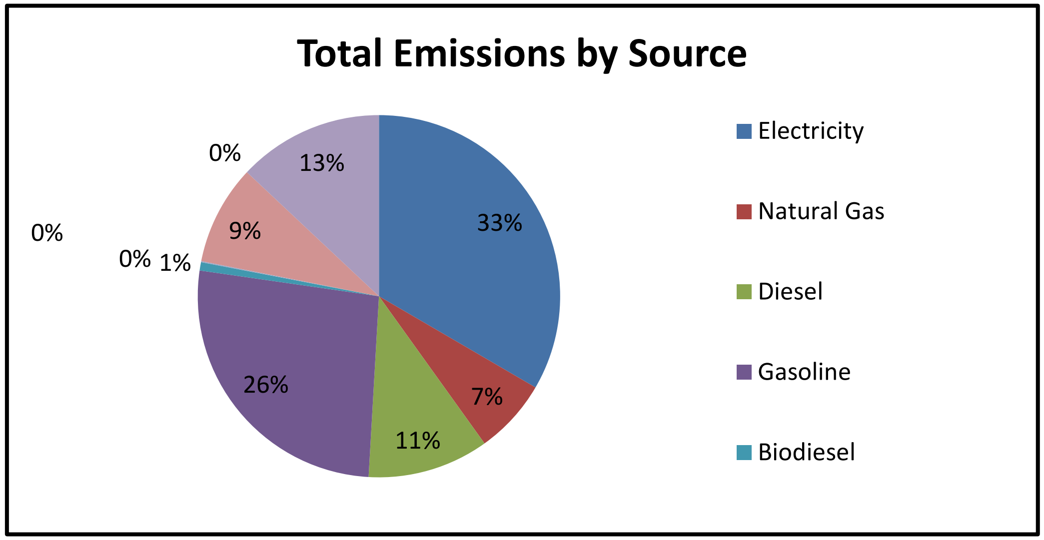
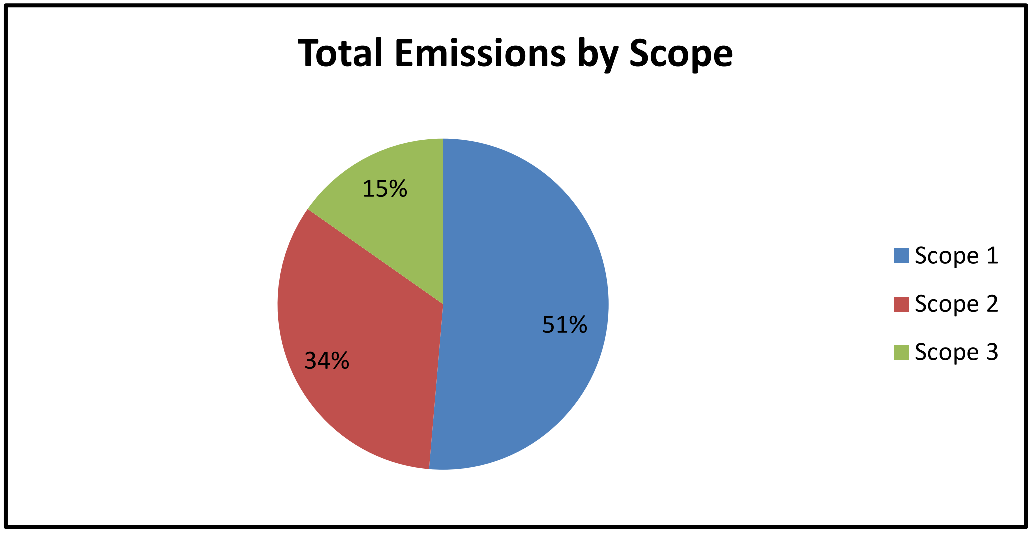


Table 1-3: Total Emissions by Scope	
Scope	**Emissions (MT CO2e)**
Scope 1	1,600.7
Scope 2	1,040.9
Scope 3	475.5
Total	**3,117**



Inventory Results: Energy Breakdown

Table 1-4: Buildings & Facilities: Emissions by Source	
Source	**Emissions (MT CO2e)**
Electricity	679.9
Natural Gas	208.9
Diesel	3.6
Refrigerants + Fire Suppressants	2.6
Totals	**895**

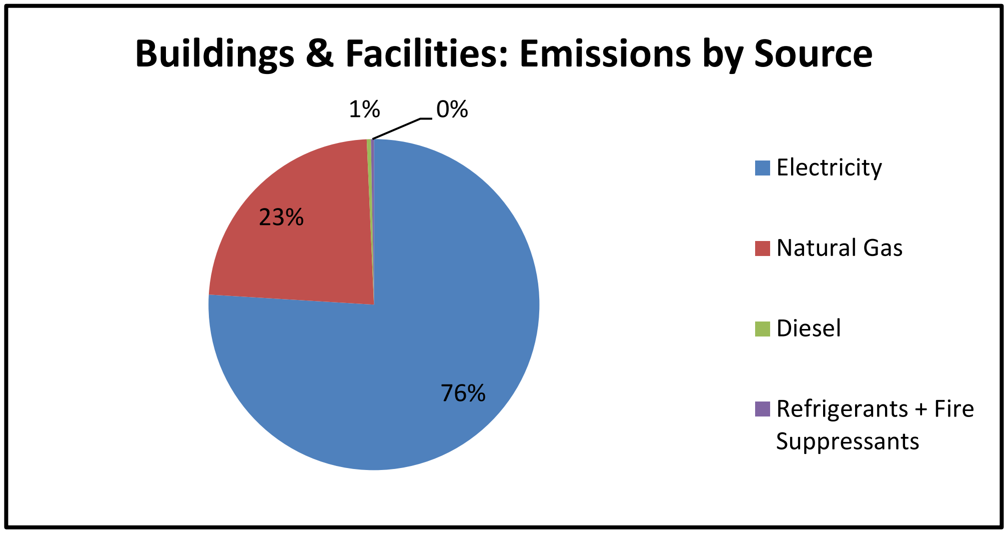
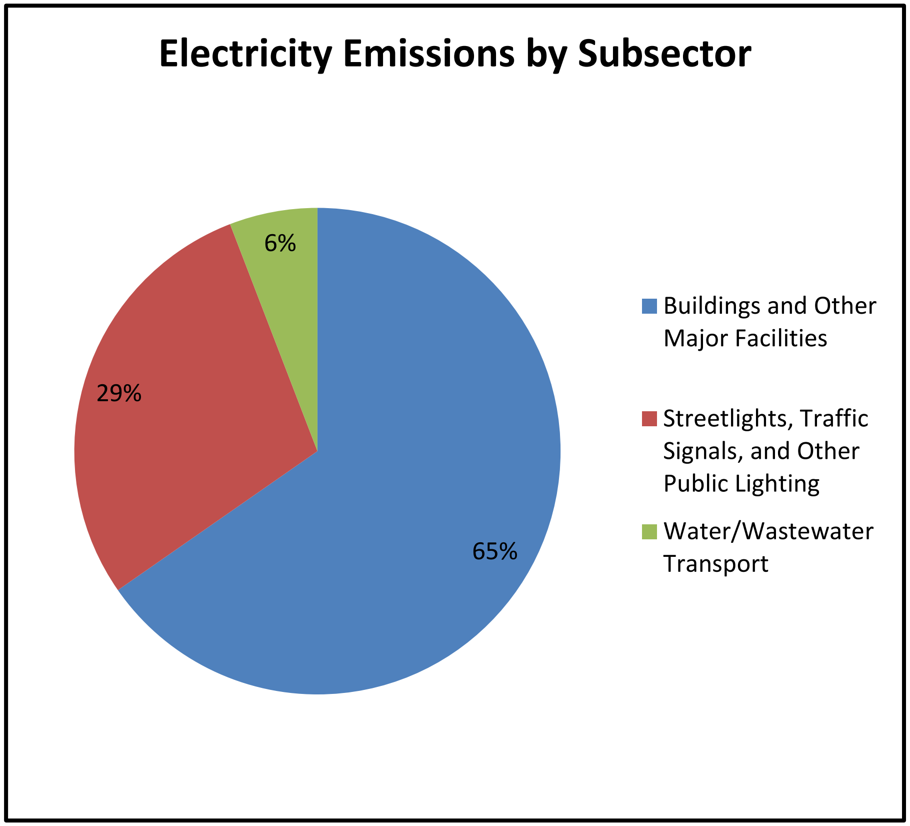
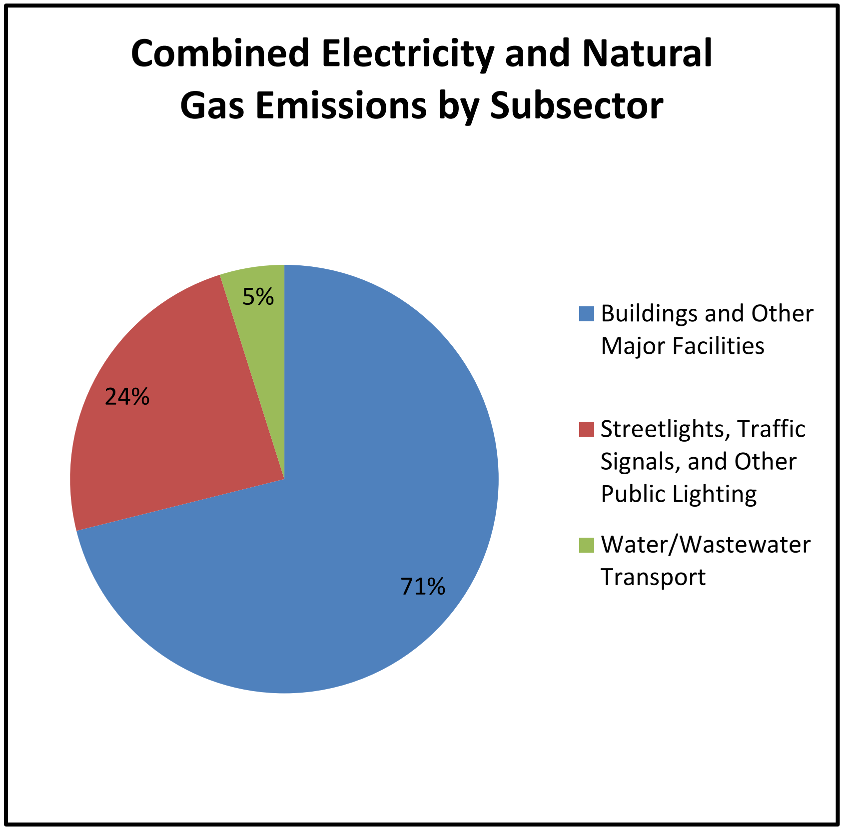


Table 1-5: Energy Emissions by Subsector

Subsector	Electricity Consumption (kWh)	Electricity Emissions (MT CO2e)	Natural Gas Consumption (Therms)	Natural Gas Emissions (MT CO2e)	Combined Electricity and Natural Gas Emissions (MT CO2e)
Buildings and Other Major Facilities	3,667,539.0	679.9	39,355.0	208.9	888.8
Streetlights, Traffic Signals, and Other Public Lighting	1,618,452.0	300.0	0.0	0.0	300.0
Water/Wastewater Transport	328,558.0	60.9	0.0	0.0	60.9
Totals	**5,614,549**	**1,041**	**39,355**	**209**	**1,250**





Energy Use - PG&E

Summary of Methodology Used

The following tables summarize the emissions generated from electricity and natural gas consumption in City-owned buildings, transportation/lighting infrastructure, and water/wastewater transport. The activity data (e.g., kWh of electricity) is summed, and then multiplied through by its respective emissiosn factor provided in the "Emissions Factors" worksheet.

Table 2-1: PG&E Energy & Emissions Summary Data by Subsector

Subsector	Electricity Consumption (kWh)	Electricity Emissions (MT CO2e)	Natural Gas Consumption (Therms)	Natural Gas Emissions (MT CO2e)	Combined Electricity and Natural Gas Emissions (MT CO2e)
Buildings and Other Major Facilities	3,667,539	679.9	39,355	208.9	888.8
Streetlights, Traffic Signals, and Other Public Lighting	1,618,452	300.0	0	0.0	300.0
Water/Wastewater Transport	328,558	60.9	0	0.0	60.9
Total	**5,614,549**	**1,040.9**	**39,355**	**208.9**	**1,249.7**

Energy Use - Generators

Summary of Methodology Used

The following tables summarize the amount of fuel and associated emissions generated by operation of City-owned generators. The fuel consumption is first summed, and then multiplied through by its respective emissions factor provided in the "Emissions Factors" worksheet.

Table 3-1: Generator Energy & Emissions Summary Data

Fuel Type	Consumption (Gallons)	Emissions (MT CO2e)
Diesel	352.64	3.63
Propane	0	0.00
	Total Generator Emissions	3.63

Table 3-2: Generator Energy Use Raw Data

Generator Description*	Generator Size (kW)	Generator Run Time (Hours)	Fuel Type	Annual Fuel Consumption (Gallons)
FS 34-125kw	125	15.1	Diesel	46.8
FS 35-33kw	33	17.9	Diesel	23.3
Fs 36-33kw	33	15.3	Diesel	19.9
Parks yard-34kw	34	16.8	Diesel	21.8
Police-125kw	125	21.6	Diesel	67.0
Pw Yard-175kw	175	7.7	Diesel	31.6
City Hall-200kw	200	9	Diesel	42.3
Pump generator	N/A	N/A	Diesel	100.0

Generator description, generator size, and generator run time provided by Sigalle Michael via email on 9/20/16. Fuel consumption data not available for most generators. City Facilities Manager suggested using Diesel Services & Supply "Approximate Fuel Consumption Chart" to convert run time to gallons of diesel consumed (see link to source below). Table to right is data pulled form this source. Assumed generators running on quarter load because they were run for testing purposes only.

Table 3-3: Diesel Generator "Approximate Fuel Consumption Chart"	
Generator Size (kW)	**1/4 Load (gal/hr)**
20	0.6
30	1.3
40	1.6
60	1.8
75	2.4
100	2.6
125	3.1
135	3.3
150	3.6
175	4.1
200	4.7

Approximate Fuel Consumption Chart Source

Transportation - Vehicle Fleet

Summary of Methodology Used
The following tables summarize the amount of fuel and associated emissions generated by operation of City-owned vehciles. The fuel consumption is first summed, and then multiplied through by its respective emissions factor provided in the "Emissions Factors" worksheet.

Table 4-1: Vehicle Fleet Energy & Emissions Summary Data

Fuel Type	Fuel Consumption Units	Fuel Consumption	Emissions (MT CO2E)
Biodiesel: B-10	Gallons	0	0
Biodiesel: B-100	Gallons	0	0
Biodiesel: B-2	Gallons	0	0
Biodiesel: B-20	Gallons	0	0
Biodiesel: B-5	Gallons	2,360	23.1
Diesel	Gallons	24,748	254.7
Electricity	kWh	0	0.0
Ethanol: E-10	Gallons	0	0
Ethanol: E-100	Gallons	0	0
Ethanol: E-85	Gallons	0	0
Gasoline	Gallons	35,972	324
Natural Gas	Gallons	0	0
		Total Vehicle Fleet Emissions:	602

Table 4-2: Vehicle Fleet Energy Raw Data

Vehicle or Group of Vehicles Description	Department	Fuel Type	Annual Fuel Consumed Non-electric Vehicles (Gallons)	Annual Fuel Consumed Electric Vehicles (kWh)
All Gasoline Vehicles	All	Gasoline	35,972	
All Biodiesel Vehicles	All	Biodiesel: B-5	2,360	
All Diesel Vehicles	All	Diesel	24,748	
Gasoline Police Vehicles	Police Department	Gasoline	24,424	

Transportation - Public Transit

Summary of Methodology Used

The following tables summarize the amount of fuel and associated emissions generated by public transit vehicles operated by funds from the City. The fuel consumption is first summed, and then multiplied through by its respective emissions factor provided in the "Emissions Factors" worksheet.

Table 5-1: Public Transportation Energy & Emissions Summary Data

Fuel Type	Fuel Consumption Units	Fuel Consumption	Emissions (MT CO2E)
Biodiesel: B-10	Gallons	0	0.0
Biodiesel: B-100	Gallons	0	0.0
Biodiesel: B-2	Gallons	0	0.0
Biodiesel: B-20	Gallons	0	0.0
Biodiesel: B-5	Gallons	0	0.0
Diesel	Gallons	0	0.0
Electricity	kWh	0	0.0
Ethanol: E-10	Gallons	0	0.0
Ethanol: E-100	Gallons	0	0.0
Ethanol: E-85	Gallons	0	0.0
Gasoline	Gallons	11275	101.5
Natural Gas	Gallons	0	0.0
		Total Vehicle Fleet Emissions:	101.5

Table 5-2: Public Transportation Energy Raw Data

Vehicle or Group of Vehicles Description	Agency	Fuel Type	Annual Fuel Consumed Non-electric Vehicles (Gallons)	Annual Fuel Consumed Electric Vehicles (kWh)
North Burlingame Shuttle	Commute.org	Gasoline	6344	
Burlingame Bayside Shuttle	Commute.org	Gasoline	4616	
Burlingame Trolley	ı Mateo Convention Cen	Gasoline	315	

Transportation - Employee Commute

Summary of Methodology Used

The following tables summarize the amount of fuel and associated emissions generated by employees commuting to an from their jobs. As detailed on the following sheets, these estimations are based on an employee survey and then extrapolated out based on total City employment. Trip distances are used in conjunction with reported fuel economy to estimate annual fuel consumption. After the fuel consumption is summed, it is then multiplied through by its respective emissions factor provided in the "Emissions Factors" worksheet.

Table 6-1: Employee Commute Energy & Emissions Summary Data

Fuel Type	Fuel Consumption Units	Surveyd Fuel Consumption	Surveyed Emissions (MT CO2E)	Total Fuel Consumption	Total Emissions (MT CO2E)
Biodiesel: B-10	Gallons	0	0.0	0	0.0
Biodiesel: B-100	Gallons	0	0.0	0	0.0
Biodiesel: B-2	Gallons	0	0.0	0	0.0
Biodiesel: B-20	Gallons	0	0.0	0	0.0
Biodiesel: B-5	Gallons	0	0.0	0	0.0
Diesel	Gallons	3,786	39.0	7,648	78.7
Electricity	kWh	604	0.1	1,221	0.2
Ethanol: E-10	Gallons	0	0.0	0	0.0
Ethanol: E-100	Gallons	0	0.0	0	0.0
Ethanol: E-85	Gallons	90	0.1	181	0.2
Gasoline	Gallons	21,785	196.2	44,011	396.3
Natural Gas	Gallons	0	0.0	0	0.0
	Totals:	26,265.4	235.4	53,061	**475.5**

Data note: A total of 10 employees entered that they commuted to work 7 days per week during the survey period. Per instructions from Sigalle Michael on 9/20/16, it was decided to adjust the data so all non-Public Works employees who entered that they had commuted 7 days per week (5 employees) were adjusted to reflect commuting 5 days per week. The data for the 5 Public Works employees who entered that they commuted 7 days per week was not adjusted.

Table 6-2: Survey Information

Total Employees Surveyed	99
Total Employees	200

Solid Waste

Summary of Methodology Used

Emissions associated with solid waste disposal were calculated by taking into account the number of dumpster / containers at City-owned facilities and calculating the volume of waste that would be generated if they were completely full. The volumes are then converted to weight and - using an emission factor derived in the community-wide inventory - multipled through to determine the emissions that would result from their disposal.

Table 7-1: Solid Waste Disposal & Emissions Summary Data

Annual Weight of Waste Sent to Landfill (US tons)	Annual Emissions from Waste Sent to Landfill (MT CO2e)
0.000	0.0

Table 7-2: Solid Waste Assumptions/Calculation Inputs

Estimated Percentage of Dumpsters/Containers Filled	100%
Weeks in Year	52.14
Convert Pounds to US Tons	0.0005
Convert Gallons to Cubic Yards	0.00495
Percent of Waste in Garbage Bins Sent to Landfill	100%

Table 7-3: Solid Waste Disposal Raw Data

Facility Name	Department	Number of Dumpsters / Containers	Dumpster / Container Size (Cubic Yards)	Estimated Percentage of Dumpster / Container Filled	Number of Trash Pick-ups per Week	Annual Volume of Waste Generated (cubic yards)	Type of Waste	Pounds Per Cubic Yard of Waste	Annual Weight of Waste Generated (US tons)	Percent of Waste Landfilled	Annual Weight of Waste Sent to Landfill (US tons)
City Hall	City Manager, Community Development, HR, Finance	1	1	100%	2	104.3	Government Operations	0	0.0	100%	0.0
Corp Yard	Public Works	1	3	100%	2	312.9	Government Operations	0	0.0	100%	0.0
Corp Yard	Public Works	2	0.32	100%	2	66.1	Government Operations	0	0.0	100%	0.0
Fire Department	Fire	1	6	100%	1	312.9	Government Operations	0	0.0	100%	0.0
Fire Department	Fire	2	0.48	100%	1	49.6	Government Operations	0	0.0	100%	0.0
Library	Main Library	1	2	100%	5	521.4	Government Operations	0	0.0	100%	0.0
Library	Easton Library	1	0.16	100%	1	8.3	Government Operations	0	0.0	100%	0.0
Police Department	Police	1	3	100%	2	312.9	Government Operations	0	0.0	100%	0.0
Rec Center	Rec	1	3	100%	2	312.9	Government Operations	0	0.0	100%	0.0
Rec Department	Parks	0	0	100%	0	0.0	Government Operations	0	0.0	100%	0.0

Table 7-4: Solid Waste Volume to Weight Conversion Factors

Type of Waste	Pounds Per Cubic Yard	Source
Commercial and Industrial (uncompacted)	600	CalRecycle
Compacted waste (compaction ratio unknown)	1300	CalRecycle
Government Operations	89	CalRecycle
Residential, (uncompacted)	300	CalRecycle

Solid Waste Landfills: Fugitive Emissions from Government Owned/Operated Landfills

Table 8-1: Partial and Comprehensive LFG Collection Data Inputs				
Description	Enter Data Here	Data Source	Notes	Default Value
Total Landfill Gas Collected (million standard cubic feet)	24.64	Burlingame 2015 data		user input - no default value
Percentage of Methane in Collected LFG	0.27	Burlingame 2015 data		0.5
Destruction Efficiency of Methane Based upon system	0.99993	Burlingame 2015 data		0.99 (or user input)
Collection Efficiency of LFG Collection System	0.90	Burlingame 2015 data		0.75
Methane Soil Oxidation Factor	0.30	Burlingame 2015 data		0.1
Surface not covered by Landfill Gas Collection System (square feet)	0.00	Burlingame 2015 data		User input - no default value. Only needs to be filled out if you have a partial LFG recovery system.
Surface covered by Landfill Gas Collection System (square feet)	1,611,720.00	Burlingame 2015 data		User input - no default value. Required field.

Table 8-2: Emissions Outputs	
CH_4 emitted (metric tons)	9.91
CO2e (metric tons)	277.37

Operations Note: The flare was operated at an average of 98 hours per week at a flow rate of 74 scfm. Due to the less than continuous operation, the % of methane has improved for better flare performance and no use of the carbon canister system was necessary during the course of 2013.

Refrigerants and Fire Suppression

Summary of Methodology Used
The total amounts of refrigerants / fire suppression materials are multiplied through by their GWPs to determine how much GHG was emitted in terms of MT CO2e.

Table 9-1: Refrigerant & Fire Suppression HFCs Use & Emissions Summary Data

Refrigerant Blend	Total Refrigerant Used (kg)	Global Warming Potential (GWP)	Emissions (MT CO2e)
R-410A	1.4	1,924	2.6
		Total Emissions from Refrigerants:	**2.6**

Table 9-2: Refrigerant & Fire Suppression HFCs Use Raw Data

Building / Department	Equipment Name	Description & Purpose	Equipment Location	Manufacturer	Model	Serial #	HFC Compound	HFC Compound Used (lbs)	HFC Compound Used (kg)
Police Station	AC3	HVAC/Cooling	Roof				R-410A	3	1.4
City Hall	Chiller	HVAC/Cooling	Basement				R-22	52	23.6

Note: According to the Local Government Operations Protocol, R-22 use does not impact reported emissions, so included as an informational item only.

Table 9-3: Conversion Factors

KG --> MT Conversion Factor	0.001
Pounds --> KG Conversion Factor	0.453592

Government Operations Emissions Inventory

Wastewater: Process N_20 Emissions from Centralized Wastewater Treatment

Step 1. Answer the following questions about your wastewater treatment plant. Your responses will be used to determine the appropriate formulas to calculate your greenhouse gas emissions from wastewater water treatment.

Question 1

Does your wastewater treatment plant use nitrification/denitrification processes to treat effluent? Select one from the menu below

No

Question 2

Does the wastewater treatment plant use aerobic or anaerobic processes to treat effluent? Select one from the menu below

Aerobic

Question 3

Does your jurisdiction record site-specific measurements for the average daily nitrogen load from treated effluent discharged from the wastewater treatment plant? Select one from the menu below. If you answer "No", be sure to fill out Step 2 on population served.

Yes	Sampled for 1X/Month

Question 4

If you answered "Yes" in question 3 above, enter the average total nitrogen discharged by your wastewater treatment plant (kg N / day) in the grey box below.

353	kg N / day	Burlingame 2014 data

Step 2. Add the population served by your municipal wastewater treatment plant and any if there is additional industrial/commercial co-discharge. Input your municipality's information in the grey boxes below.

Information needed	Units	Input Data Here
Total domestic population served by your wastewater treatment plant	# people	36000.00

Question 1

Does your jurisdiction contain commercial and/or industrial facilities? Please select one from the menu below.

No

Process emissions from your wastewater treatment plant	
Units	**N2O Process Emissions**
Metric Tons of N20	0.1152

Process emissions from effluent discharge to rivers and estuaries	
Units	**N2O Process Emissions**
Metric Tons of N2O	1.0121

Total N2O Emissions from your wastewater treatment plant	
Units	**Total N2O Process Emissions**
Metric Tons of N2O	1.1273
Metric Tons of CH4 (From Wastewater-Digester Sheet)	3.7974
Total Wastewater CO2e:	405.0674359

Data Sources and Notes for this Worksheet:

Nitrogen is sampled once per month and that figure is used for the monthly calculation; Total Nitrogen Concentration used in kg/Day calculation is as reported in CIWQS for the period 1/1/2015-12/31/2015.

Wastewater: Stationary CH_4 Emissions from an Anaerobic Digester

Step 1. Anaerobic digesters are used to treat excess biosolids produced during wastewater treatment. If your municipality operates an anaerobic digester, answer the following question about your facility:
Question 1

Do you have site-specific measurements for (1) the volume of digester gas produced at your facility and (2) the fraction of methane in the digester gas?   Select one from the drop down menu

Yes

NOTE: If significant industrial contributions of BOD5 are discharged to you municipal treatment system, it is recommended that you collect site-specific measurements for (1) the volume of digester gas produced at your facility and (2) the fraction of methane in the digester gas. This information allows the calculator to more accurately reflect the contribution of industry to your anaerobic digester's methane emissions.

Step 2. Input the following information about your anarobic digester in the grey boxes below.		
Information needed	Units	Input Data Here
Digester gas produced	Cubic feet/day	81,609.00
Percent of methane in digester gas	Percent	68.00

Calculated CH4 emissions from your anaerobic digester			
Units	CH4 Process Emissions		
Metric Tons of CH4		3.7974	

Data Sources and Notes for this Worksheet:

Data from HachWIMS CY2015 data query using HachWIMs variables 7014 and 137; received from Carolyn Critz and Manual Molina, Plant Manager on 8/9/2016

Emission Factors

About

This page summarizes the various emission factors used to estimate GHG emissions throughout the inventory.

Table 12-1: Emission Factors

Category	Type of Emission	Emission Factor	Units	Source
Fuel Combustion	Biodiesel: B-10	0.00926	MT CO2e/gallon	Calculated using EIA
Fuel Combustion	Biodiesel: B-100	0.00000	MT CO2e/gallon	Calculated using EIA
Fuel Combustion	Biodiesel: B-2	0.01008	MT CO2e/gallon	Calculated using EIA
Fuel Combustion	Biodiesel: B-20	0.00823	MT CO2e/gallon	Calculated using EIA
Fuel Combustion	Biodiesel: B-5	0.00978	MT CO2e/gallon	Calculated using EIA
Fuel Combustion	Diesel	0.01029	MT CO2e/gallon	EIA
Waste Disposal	Disposed Waste	0.18339	MT CO2e/short ton	Community GHG Inventory
Electricity	Electricity	0.00019	MT CO2e/kWh	Calculated from Community GHG Inventory
Fuel Combustion	Ethanol: E-10	0.00802	MT CO2e/gallon	EIA
Fuel Combustion	Ethanol: E-100	0.00000	MT CO2e/gallon	EIA
Fuel Combustion	Ethanol: E-85	0.00134	MT CO2e/gallon	EIA
Fuel Combustion	Gasoline	0.00900	MT CO2e/gallon	EIA
Fuel Combustion	Hybrid Gasoline	0.00889	MT CO2e/gallon	EIA
Fuel Combustion	Natural Gas	0.00531	MT CO2e/therm	PG&E
Fuel Combustion	Propane	0.00576	MT CO2e/gallon	EIA

Note: Emissions factors for biodiesel have been pulled from the website sourced.

Table 12-2: Diesel & Gasoline Emission Factors (CO2)

Diesel	0.0102	MT CO2/gallon	EIA
Gasoline	0.0089	MT CO2/gallon	EIA

Table 12-3: CH4 and N20 Emission Factors for Gasoline and Diesel Vehicles

GHG	MT GHG per MT of CO2	100-year GWP	MT CO2e Per MT of Carbon Emissions	MT CO2e Per Gallon of Diesel	MT CO2e Per Gallon of Gasoline	Source
CH4	6.49E-05	28	0.0018	0.000018	0.000016	TCR
N2O	4.17E-05	265	0.0111	0.000112	0.000098	TCR

Table 12-4: Conversion Factors

Conversion From:	Conversion To:	Conversion Factor
Pounds (lbs)	Metric Tons (MT)	0.000453592
Kilograms (kg)	Metric Tons (MT)	0.001

Table 12-5: Calcuations - Emission Factor for Disposed Waste

Category	Annual Waste (short tons)	Annual MT CO2e	MT CO2e/Short Ton	Percent of Total Waste
Landfilled Waste	31,092.7	5,772.7	0.186	95.5%
ADC	2,006.1	270.6	0.135	4.5%
Weighted Waste Average	-	-	**0.183**	

Table 12-6: Jurisdiction-specific Disposed Waste Data from Community GHG Inventory

Jurisdiction	2015 Landfilled Waste (Short Tons)	2015 Landfilled Waste Emisseions (MT CO2e)	2015 Alternative Daily Cover (Short Tons)	2015 Alternative Daily Cover Emissions (MT CO2e)
Burlingame	31,092.7	5,772.7	2,006.1	270.6

Table 12-7: IPCC AR5 Global Warming Potentials

CO2	CH4	N2O
1	28	265

Table 12-8: Universal Conversion Factors

MT / lb.	0.00045
GWh / kWh	0.0000010
MMBTU / therm	0.10
MT / kg	0.0010

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APPENDIX B

CITY OF BURLINGAME 2030 CLIMATE ACTION PLAN UPDATE

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City of Burlingame: Community-wide GHG Emissions Forecast (BAU and Adjusted BAU)

Developed by MIG, Inc. in 2019 for the City's 2030 Climate Action Plan Update

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Introduction to the Community-Wide GHG Emissions Forecast

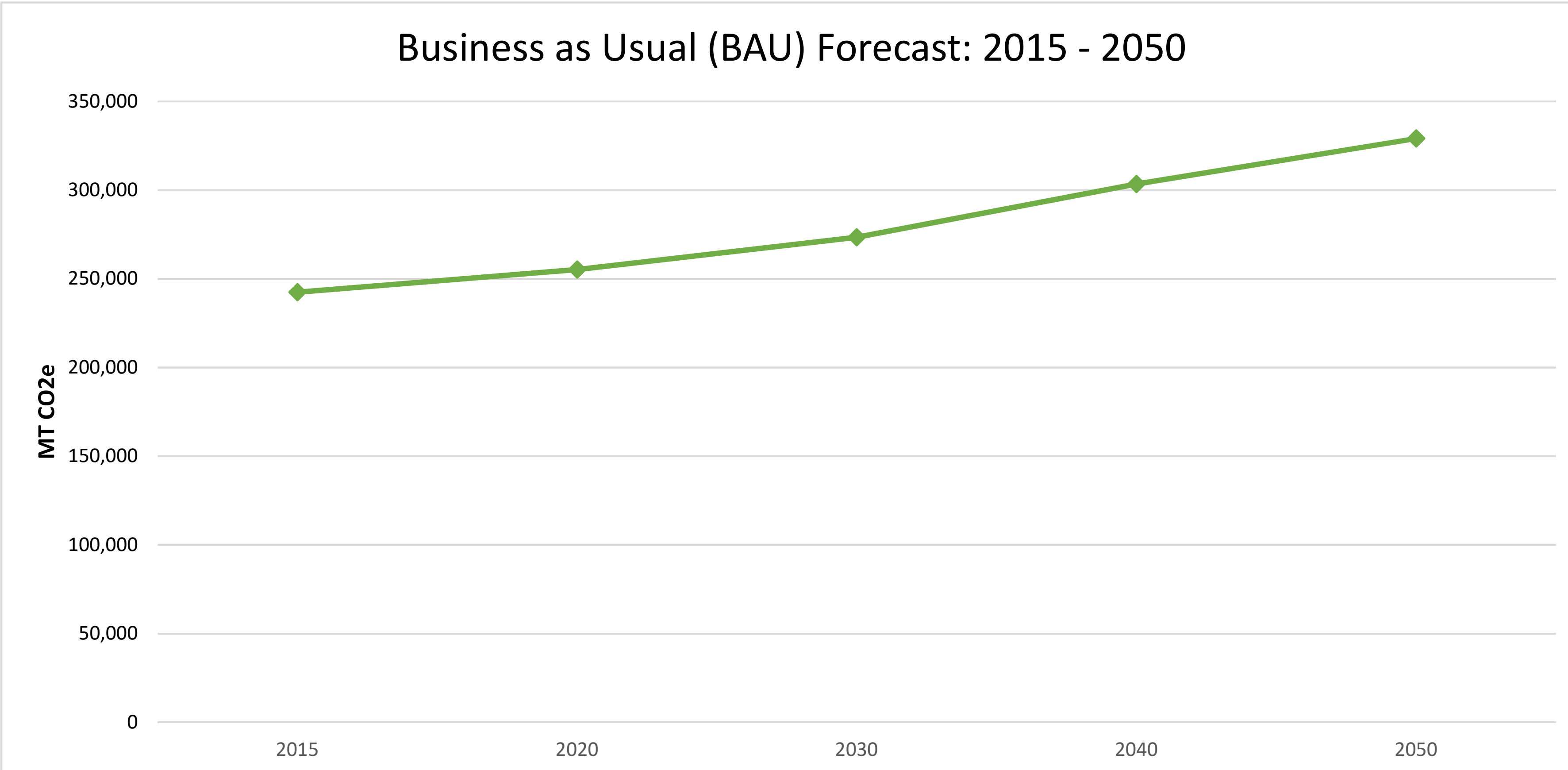
This workbook serves to document the calculations associated with the BAU and Adjusted BAU forecast scenarios. Specific discussions for how emissions were forecasted are summarized under their respective worksheets.

Version: August 28, 2019
MIG, Inc.

Contents:

BAU Forecasted Community Emissions Summary by Sector: 2020, 2030, 2040, and 2050 (MT CO2e)

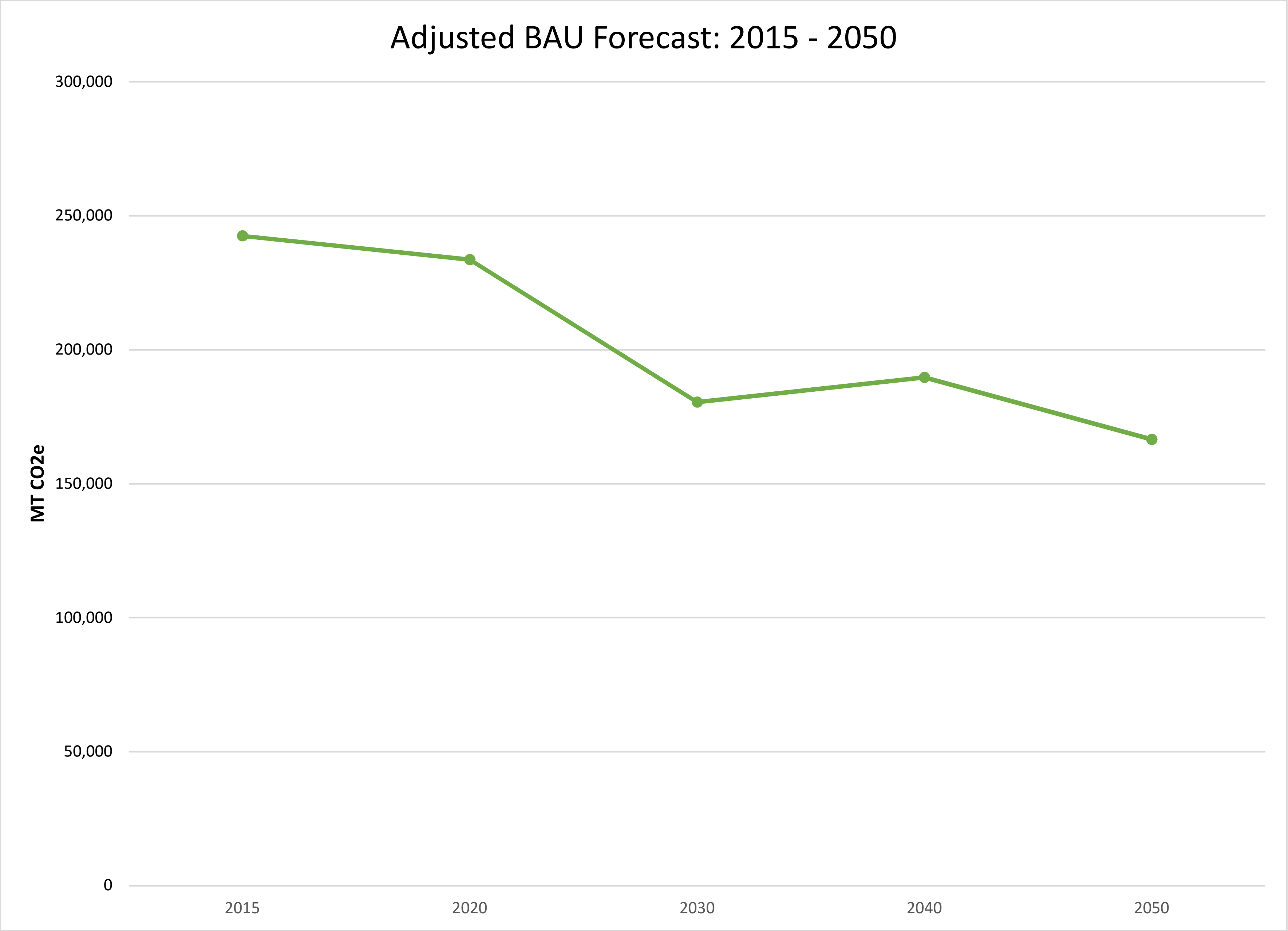
Sector	Source		2015	2020	2030	2040	2050	Activity Data Used to Forecast
Energy	Residential Energy	Electricity	11,343	11,847	12,856	13,864	14,872	Population growth
		Natural Gas	26,906	28,102	30,493	32,885	35,277	
	Commercial / Industrial Energy	Electricity	29,478	31,398	35,239	39,079	42,919	Employment growth
		Natural Gas	29,353	31,265	35,089	38,913	42,737	
	Direct Access	Electricity	8,837	9,412	10,564	11,715	12,866	Employment growth
	Stationary Sources	Multiple Fuels	6	7	7	8	9	
Transportation	On-Road Vehicle Travel	Gasoline	91,481	94,964	97,476	110,357	119,461	VMT Data from MTC
		Diesel	10,885	11,300	11,599	13,131	14,215	
		Natural Gas	99	103	106	120	130	
	Off-Road Equipment	Off-Road Equipment (Residential and Commercial)	24,105	26,316	28,509	30,701	32,894	Population growth or employment growth depending on source category
	Rail	CalTrain	2,471	2,632	2,954	3,276	3,598	Employment growth
Solid Waste	Solid Waste Disposal	Landfilled Waste	5,773	6,094	6,738	7,381	8,025	Service population growth
		ADC	271	286	316	346	376	Service population growth
	Solid Waste Landfills	Landfills	277	251	206	168	138	Closed landfill, emissions held constant.
Wastewater	Wastewater Treatment		497	520	566	612	658	Population growth
Water	Water Use		707	746	825	903	982	Service population growth
		Annual Emissions Total	**242,489**	**255,244**	**273,541**	**303,460**	**329,155**	--


Business as Usual (BAU) Forecast: 2015 - 2050
MT CO2e
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
2015
2020
2030
2040
2050

Adjusted BAU Forecasted Community Emissions Summary by Sector: 2020, 2030, 2040, and 2050 (MT CO2e)

Sector	Source		2015	2020	2030	2040	2050	Activity Data Used to Forecast
Energy	Residential Energy	Electricity	11,343	11,028	6,647	6,792	-	Population growth
		Natural Gas	26,906	27,552	27,816	28,423	29,030	
	Commercial / Industrial Energy	Electricity	29,478	29,190	18,465	19,636	-	Employment growth
		Natural Gas	29,353	30,615	32,439	34,497	36,554	
	Direct Access	Electricity	8,837	7,907	5,002	5,319	-	Employment growth
	Stationary Sources	Multiple Fuels	6	7	7	8	9	
Transportation	On-Road Vehicle Travel	Gasoline	91,481	79,607	45,534	47,353	50,473	VMT Data from MTC
		Diesel	10,885	11,946	10,223	10,569	11,194	
		Natural Gas	99	327	458	492	522	
	Off-Road Equipment	Off-Road Equipment (Residential and Commercial)	24,105	25,027	22,807	24,561	26,315	Population growth or employment growth depending on source category
	Rail	CalTrain	2,471	2,632	2,954	3,276	3,598	Employment growth
Solid Waste	Solid Waste Disposal	Landfilled Waste	5,773	6,046	6,592	7,138	7,684	Service population growth
		ADC	271	283	309	335	360	Service population growth
	Solid Waste Landfills	Landfills	277	251	206	168	138	Applied First-Order Decay Equation to Estimate Emissions
Wastewater	Wastewater Treatment		497	520	566	612	658	Population growth
Water	Water Use		707	708	468	512	-	Service population growth
		Annual Emissions Total	**242,489**	**233,646**	**180,493**	**189,690**	**166,534**	--

ABAU Legislative Reductions	Year			
	2020	2030	2040	2050
Title 24	2,281	9,915	16,525	23,134
RPS	3,491	24,314	25,656	60,935
EO B-48-18	-	9,080	9,573	10,528
On-Road Transportation	9,752	29,831	41,018	45,542
On-Road LCFS	4,734	14,054	14,603	15,547
Off-Road LCFS	1,290	5,702	6,140	6,579
AB341	51	153	255	357
Total	21,598	93,048	113,770	162,621


Adjusted BAU Forecast: 2015 - 2050
MT CO2e
300,000
250,000
200,000
150,000
100,000
50,000
0
2015
2020
2030
2040
2050

Growth Factors

Summary of Data on This Sheet

This worksheet presents the growth estimates for population, housing, employment, and service population. These growth metrics are used to forecast what community-wide GHG emissions would look like under a BAU scenario and Adjusted BAU scenario. The 2015 data and 2040 data reflect values presented in Table CX-1 of the Community Context chapter of Envision Burlingame 2040; the 2020, 2030, and 2050 values have been interpolated based on the 2015 and 2040 metrics.

Table 3-1: Growth Estimates

Sector	2015	2020	2030	2040	2050
Population	29,724	31,099	33,850	36,600	39,350
Households	13,144	13,728	14,897	16,065	17,233
Employment	29,879	31,825	35,718	39,610	43,502
Service Population	59,603	62,924	69,567	76,210	82,853
Sources:	http://www.envisionburlingame.org/files/managed/Document/320/Burlingame_Public_Draft_August2017_Chapter2_FINAL.pdf				

Table 3-2: Percent Change

Sector	2015	2020	2030	2040	2050
Population	0%	4.6%	13.9%	23.1%	32.4%
Households	0%	4.4%	13.3%	22.2%	31.1%
Employment	0%	6.5%	19.5%	32.6%	45.6%
Service Population	0%	5.6%	16.7%	27.9%	39.0%

Table 3-3: Metric Change From 2015

Sector	2015	2020	2030	2040	2050
Population	-	1,375.20	4,125.60	6,876.00	9,626.40
Households	-	584.20	1,752.60	2,921.00	4,089.40
Employment	-	1,946.20	5,838.60	9,731.00	13,623.40
Service Population	-	3,321.40	9,964.20	16,607.00	23,249.80

BAU Emissions Forecast: PG&E Electricity and Gas

Summary of Data on This Sheet

This worksheet forecasts electricity use and natural gas use, and the corresponding emissions that would be associated with this consumption under a BAU scenario. Residential energy usage is scaled based on household growth, and non-resdiential energy is scaled based on employment growth.

Electricity

Table 4-1: Electricity Usage Information

Source	Activity Data (kWh)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
PG&E Residential Electricity	61,186,049.00	63,905,532.40	69,344,499.20	74,783,466.01	80,222,432.81
PG&E Non-Residential Electricity	159,007,040.00	169,364,130.31	190,078,310.92	210,792,491.53	231,506,672.14
PG&E Total Electricity Use	220,193,089.00	233,269,662.71	259,422,810.12	285,575,957.54	311,729,104.95

Table 4-2: BAU Electricity GHG Emissions

Source	Annual Emissions (MT CO2e)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
PG&E Residential Electricity	11,343.27	11,847.44	12,855.77	13,864.09	14,872.42
PG&E Non-Residential Electricity	29,478.29	31,398.39	35,238.59	39,078.79	42,918.98
PG&E Total Electricity Use	40,821.56	43,245.82	48,094.35	52,942.88	57,791.41

Natural Gas

Table 4-3: Natural Gas Usage Information

Source	Activity Data (Therms)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
PG&E Residential Natural Gas	5,058,785.00	5,283,628.44	5,733,315.32	6,183,002.21	6,632,689.09
PG&E Non-Residential Natural Gas	5,518,975.00	5,878,459.22	6,597,427.67	7,316,396.12	8,035,364.57
PG&E Total Natural Gas Use	10,577,760.00	11,162,087.67	12,330,743.00	13,499,398.33	14,668,053.66

Table 4-4: BAU Natural Gas GHG Emissions

Source	Annual Emissions (MT CO2e)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
PG&E Residential Natural Gas	26,906	28,102	30,493	32,885	35,276.95
PG&E Non-Residential Natural Gas	29,353	31,265	35,089	38,913	42,737.29
PG&E Total Natural Gas Use	56,259	59,367	65,583	71,799	78,014.24

Adjusted BAU Emissions Forecast - PG&E Electricity and Gas

Summary of Data on This Sheet

This worksheet forecasts electricity use and natural gas use, and the corresponding emissions that would be associated with this consumption under a BAU scenario. Residential energy usage is scaled based on household growth, and non-resdiential energy is scaled based on employment growth.

Assumptions:

Title 24 Adjustments - All new construction taking place between 2018 and 2050 would be subject to the State's Title 24 Building Energy Efficiency Standards. The CEC estimates that new residential buildings built to the 2019 Title 24 building standards would be 53 percent more effecient than the 2016 Title 24 building standards, and the 2016 Title 24 standards would be 28 percent more efficient than buildings built to the 2013 Title 24 standard. The 2013 Title 24 standards were also estimated to result in residneces that would be 25 percent more efficient than those built to the 2008 Title 24 standards. This results in an improved energy efficiency for residential units of 74.62 and 46 percent for the 2019 and 2016 Title 24 standards, respectively, when compared to the 2008 standards. Similarly for commercial land uses, the 2019 and 2016 Title 24 standards are 53.8 and 34 percent more efficient than the 2008 Title 24 standards, respectively.

RPS Adjustment (Electricity) - In 2015, PG&E sourced 29.5 percent of its electicity from renewable sources. Per SB 350, California public utilities are required to reach a 33 percent renewable mix by 2020. Per SB 100 California public utility are required to reach a 60 percent renewable mix by 2030 and be carbon free by 2045. Although this would not affect electricity consumption, it would affect the GHG emissions intensity factor. These calculations have been carried out under the "Energy Reference Sheet" tab.

Electricity

Table 5-1: Electricity Usage Information

Source	Activity Data (kWh)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
PG&E Residential Electricity	61,186,049.00	63,905,532.40	69,344,499.20	74,783,466.01	80,222,432.81
PG&E Non-Residential Electricity	159,007,040.00	169,364,130.31	190,078,310.92	210,792,491.53	231,506,672.14
PG&E Total Electricity Use	220,193,089.00	233,269,662.71	259,422,810.12	285,575,957.54	311,729,104.95

Table 5-2: Adjusted BAU Electricity Usage Information (Title 24 Adjustments)

Source	Activity Data (kWh)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
PG&E Residential Electricity	61,186,049.00	62,654,570.04	63,256,663.66	64,637,073.44	66,017,483.21
PG&E Non-Residential Electricity	159,007,040.00	165,842,719.60	175,723,383.75	186,867,612.92	198,011,842.09
PG&E Total Electricity Use	220,193,089.00	228,497,289.64	238,980,047.42	251,504,686.36	264,029,325.30

Table 5-3: Adjusted BAU Electricity GHG Emissions (Accounting for RPS)					
Source	Annual Emissions (MT CO2e)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
PG&E Residential Electricity	11,343.27	11,027.80	6,647.03	6,792.09	-
PG&E Non-Residential Electricity	29,478.29	29,189.91	18,465.07	19,636.11	-
PG&E Total Electricity Use	40,821.56	40,217.71	25,112.10	26,428.20	-

Natural Gas

Table 5-4: Natural Gas Usage Information					
Source	Activity Data (Therms)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
PG&E Residential Natural Gas	5,058,785.00	5,283,628.44	5,733,315.32	6,183,002.21	6,632,689.09
PG&E Non-Residential Natural Gas	5,518,975.00	5,878,459.22	6,597,427.67	7,316,396.12	8,035,364.57
PG&E Total Natural Gas Use	10,577,760.00	11,162,087.67	12,330,743.00	13,499,398.33	14,668,053.66

Table 5-5: Adjusted BAU Natural Gas Usage Information (Title 24 Adjustments)					
Source	Activity Data (Therms)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
PG&E Residential Natural Gas	5,058,785.00	5,180,200.46	5,229,980.80	5,344,111.33	5,458,241.86
PG&E Non-Residential Natural Gas	5,518,975.00	5,756,234.59	6,099,182.54	6,485,987.56	6,872,792.59
PG&E Total Natural Gas Use	10,577,760.00	10,936,435.05	11,329,163.33	11,830,098.89	12,331,034.45

Table 5-6: Adjusted BAU Natural Gas GHG Emissions					
Source	Annual Emissions (MT CO2e)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
PG&E Residential Natural Gas	26,906	27,552	27,816	28,423	29,030.48
PG&E Non-Residential Natural Gas	29,353	30,615	32,439	34,497	36,553.98
PG&E Total Natural Gas Use	56,259	58,167	60,256	62,920	65,584.46

BAU Emissions Forecast - Direct Access Electricity

Summary of Data on This Sheet

This worksheet forecasts Direct Access electricity consumption. Forecasted activity data and emissions are based on employment growth, since Direct Access is from the non-residential sector.

Table 6-1: Electricity Usage Information

Source	Activity Data (kWh)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
Direct Access	31,201,861	33,234,227	37,298,959	41,363,691	45,428,423

Table 6-2: BAU Electricity GHG Emissions

Source	GHG Emissions (MT CO2e)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
Direct Access	8,837	9,412	10,564	11,715	12,865.89

Adjusted BAU Emissions Forecast - Direct Access Electricity

Summary of Data on This Sheet

This worksheet forecasts Direct Access electricity consumption. Forecasted activity data and emissions are based on employment growth since Direct Access is from the non-residential sector. Adjusted BAU emissions forecast takes into account new development complying with current Title 24 standards and RPS, as described under the "Adjusted BAU - PG&E Electricity and Gas" worksheet.

Table 7-1: Electricity Usage Information

Source	Activity Data (kWh)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
Direct Access	31,201,861.00	33,234,226.94	37,298,958.82	41,363,690.69	45,428,422.57

Table 7-2: Adjusted BAU Electricity Usage Information (Title 24 Adjustments)

Source	Activity Data (kWh)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
Direct Access	31,201,861.00	32,543,222.52	34,482,099.62	36,668,925.37	38,855,751.12

Table 7-3: Adjusted BAU Electricity GHG Emissions (Accounting for RPS)

Source	GHG Emissions (MT CO2e)				
	2015 Historic	2020 Forecasted	2030 Forecasted	2040 Forecasted	2050 Forecasted
Direct Access	8,836.75	7,906.72	5,001.67	5,318.87	-

Energy Reference Sheet

Summary of Data on This Sheet

This worksheet summarizes the emission factors used to forecast GHG emissions under a BAU scenario. Table 1 presents the 2015 electricity emission factors (historic) and Table 2 caculates the anticipated reductions that would be realized under the RPS mandated standards. Natural gas emission factors are anticiapted to remain constant over time, and Tables 4 and 5 provide GWP values and universal conversion factors, respectively.

Table 8-1: 2015 Electricity Emission Factors

Electricity Type	CO2 Emission Factor (lbs/kWh)	CH4 Emission Factor (lbs/GWh)	N2O Emission Factor (lbs/GWh)
PG&E Electricity	0.4045	70.66	8.41
Direct Access Electricity	0.620	70.66	8.41

Note: The 2015 electricity emissions factor for PG&E reflects PG&E's electicity service was 29.5 percent renewable in 2015.

Table 8-2: 2020, 2030, and Beyond Electricity Emission Factors

Electricity Type	2020 (33% Renewable)			2030 and 2040 (60% Renewable)			2050 (Zero-Carbon)		
	CO2 Emission Factor (lbs/kWh)	CH4 Emission Factor (lbs/GWh)	N2O Emission Factor (lbs/GWh)	CO2 Emission Factor (lbs/kWh)	CH4 Emission Factor (lbs/GWh)	N2O Emission Factor (lbs/GWh)	CO2 Emission Factor (lbs/kWh)	CH4 Emission Factor (lbs/GWh)	N2O Emission Factor (lbs/GWh)
PG&E Electricity	0.3844	60.62	7.22	0.2295	36.19	4.31	0.0000	0.00	0.00
Direct Access Electricity	0.5320	60.62	7.22	0.318	36.19	4.31	0.000	0.00	0.00

Note: Per SB 350, California public utilities are required to reach a 33 percent renewable mix by 2020, 60 percent renewable mix by 2030 and carbon-free by 2045. The 2015 electricity emissions factor for PG&E reflects PG&E's electicity service was 29.5 percent renewable in 2015. According to the CEC, the statewide renewable mix in 2015 was 21.9 percent.

CEC Source

Table 8-3: 2015 Natural Gas Emission Factors		
CO2 Emission Factor (kg/MMBtu)	CH4 Emission Factor (kg/MMBtu)	N2O Emission Factor (kg/MMBtu)
53.02000	0.00500	0.00010

Table 8-4: IPCC AR5 GWPs		
CO2	CH4	N2O
1	28	265

Table 8-5: Universal Conversion Factors	
MT / lb.	0.00045
GWh / kWh	0.0000010
MMBTU / therm	0.10
MT / kg	0.0010

BAU Emissions Forecast - Mobile Sources

Summary of Data on This Sheet

This worksheet forecasts BAU mobile source emissions through the year 2050. The VMT data utilzied was provided by MTC, and is the same dataset used in Plan Bay Area 2040. The BAU forecast assumes the percent of gasoline vehices vs. electric vehicles vs. natural gas vehicles, etc. would remain constant. In addition, it also assumes fuel economy standards and emission rates would remain the same as they were in 2015.

Table 9-1: Summary of Origin Destination On-road Transportation Emissions by Fuel Type

Year	Annual VMT Emissions in City			
	Gasoline Emissions (MT CO2e)	Diesel Emissions (MT CO2e)	Natural Gas Emissions (MT CO2e)	Total Emissions (MT CO2e)
2015	91,481	10,885	99	102,465
2020	94,964	11,300	103	106,367
2030	97,476	11,599	106	109,181
2040	110,357	13,131	120	123,608
2050	119,461	14,215	130	133,805

Table 9-2: 2005 and 2015 Summary of Origin-Destination On-road Transportation VMT

Year	Burlingame		
	Days In Year Multiplier	Daily VMT	Annual VMT
2015	347.00	734,277	254,793,946
2020		762,234	264,495,198
2030		782,399	271,492,453
2040		885,785	307,367,222
2050		958,862	332,725,017

Note: Tom Buckley (tbuckley@bayareametro.gov) and Kearey Smith (ksmith@bayareametro.gov) at MTC provided these VMT metrics. This dataset was also used in Plan Bay Area 2040. Multiplier based on CARB's GHG inventory technical support document for LDA.

CARB Technical Support Document

Table 9-3: 2015 Emission Factors for On-road Transportation Fuels

	Gasoline		Diesel		Natural Gas	
Greenhouse Gas	Emissions (grams/gal)	Emissions (grams/mile)	Emissions (grams/gal)	Emissions (grams/mile)	Emissions (grams/gal)	Emissions (grams/mile)
CO2	8,595		10,179		7848.654391	
CH4		0.024557273		0.026694083		4.163352435
N2O		0.02		0.16		0.730993021

Emission Factors derived from the EMFAC model, specifically using EMFAC2017 (v1.0.2).

Table 9-4: 2015 On-road VMT Attributable to Gasoline vs. Diesel Vehicles

Percent of Total VMT Attributable to Gasoline Vehicles	Percent of Total VMT Attributable to Diesel Vehicles	Percent of Total VMT Attributable to Electric Vehicles	Percent of Total VMT Attributable to Natural Gas Vehicles
95.30%	3.95%	0.73%	0.01%

Note: Percent of VMT attributable to gasoline, diesel, and nautral gas vehicles derived from the EMFAC model, specifically using EMFAC2017 (v1.0.2).

Table 9-5: 2015 On-road Fuel Efficiencies of Gasoline, Diesel, and Natural Gas Vehicles

Gasoline Vehicles Miles Per Gallon (MPG)	Diesel Vehicles Miles Per Gallon (MPG)	Natural Gas Vehicles Miles Per Gallon (MPG)
23.13	9.81	2.19

Note: MPG of gasoline and diesel vehicles are based on the EMFAC model, specifically EMFAC2017 (v1.0.2).

Table 9-6: Summary of Origin-Destination On-road Transportation VMT & Fuel

Year	In Burlingame			Gallons of Fuel Consumed		
	Gasoline VMT	Diesel VMT	Natural Gas VMT	Gasoline Fuel Consumption (gal)	Diesel Fuel Consumption (gal)	Natural Gas Fuel Consumption (gal)
2015	242,818,630	10,064,361	25,479	10,497,995	1,025,929	11,634
2020	252,063,924	10,447,560	26,450	10,897,705	1,064,991	12,077
2030	258,732,308	10,723,952	27,149	11,186,006	1,093,165	12,397
2040	292,920,962	12,141,005	30,737	12,664,114	1,237,615	14,035
2050	317,086,941	13,142,638	33,273	13,708,904	1,339,718	15,193

Table 9-7: Summary of In-boundary On-road Transportation Emissions by Fuel Type & Greenhouse Gas

Year	In Burlingame								
	Gasoline Emissions (MT CO2)	Gasoline Emissions (MT CH4)	Gasoline Emissions (MT N2O)	Diesel Emissions (MT CO2)	Diesel Emissions (MT CH4)	Diesel Emissions (MT N2O)	Natural Gas Emissions (MT CO2)	Natural Gas Emissions (MT CH4)	Natural Gas Emissions (MT N2O)
2015	90,226	5.96	4.11	10,443	0.27	1.64	91.3	0.1	0.02
2020	93,661	6.19	4.26	10,841	0.28	1.70	94.8	0.1	0.02
2030	96,139	6.35	4.38	11,127	0.29	1.75	97.3	0.1	0.02
2040	108,843	7.19	4.95	12,598	0.32	1.98	110.2	0.1	0.02
2050	117,822	7.79	5.36	13,637	0.35	2.14	119.2	0.1	0.02

Table 9-8: IPCC AR5 Global Warming

CO2	CH4	N2O
1	28	265

Table 9-9: Universal Conversion Factors

MT / gram	0.000001

Adjusted BAU Emissions Forecast - Mobile Sources (Without EO B-48-18)

Summary of Data on This Sheet

This worksheet forecasts Adjusted BAU mobile source emissions through the year 2040. The VMT data utilzied was provided by MTC, and is the same dataset used in Plan Bay Area 2040. The Adjusted BAU forecast on this sheet takes into account changes to vehicle type changes and emission improvements that are accounted for in EMFAC2017 (v1.0.2). Table 2 also takes into account reduction achieved through the LCFS regulation. This sheet does not account for reductions assoicated with EO B-48-18.

Table 10-1: Adj BAU Summary of Origin Destination On-road Transportation Emissions by Fuel Type (EMFAC)

Year	Annual VMT Emissions in City			
	Gasoline Emissions (MT CO2e)	Diesel Emissions (MT CO2e)	Natural Gas Emissions (MT CO2e)	Total Emissions (MT CO2e)
2015	91,481	10,885	99	102,465
2020	83,709	12,562	344	96,615
2030	65,998	12,779	573	79,349
2040	67,616	14,336	638	82,590
2050	71,717	15,857	689	88,264

Table 10-2: Adj BAU Summary of Origin Destination On-road Transportation Emissions by Fuel Type (EMFAC + LCFS)

Year	Annual VMT Emissions in City			
	Gasoline Emissions (MT CO2e)	Diesel Emissions (MT CO2e)	Natural Gas Emissions (MT CO2e)	Total Emissions (MT CO2e)
2015	91,481	10,885	99	102,465
2020	79,607	11,946	327	91,881
2030	52,798	10,223	458	63,480
2040	54,093	11,468	511	66,072
2050	57,374	12,686	551	70,611

Table 10-3: 2005 and 2015 Summary of Origin-Destination On-road Transportation VMT

Year	Burlingame		
	Days In Year Multiplier	Daily VMT	Annual VMT
2015	347.00	734,277	254,793,946
2020		762,234	264,495,198
2030		782,399	271,492,453
2040		885,785	307,367,222
2050		958,862	332,725,017

Note: Tom Buckley (tbuckley@bayareametro.gov) and Kearey Smith (ksmith@bayareametro.gov) at MTC provided these VMT metrics. This dataset was also used in Plan Bay Area 2040.
Multiplier based on CARB's GHG inventory technical support document for LDA (conservative).

CARB Technical Support Document

Table 10-4: 2015 Emission Factors for On-road Transportation Fuels

Year	Greenhouse Gas	Gasoline		Diesel		Natural Gas	
		Emissions (grams/gal)	Emissions (grams/mile)	Emissions (grams/gal)	Emissions (grams/mile)	Emissions (grams/gal)	Emissions (grams/mile)
2015	CO2	8,595		10179.02		7848.65	
	CH4		0.02		0.03		4.16
	N2O		0.02		0.16		0.73
2020	CO2	8594.57		10179.02		7848.65	
	CH4		0.02		0.01		4.58
	N2O		0.01		0.14		0.59
2030	CO2	8594.57		10179.02		7848.65	
	CH4		0.01		0.00		4.66
	N2O		0.01		0.11		0.49
2040	CO2	8594.57		10179.02		7848.65	
	CH4		0.01		0.00		4.51
	N2O		0.01		0.10		0.47
2050	CO2	8594.57		10179.02		7848.65	
	CH4		0.01		0.00		4.42
	N2O		0.01		0.10		0.46

Note: Emission Factors derived from the EMFAC model, specifically using EMFAC2017 (v1.0.2).

Table 10-5: 2015 On-road VMT Attributable to Gasoline vs. Diesel Vehicles

Year	Percent of Total VMT Attributable to Gasoline Vehicles	Percent of Total VMT Attributable to Diesel Vehicles	Percent of Total VMT Attributable to Electric Vehicles	Percent of Total VMT Attributable to Natural Gas Vehicles
2015	95.30%	3.95%	0.73%	0.01%
2020	93.44%	5.16%	1.37%	0.04%
2030	89.75%	6.45%	3.72%	0.08%
2040	88.42%	7.00%	4.50%	0.08%
2050	87.98%	7.31%	4.62%	0.08%

Note: Percent of VMT attributable to gasoline, diesel, and nautral gas vehicles derived from the EMFAC model, specifically using EMFAC2017 (v1.0.2).

Table 10-6: 2015 On-road Fuel Efficiencies of Gasoline, Diesel, and Natural Gas Vehicles

Year	Gasoline Vehicles Miles Per Gallon (MPG)	Diesel Vehicles Miles Per Gallon (MPG)	Natural Gas Vehicles Miles Per Gallon (MPG)
2015	23.13	9.81	2.19
2020	25.63	11.52	2.73
2030	32.02	14.53	3.25
2040	34.87	15.91	3.43
2050	35.43	16.27	3.50

Note: MPG of gasoline and diesel vehicles are based on the EMFAC model, specifically EMFAC2017 (v1.0.2).

Table 10-7: Summary of Origin-Destination On-road Transportation VMT & Fuel						
Jurisdiction	In Burlingame			Gallons of Fuel Consumed		
	Gasoline VMT	Diesel VMT	Natural Gas VMT	Gasoline Fuel Consumption (gal)	Diesel Fuel Consumption (gal)	Natural Gas Fuel Consumption (gal)
2015	242,818,630	10,064,361	25,479	10,497,995	1,025,929	11,634
2020	247,132,916	13,639,942	108,862	9,641,049	1,184,255	39,883
2030	243,659,804	17,511,928	213,976	7,610,576	1,205,079	65,839
2040	271,765,977	21,513,512	251,624	7,793,948	1,351,828	73,328
2050	292,738,740	24,322,074	277,177	8,262,373	1,495,345	79,163

Table 10-8: Summary of In-boundary On-road Transportation Emissions by Fuel Type & Greenhouse Gas									
Jurisdiction	In Burlingame								
	Gasoline Emissions (MT CO2)	Gasoline Emissions (MT CH4)	Gasoline Emissions (MT N2O)	Diesel Emissions (MT CO2)	Diesel Emissions (MT CH4)	Diesel Emissions (MT N2O)	Natural Gas Emissions (MT CO2)	Natural Gas Emissions (MT CH4)	Natural Gas Emissions (MT N2O)
2015	90,226	5.96	4.11	10,443	0.27	1.64	91.3	0.1	0.02
2020	82,861	4.12	2.77	12,055	0.18	1.89	313.0	0.5	0.06
2030	65,410	2.80	1.92	12,267	0.06	1.93	516.7	1.0	0.11
2040	66,986	2.68	2.09	13,760	0.07	2.16	575.5	1.1	0.12
2050	71,012	2.81	2.37	15,221	0.08	2.39	621.3	1.2	0.13

Table 10-9: IPCC AR5 Global		
CO2	CH4	N2O
1	28	265

Table 10-10: Universal Conversion Factors	
MT / gram	0.000001

Adjusted BAU Emissions Forecast - Mobile Sources (With EO B-48-18)

Summary of Data on This Sheet

This worksheet forecasts Adjusted BAU mobile source emissions through the year 2050. The VMT data utilzied was provided by MTC, and is the same dataset used in Plan Bay Area 2040. The Adjusted BAU forecast on this sheet takes into account changes to vehicle type changes and emission improvements that are accounted for in EMFAC2017 (v1.0.2) as well as reductions from an increased amount of electric cars on the roadway from EO B-48-18. Table 2 also takes into account reduction achieved through the LCFS regulation.

Table 11-1: Adj BAU Summary of Origin Destination On-road Transportation Emissions by Fuel Type (EMFAC + EO)

Year	Annual VMT Emissions in City			
	Gasoline Emissions (MT CO2e)	Diesel Emissions (MT CO2e)	Natural Gas Emissions (MT CO2e)	Total Emissions (MT CO2e)
2015	91,481	10,885	99	102,465
2020	83,709	12,562	344	96,615
2030	56,918	12,779	573	70,269
2040	59,191	13,211	615	73,016
2050	63,092	13,992	652	77,736

Table 11-2: Adj BAU Summary of Origin Destination On-road Transportation Emissions by Fuel Type (EMFAC + LCFS + EO)

Year	Annual VMT Emissions in City			
	Gasoline Emissions (MT CO2e)	Diesel Emissions (MT CO2e)	Natural Gas Emissions (MT CO2e)	Total Emissions (MT CO2e)
2015	91,481	10,885	99	102,465
2020	79,607	11,946	327	91,881
2030	45,534	10,223	458	56,216
2040	47,353	10,569	492	58,413
2050	50,473	11,194	522	62,189

Table 11-3: 2005 and 2015 Summary of Origin-Destination On-road Transportation VMT

Year	Burlingame		
	Days In Year Multiplier	Daily VMT	Annual VMT
2015	347.00	734,277	254,793,946
2020		762,234	264,495,198
2030		782,399	271,492,453
2040		885,785	307,367,222
2050		958,862	332,725,017

Note: Tom Buckley (tbuckley@bayareametro.gov) and Kearey Smith (ksmith@bayareametro.gov) at MTC provided these VMT metrics. This dataset was also used in Plan Bay Area 2040.
Multiplier based on CARB's GHG inventory technical support document for LDA (conservative).
CARB Technical Support Document

Table 11-4: 2015 Emission Factors for On-road Transportation Fuels

Year	Greenhouse Gas	Gasoline		Diesel		Natural Gas	
		Emissions (grams/gal)	Emissions (grams/mile)	Emissions (grams/gal)	Emissions (grams/mile)	Emissions (grams/gal)	Emissions (grams/mile)
2015	CO2	8,595		10179.02		7848.65	
	CH4		0.02		0.03		4.16
	N2O		0.02		0.16		0.73
2020	CO2	8594.57		10179.02		7848.65	
	CH4		0.02		0.01		4.58
	N2O		0.01		0.14		0.59
2030	CO2	8594.57		10179.02		7848.65	
	CH4		0.01		0.00		4.66
	N2O		0.01		0.11		0.49
2040	CO2	8594.57		10179.02		7848.65	
	CH4		0.01		0.00		4.51
	N2O		0.01		0.10		0.47
2050	CO2	8594.57		10179.02		7848.65	
	CH4		0.01		0.00		4.42
	N2O		0.01		0.10		0.46

Note: Emission Factors derived from the EMFAC model, specifically using EMFAC2017 (v1.0.2).

Table 11-5: 2015 On-road VMT Attributable to Gasoline vs. Diesel Vehicles

Year	Percent of Total VMT Attributable to Gasoline Vehicles	Percent of Total VMT Attributable to Diesel Vehicles	Percent of Total VMT Attributable to Electric Vehicles	Percent of Total VMT Attributable to Natural Gas Vehicles
2015	95.30%	3.95%	0.73%	0.01%
2020	93.44%	5.16%	1.37%	0.04%
2030 EO	77.40%	6.45%	16.07%	0.08%
2040 EO	77.40%	6.45%	16.07%	0.08%
2050 EO	77.40%	6.45%	16.07%	0.08%

Note: Percent of VMT attributable to gasoline, diesel, and nautral gas vehicles derived from the EMFAC model, specifically using EMFAC2017 (v1.0.2). 2030, 2040, and 2050 adjusted to account for EO; percent of Evs on the road expected to stay constant for 2040 and 2050.

Table 11-6: 2015 On-road Fuel Efficiencies of Gasoline, Diesel, and Natural Gas Vehicles

Year	Gasoline Vehicles Miles Per Gallon (MPG)	Diesel Vehicles Miles Per Gallon (MPG)	Natural Gas Vehicles Miles Per Gallon (MPG)
2015	23.13	9.81	2.19
2020	25.63	11.52	2.73
2030	32.02	14.53	3.25
2040	34.87	15.91	3.43
2050	35.43	16.27	3.50

Note: MPG of gasoline and diesel vehicles are based on the EMFAC model, specifically EMFAC2017 (v1.0.2).

Table 11-7: Summary of Origin-Destination On-road Transportation VMT & Fuel

Year	In Burlingame			Gallons of Fuel Consumed		
	Gasoline VMT	Diesel VMT	Natural Gas VMT	Gasoline Fuel Consumption (gal)	Diesel Fuel Consumption (gal)	Natural Gas Fuel Consumption (gal)
2015	242,818,630	10,064,361	25,479	10,497,995	1,025,929	11,634
2020	247,132,916	13,639,942	108,862	9,641,049	1,184,255	39,883
2030	210,136,763	17,511,928	213,976	6,563,503	1,205,079	65,839
2040	237,904,046	19,825,939	242,251	6,822,825	1,245,787	70,597
2050	257,531,129	21,461,579	262,236	7,268,660	1,319,479	74,896

Table 11-8: Summary of In-boundary On-road Transportation Emissions by Fuel Type & Greenhouse Gas

Year	In Burlingame								
	Gasoline Emissions (MT CO2)	Gasoline Emissions (MT CH4)	Gasoline Emissions (MT N2O)	Diesel Emissions (MT CO2)	Diesel Emissions (MT CH4)	Diesel Emissions (MT N2O)	Natural Gas Emissions (MT CO2)	Natural Gas Emissions (MT CH4)	Natural Gas Emissions (MT N2O)
2015	90,226	5.96	4.11	10,443	0.27	1.64	91.3	0.1	0.02
2020	82,861	4.12	2.77	12,055	0.18	1.89	313.0	0.5	0.06
2030	56,411	2.41	1.66	12,267	0.06	1.93	516.7	1.0	0.11
2040	58,639	2.34	1.83	12,681	0.07	1.99	554.1	1.1	0.11
2050	62,471	2.47	2.08	13,431	0.07	2.11	587.8	1.2	0.12

Table 11-9: IPCC AR5 Global

CO2	CH4	N2O
1	28	265

Table 11-10: Universal Conversion Factors

MT / gram	0.000001

Plan Bay Area 2040 VMT Data

Summary of Data on This Sheet

This worksheet provides the raw VMT data provided by MTC. Consistent with the 2005 and 2015 community-wide inventories, annual VMT is calculated following the origin-destination methodology.

Table 12-1: 2015 Raw Origin-Destination On-road Transportation VMT Data Supplied by MTC

Population_Segment	persons	model_run	Entirely_Within	Partially_Within	Entirely_Outside
Live in area-Works in area	2245	2005_05_YYY	4928	13913	1405
Live in area-Works out of area	11625	2005_05_YYY	5283	232198	63585
Live in area-Non-worker	15414	2005_05_YYY	10945	130054	19279
Live out of area-Works in area	20178	2005_05_YYY	3911	453013	146421
Live out of area-Works out of area	3186508	2005_05_YYY	1058	202633	77044392
Live out of area-Non-worker	3743013	2005_05_YYY	2271	187435	32921606
Live in area-Works in area	2347	2010_06_YYY	5175	14173	1269
Live in area-Works out of area	10351	2010_06_YYY	5379	204244	54189
Live in area-Non-worker	16275	2010_06_YYY	13624	139508	19731
Live out of area-Works in area	24664	2010_06_YYY	5103	553582	176721
Live out of area-Works out of area	3334535	2010_06_YYY	1455	215407	76158712
Live out of area-Non-worker	3690829	2010_06_YYY	2621	185717	31308784
Live in area-Works in area	2852	2015_06_YYY	6321	16899	1770
Live in area-Works out of area	12214	2015_06_YYY	6628	227621	60676
Live in area-Non-worker	15012	2015_06_YYY	11838	117307	16932
Live out of area-Works in area	30446	2015_06_YYY	6039	642452	208988
Live out of area-Non-worker	3536548	2015_06_YYY	2382	161560	28014216
Live out of area-Works out of area	3973450	2015_06_YYY	1546	233206	85764160
Live in area-Works in area	2812	2020_06_694	6124	16431	1747
Live in area-Works out of area	12414	2020_06_694	6553	232399	60307
Live in area-Non-worker	15936	2020_06_694	12937	127562	17434
Live out of area-Works in area	31588	2020_06_694	5944	651254	216820
Live out of area-Non-worker	3734358	2020_06_694	2410	170798	29822378
Live out of area-Works out of area	4092962	2020_06_694	1643	254802	87303400
Live in area-Works in area	2778	2030_06_694_Amd	5878	19712	2093
Live in area-Works out of area	13066	2030_06_694_Amd	6000	238278	65262
Live in area-Non-worker	17000	2030_06_694_Amd	12997	147941	21419
Live out of area-Works in area	31970	2030_06_694_Amd	6044	653651	225595
Live out of area-Non-worker	4221946	2030_06_694_Amd	2372	183884	34694588
Live out of area-Works out of area	4352832	2030_06_694_Amd	1721	251308	92703520
Live in area-Works in area	3064	2040_06_694_Amd	6330	20296	2060
Live in area-Works out of area	12770	2040_06_694_Amd	6238	226739	60389
Live in area-Non-worker	18082	2040_06_694_Amd	14064	150350	21582
Live out of area-Works in area	39774	2040_06_694_Amd	7003	811316	281530
Live out of area-Works out of area	4617162	2040_06_694_Amd	1685	271962	95260280
Live out of area-Non-worker	4863081	2040_06_694_Amd	2762	214742	39660324

Table 12-2: Daily VMT Summary	
Year	VMT
2015	734,276.50
2020	762,234.00
2030	782,399.00
2040	885,784.50
2050	970,365.87

Note: 2050 VMT estimated by taking the daily VMT for 2040 and multiplying through by the percent increase in service population from 2030 to 2040.

BAU Emissions Forecast - Offroad Vehicles and Equipment

Summary of Data on This Sheet

This worksheet forecasts BAU associated with offroad vehicles and equipment. Emission forecasts are based on population growth or employment growth (based on the type of off-road emissions subets they were allocated to in the community-wide inventory). The rate of cahnge by population/emplyment is based on the sector emissions between 2015 and 2020 (see "OFFROAD Emissions Rate Derivation" sheet for details").

Table 13-1: BAU Off-road Emissions in Burlingame by Year

Calendar Year	Total Off-road Emissions (MT CO2e/year)
2015	24,105
2020	26,316
2030	28,509
2040	30,701
2050	32,894

Table 13-2: BAU Off-road Emissions in Burlingame in 2020

Type of Off-road Emissions	Allocate Emissions Based On:	2015 Emissions (MTCO2e)	Rate of change, By Pop/Emply (MTCO2e)	Change from 2015 (Pop/Emply)	Year's Emissions (MTCO2e)
Agricultural Equipment	Change In Employment	731.55	0.01	1,946.20	746.53
Airport Ground Support Equipment	--	-	-	-	
Construction and Mining Equipment	Annual Change in Service Pop	-	23.46	664.28	15,581.89
Entertainment Equipment	Change In Employment	38.88	0.00	1,946.20	39.09
Industrial Equipment	Change In Employment	3,397.33	0.12	1,946.20	3,628.36
Lawn and Garden Equipment	Change in Population	570.09	0.02	1,375.20	594.96
Light Commercial Equipment	Change In Employment	2,437.47	0.08	1,946.20	2,596.94
Oil Drilling	Change In Employment	14.30	0.00	1,946.20	14.38
Pleasure Craft	Change in Population	421.33	0.07	1,375.20	511.79
Rail yard Operations	Standard Yearly Rate	0.53	0.00	5	0.53
Recreational Equipment	Change in Population	126.06	0.02	1,375.20	150.28
Transport Refrigeration Units	Change In Employment	1,900.75	0.28	1,946.20	2,451.63
	Total	**24,104.78**			26,316.39

Table 13-3: BAU Off-road Emissions in Burlingame in 2030					
Type of Off-road Emissions	**Allocate Emissions Based On:**	**2015 Emissions (MTCO2e)**	**Rate of change, By Pop/Emply (MTCO2e)**	**Change from 2015 (Pop/Emply)**	**Year's Emissions (MTCO2e)**
Agricultural Equipment	Change In Employment	731.55	0.01	5,838.60	776.49
Airport Ground Support Equipment	--	-	-	-	
Construction and Mining Equipment	Annual Change in Service Pop	-	23.46	664.28	15,581.89
Entertainment Equipment	Change In Employment	38.88	0.00	5,838.60	39.52
Industrial Equipment	Change In Employment	3,397.33	0.12	5,838.60	4,090.42
Lawn and Garden Equipment	Change in Population	570.09	0.02	4,125.60	644.72
Light Commercial Equipment	Change In Employment	2,437.47	0.08	5,838.60	2,915.88
Oil Drilling	Change In Employment	14.30	0.00	5,838.60	14.53
Pleasure Craft	Change in Population	421.33	0.07	4,125.60	692.70
Rail yard Operations	Standard Yearly Rate	0.53	0.00	15	0.53
Recreational Equipment	Change in Population	126.06	0.02	4,125.60	198.71
Transport Refrigeration Units	Change In Employment	1,900.75	0.28	5,838.60	3,553.39
	Total	24,104.78			28,508.78

Table 13-4: BAU Off-road Emissions in Burlingame in 2040					
Type of Off-road Emissions	**Allocate Emissions Based On:**	**2015 Emissions (MTCO2e)**	**Rate of change, By Pop/Emply (MTCO2e)**	**Change from 2015 (Pop/Emply)**	**Year's Emissions (MTCO2e)**
Agricultural Equipment	Change In Employment	731.55	0.01	9,731.00	806.45
Airport Ground Support Equipment	--	-	-	-	
Construction and Mining Equipment	Annual Change in Service Pop	-	23.46	664.28	15,581.89
Entertainment Equipment	Change In Employment	38.88	0.00	9,731.00	39.94
Industrial Equipment	Change In Employment	3,397.33	0.12	9,731.00	4,552.49
Lawn and Garden Equipment	Change in Population	570.09	0.02	6,876.00	694.47
Light Commercial Equipment	Change In Employment	2,437.47	0.08	9,731.00	3,234.81
Oil Drilling	Change In Employment	14.30	0.00	9,731.00	14.68
Pleasure Craft	Change in Population	421.33	0.07	6,876.00	873.61
Rail yard Operations	Standard Yearly Rate	0.53	0.00	25	0.54
Recreational Equipment	Change in Population	126.06	0.02	6,876.00	247.15
Transport Refrigeration Units	Change In Employment	1,900.75	0.28	9,731.00	4,655.14
	Total	24,104.78			30,701.17

Table 13-5: BAU Off-road Emissions in Burlingame in 2050					
Type of Off-road Emissions	**Allocate Emissions Based On:**	**2015 Emissions (MTCO2e)**	**Rate of change, By Pop/Emply (MTCO2e)**	**Change from 2015 (Pop/Emply)**	**Year's Emissions (MTCO2e)**
Agricultural Equipment	Change In Employment	731.55	0.01	13,623.40	836.41
Airport Ground Support Equipment	--	-	-	-	
Construction and Mining Equipment	Annual Change in Service Pop	-	23.46	664.28	15,581.89
Entertainment Equipment	Change In Employment	38.88	0.00	13,623.40	40.37
Industrial Equipment	Change In Employment	3,397.33	0.12	13,623.40	5,014.55
Lawn and Garden Equipment	Change in Population	570.09	0.02	9,626.40	744.23
Light Commercial Equipment	Change In Employment	2,437.47	0.08	13,623.40	3,553.75
Oil Drilling	Change In Employment	14.30	0.00	13,623.40	14.83
Pleasure Craft	Change in Population	421.33	0.07	9,626.40	1,054.52
Rail yard Operations	Standard Yearly Rate	0.53	0.00	35	0.54
Recreational Equipment	Change in Population	126.06	0.02	9,626.40	295.58
Transport Refrigeration Units	Change In Employment	1,900.75	0.28	13,623.40	5,756.90
	Total	24,104.78			32,893.57

ABAU Emissions Forecast - Offroad Vehicles and Equipment

Summary of Data on This Sheet

This worksheet forecasts Adjusted BAU emissions associated with offroad vehicles and equipment. The ABAU scenario takes into account reductions from LCFS.

Table 14-1: ABAU Off-road Emissions in Burlingame by Year (LCFS)

Calendar Year	Total Off-road Emissions (MT CO2e/year)
2015	24,105
2020	25,027
2030	22,807
2040	24,561
2050	26,315

Table 14-2: BAU Off-road Emissions in Burlingame by Year

Calendar Year	Total Off-road Emissions (MT CO2e/year)
2015	24,105
2020	26,316
2030	28,509
2040	30,701
2050	32,894

OFFROAD: Emissions Rate Derivation

Summary of Data on This Sheet

This worksheet calculates the rate that GHG emissions changed from 2015 to 2020, based on growth characteristics associated with that sector. The 2015 emissions calculations are provided in the 2015 Community-wide Inventory, and the 2020 emissions are provided on the "OFFROAD 2020" provided in this workbook.

Table 15-1: Growth Rate of Change

Year	Population	Employment
2015	29724	29,879
2020	31,099	31,825
Change	1,375	1,946

Table 15-2: OFFROAD Emissions Rate Derivation

Type of Off-road Emissions	2015 Emissions (MTCO2e/YR)	2020 Emissions (MTCO2e/YR)	Change In Emissions (MTCO2e)	Rate of Change (MTCO2e/(pop/employ/SP))	Allocate Emissions Based On:
Agricultural Equipment	731.5549659	716.5761785	14.97878747	0.007696428	Total Employment
Airport Ground Support Equipment	0	0	0		--
Construction and Mining Equipment	14466.47821	15581.89311	15581.89311	23.45681507	Change in Service Pop from Previous Year
Entertainment Equipment	38.88262725	39.09462568	0.211998431	0.000108929	Total Employment
Industrial Equipment	3397.325499	3628.358264	231.0327655	0.118709673	Total Employment
Lawn and Garden Equipment	570.0863918	594.9636054	24.87721363	0.018089888	Total Population
Light Commercial Equipment	2437.472907	2596.940477	159.4675706	0.081937915	Total Employment
Oil Drilling	14.30279878	14.37811693	0.075318148	3.87001E-05	Total Employment
Pleasure Craft	421.3309771	511.7865504	90.45557325	0.065776304	Total Population
Rail yard Operations	0.533151395	0.532727867	0.000423527	8.47055E-05	Standard Yearly Rate
Recreational Equipment	126.0586881	150.2766963	24.2180082	0.017610535	Total Population
Transport Refrigeration Units	1900.753383	2451.631562	550.8781786	0.283053221	Total Employment

Note: Rate derivation evaluates change in absolute value to avoid reduction overcounting in future years.

OFFROAD: 2020 GHG Emissions

Summary of Methodology Used

Off-road emissions were calculated using the ARB Offroad2007 Model. The EPA NONROAD model was not used, as recommended in the ICLEI Community GHG Protocol, because the ARB model is assumed to be more accurate for California communities. The model was run for the 2015 calendar year, and for all of San Mateo County. Total county-wide emissions are summed below. Emissions are then allocated to each jurisdiction based on population or the number of jobs, by emission type. This worksheet includes a summary of the model's data and the allocation methodology for each type of emissions. The table below shows the total allocated emissions.

Table 16-1: Summary of Off-road Emissions in San Mateo County by Emissions Type

Type of Off-road Emissions	Off-road CO2 Emissions (tons CO2/day)	Off-road N2O Emissions (tons N2O/day)	Off-road CH4 Emissions (tons CH4/day)	Allocate Emissions to Jurisdiction by:
Agricultural Equipment	26.12351271	0.00033337	0.00184957	Number of Jobs
Airport Ground Support Equipment	237.0440098	0.01635941	0.02239097	SFO is located in unincorporated San Mateo County, and the County owns and operates two general aviation airports: the San Carlos Airport and the Half Moon Bay Airport. Thus, 100% of these emissions will be allocated to San Mateo County.
Construction and Mining Equipment	569.0410172	0.00347023	0.04072361	Number of Jobs
Entertainment Equipment	1.431482751	0	4.9884E-05	Number of Jobs
Industrial Equipment	130.0367253	0.00715662	0.03756453	Number of Jobs
Lawn and Garden Equipment	37.99567921	0.02436766	0.0557567	Population
Light Commercial Equipment	90.83722922	0.01416572	0.02110029	Number of Jobs
Oil Drilling	0.52605544	0	3.3041E-05	Number of Jobs
Pleasure Craft	36.49840667	0.00813079	0.03315508	Population
Railyard Operations	0.019279351	0	9.607E-07	Emissions will be evenly allocated to the following 12 jurisdictions with rail lines: Atherton, Belmont, Brisbane, Burlingame, Menlo Park, Millbrae, Redwood City, San Bruno, San Carlos, San Mateo (City), San Mateo
Recreational Equipment	7.308401832	0.01017269	0.05779241	Population
Transport Refrigeration Units	89.5282746	0.00054329	0.00656803	Number of Jobs
Grand Total	1226.390074	0.08469978	0.27698507	

Off-road emissions data from ARB Offroad2007 Model.

Table 16-2: Summary of Off-road Emissions in San Mateo County by Emissions Type

Type of Off-road Emissions	Off-road CO2 Emissions (MTCO2e/ YR)	Off-road N2O Emissions (MTCO2e/ YR)	Off-road CH4 Emissions (MTCO2e/ YR)	Total Emissions (MTCO2e/ YR)	Allocate Emissions to Jurisdiction by:
Agricultural Equipment	712.8	2.4	1.4	716.6	Number of Jobs
Airport Ground Support Equipment	0.0	0.0	0.0	0.0	SFO is located in unincorporated San Mateo County, and the County owns and operates two general aviation airports: the San Carlos Airport and the Half Moon Bay Airport. Thus, 100% of these emissions will be allocated to San Mateo County.
Construction and Mining Equipment	15525.7	25.1	31.1	15581.9	Number of Jobs
Entertainment Equipment	39.1	0.0	0.0	39.1	Number of Jobs
Industrial Equipment	3547.9	51.7	28.7	3628.4	Number of Jobs
Lawn and Garden Equipment	491.3	83.5	20.2	595.0	Population
Light Commercial Equipment	2478.4	102.4	16.1	2596.9	Number of Jobs
Oil Drilling	14.4	0.0	0.0	14.4	Number of Jobs
Pleasure Craft	471.9	27.9	12.0	511.8	Population
Rail yard Operations	0.5	0.0	0.0	0.5	Emissions will be evenly allocated to the following 12 jurisdictions with rail lines: Atherton, Belmont, Brisbane, Burlingame, Menlo Park, Millbrae, Redwood City, San Bruno, San Carlos,
Recreational Equipment	94.5	34.9	20.9	150.3	Population
Transport Refrigeration Units	2442.7	3.9	5.0	2451.6	Number of Jobs
Total:	**25,819.1**	**331.8**	**135.5**	**26,286.4**	

Note: Off-road emissions data from ARB Offroad2007 Model; values presented for 2020 were not directly used for estimating 2020 offroad emissions; rather, a rate was derived between 2015 and 2020 values. This rate was then used to estimate emissions for 2020, 2030, 2040, and 2050. See "OFFROAD Emissions Rate Derivation" and "BAU Emissions Forecast - Offroad Vehicles and Equipment".

Table 16-3: Summary of Total Off-road Emissions in Jurisdiction (2020)

Jurisdiction	Jurisdiction Population	Jurisdiction Employment	Percent of Total County Population in Jurisdiction	Percent of Total County Employment in Jurisdiction	Total Off-road CO_2 Emissions (tons CO_2/day)	Total Off-road N_2O Emissions (tons N_2O/day)	Total Off-road CH_4 Emissions (tons CH_4/year)	Total Off-road CO_2 Emissions (MT CO_2/year)	Total Off-road N_2O Emissions (MT N_2O/year)	Total Off-road CH_4 Emissions (MT CH_4/year)	Total Off-road Emissions (MT CO_2e/year)
Burlingame	31,009	31,825	3.9%	8.2%	77.97443	0.0038	0.0146	25,819	1.3	4.8	26,286
County Total:	794,107	386,233	100.0%	100.0%	1,226	0.0847	0.2770	406,085	28.0	91.7	416,086

Jurisdiction population and employment pulled from the 2020 estimates derived from Table CX-1. County population and employment derived based on the average growth rate from 2010 through 2017, and extrapolated out to 2020. See Table 4.

Table 16-4: San Mateo County Population: 2010-2020

Year	Estimated Population	Average Annual Growth Rate (Persons / Yr)
2010	718,451	
2017	771,410	7565.57
2020	794,107	

Data on 2010-2015 San Mateo County population estimates are form the US Census.

US Census Source

Table 16-5: San Mateo Population and Employment Projections: 2020

	2010 Employment	2015 Estimated Employment	Estimated 2020 Employment	Estimated 2030 Employment	2040 Employment	Estimated 2050 Employment	Rate
County Total:	343,300	364,767	386,233	429,167	472,100	515,033	4,293.33

Data on 2010 and 2040 San Mateo County employment estimates are from Plan Bay Area (2040). 2015, 2020, 2030, and 2050 values interpolated.

Plan Bay Area Source

Table 16-6: IPCC 5AR GWPs		
CO2	CH4	N2O
1	28	265

Table 16-7: Universal Conversion Factors	
days / year	365
MT / short ton	0.907185

BAU and ABAU Emissions Forecast - Caltrain

Summary of Data on This Sheet
This worksheet forecasts BAU and Adjusted BAU emissions associated with Caltrain operation. Forecast is based on service population growth.

Table 17-1: Summary of Off-road Emissions in Burlingame by Year

Calendar Year	Emissions
2015	2,471.06
2020	2,632.02
2030	2,953.93
2040	3,275.84
2050	3,597.75

Landfill Methane Emissions Estimation Methodology

Table 18-1: Basis for Calculations

The calculations made by this tool are based on:

1) The following equations from IPCC's Mathematically Exact First-Order Decay Model, see section
http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

ANDOC% = Σ *WIPFRAC$_i$* x *TDOC$_i$* x *DANF$_i$*	
ANDOC%	Percent of the waste that is degradable
WIPFRAC$_i$	Fraction of the ith component in the Waste-in-Place (WIP)
TDOC$_i$	Total Degradable Organic Carbon fraction of the ith waste
DANF$_i$	Decomposable Anaerobic Fraction of the ith waste component.

ANDOC = WIP (Tons) x 0.9072 (Mg/Ton) x **ANDOC%**	
ANDOC	Anaerobically Degradable Organic Carbon, carbon that is capable
WIP	Waste-in-Place estimate of all the landfilled waste (wet weight) as

$ANDOC_{year-end}$ = $ANDOC_{year-start}$ x $e^{-[k]}$	
$ANDOC_{year-end}$	ANDOC remaining undecomposed at the end of the inventory year in question
$ANDOC_{year-start}$	ANDOC in place at the beginning of the inventory year in question
$ANDOC_{deposited-last\ year}$	ANDOC deposited during the previous inventory year
$ANDOC_{deposited-same\ year}$	ANDOC deposited during the inventory year in question
M	Assumed delay before newly deposited waste begins to undergo anaerobic decomposition (Months, Default=6)
k	Assumed rate constant for anaerobic decomposition; k = ln2/half-life (years); half-life is the number of years required for half of the original mass of carbon to degrade

CH_4 Generation = {$ANDOC_{year-start}$ x $[1-e^{-[k]}]$	
CH_4 Generation	CH_4 generated in the inventory year in question (Mg of CH_4)
FCH_4	Fraction of decomposing carbon converted into CH_4 (Default = 0.5)

CH_4 Emitted = CH_4 Generation x (1-**OX**)	
CH_4 Emitted	CH_4 emitted to the atmosphere in the inventory year in question
OX	Fraction of escaping CH_4 that is oxidized to CO_2 in the cover soil

2) Using an iterative approach (where the $ANDOC_{year-start}$ for the next inventory year equals the the

3) Choosing the rate of anaerobic decomposition (k). For the US and Mexico, select one of the

Average Rainfall (Inches/Year)			
<20	**20-40**	**>40**	
k = 0.02	k = 0.038	k = 0.057	Where to input k values

For Canada, select the k value that corresponds to the province/territory :

Province/Territories	k
Alberta	0.012
British Columbia	0.082
Manitoba	0.019
New Brunswick	0.062
wfoundland & Labrador	0.078
Nova Scotia	0.077
Northwest Territories	0.005
Nunavut	0.005
Ontario	0.045
Prince Edward Island	0.060
Quebec	0.056
Sakatchewan	0.010
Yukon	0.001

4) Using IPCC default value for the percent of methane oxidized while passing through the landfill

Percent oxidation: 10%

Note: *Items 5 & 6 below only pertain when using this tool to assist in compliance with*

5) Using EPA default value for the percent of methane captured by a landfill gas collection system:

Percent collection: 75%

6) Using EPA value for heat content of methane:

Methane heat content: 1,012 btu/sc

Table 18-2: Derivation of Exponential Decay Formula Applied for Burlingame Landfill

Start with the Equation:

CH_4 Generation = {ANDOCyear-start * [1-e-k] - ANDOCdeposited-last year * [1/k * (e-[k*(1-M/12)]-e-k)-(M/12)*e-k] + ANDOCdeposited-same year * [1-((1/k)*(1-e-[k*(1-M/12)]+(M/12))]} * FCH4 * 16/12

Where:

CH_4 Generation =	CH4 Generated in the inventory year in question (Mg of CH4); 1 Mg = 1 Metric Ton
$ANDOC_{year\text{-}start}$ =	Anaerobically Degradable Organic Carbon (ANDOC) in place at the beginning of the inventory year in question (Mg of Carbon)
$ANDOC_{deposited\text{-}last\ year}$ =	ANDOC deposited during the previous inventory year
$ANDOC_{deposited\text{-}same\ year}$ =	ANDOC deposited during the inventory year in question
M =	Assumed delay before newly deposited waste begins to undergo anaerobic decomposition (Months, Default = 6)
K =	Assumed rate constant for anaerobic decomposition; k=ln2/half-life (years); half-life is the number of years required for half of the original mass of carbon to degrade
FCH_4 =	Fraction of decomposing carbon converted into CH4 (Default = 0.5)

Note: The Burlingame landfill was in operation from 1957 – 1987, meaning that the ANDOCdeposited-last year and ANDOCdeposited-same year terms are zeroed out. The resulting, modified equation then becomes:

CH_4 Generation = {ANDOCyear-start * [1-e-k]} * FCH4 * 16/12

From previous reports and inventories, we have solved for CH_4 Generation; the factor to solve for now is $ANDOC_{year\text{-}start.}$

Solving for $ANDOC_{year\text{-}start}$ results in an equation of:

$ANDOC_{year\text{-}start}$ = (CH4 Generation * 12) / [(1-e-k) * FCH4 * 16]

BAU and Adjusted BAU Emissions Forecast - Landfill

Summary of Data on This Sheet

This worksheet forecasts BAU and Adjusted BAU emissions associated with the existing, closed Burlingame landfill. The forecast assumes exponential decay of emissions over time.

Assumption: Percentage of methane in collected LFG remains constant from 2015 data (0.27), destruction efficency remains constant (0.99993) and methane soil ozidation factor remains constant (0.3).

Taking the equation (2) from the "Landfill - FOD Methodology" sheet and solving for: ANDOCyear-start

Eq (1) $CH_4 \text{ Generation} = \{ANDOC_{year\text{-}start} * [1-e^{-k}] - ANDOC_{deposited\text{-}last\ year} * [1/k * (e^{-[k*(1-M/12)]}-e^{-k})-(M/12)*e^{-k}] + ANDOC_{deposited\text{-}same\ year} * [1-((1/k)*(1-e^{-[k*(1-M/12)]}+(M/12))]\} * FCH_4 * 16/12$

Eq (2) $ANDOC_{year\text{-}start} = (CH_4 \text{ Generation} * 12) / [(1-e^{-k}) * FCH_4 * 16]$

Eq (3) ADONCyear-end = ADONCyear-start * e^(-k)

Table 19-1: Calculation Variables	
CH4 Generation (2015):	9.91
k (for Burlingame <20 in/yr) :	0.02
Constant (12/16)	0.75
FCH4	0.5
CH4 GWP (5AR)	28

Table 19-2: First Order Decay Calculations

Year	CH4 Generation	ADONC year-start	ADONC year-end
2015	9.91	1335	1308
2016	9.71	1308	1282
2017	9.52	1282	1257
2018	9.33	1257	1232
2019	9.15	1232	1208
2020	8.97	1208	1184
2021	8.79	1184	1160
2022	8.62	1160	1137
2023	8.44	1137	1115
2024	8.28	1115	1093
2025	8.11	1093	1071
2026	7.95	1071	1050
2027	7.80	1050	1029
2028	7.64	1029	1009
2029	7.49	1009	989
2030	7.34	989	969
2031	7.20	969	950
2032	7.05	950	931
2033	6.91	931	913
2034	6.78	913	895
2035	6.64	895	877
2036	6.51	877	860
2037	6.38	860	843
2038	6.26	843	826
2039	6.13	826	809
2040	6.01	809	793
2041	5.89	793	778
2042	5.78	778	762
2043	5.66	762	747
2044	5.55	747	732
2045	5.44	732	718
2046	5.33	718	704

2047	5.23	704	690
2048	5.12	690	676
2049	5.02	676	663
2050	4.92	663	650

Table 19-3: Included Landfill Emissions

Landfill Name	Landfill Jurisdiction	Activity	Operational Status	Owner	2015		2020		2030		2040		2050	
					Landfill Emissions (MT CO2e)	Landfill Emissions (MT CH4)	Landfill Emissions (MT CO2e)	Landfill Emissions (MT CH4)	Landfill Emissions (MT CO2e)	Landfill Emissions (MT CH4)	Landfill Emissions (MT CO2e)	Landfill Emissions (MT CH4)	Landfill Emissions (MT CO2e)	Landfill Emissions (MT CH4)
Burlingame Refuse Disposal Area	Burlingame	Solid Waste Disposal Site	Closed	City of Burlingame	277	9.91	251.1	8.97	205.6	7.34	168.3	6.01	137.8	4.92

BAU Emissions Forecast - Solid Waste

Summary of Data on This Sheet
This worksheet forecasts BAU emissions associated with solid waste disposal. Forecast is based on service population growth.

Table 20-1: Summary of Disposed Waste Emissions

Year	Disposed Waste Emissions (MT CO2e)	Alternative Daily Cover Emissions (MT CO2e)	Total Solid Waste Disposal Emissions (MT CO2e)
2015	5,772.7	270.6	6,043.3
2020	6,094.4	285.7	6,380.1
2030	6,737.8	315.8	7,053.6
2040	7,381.1	346.0	7,727.1
2050	8,024.5	376.1	8,400.7

ABAU Emissions Forecast - Solid Waste

Summary of Data on This Sheet

This worksheet forecasts Adjusted BAU emissions associated with solid waste disposal. The BAU forecast is based on service population growth and adjusted to reflect the City of Burlingame had a waste diversion rate of 70.5% in 2015. Per SB 341 the waste diversion rate must be increased to 75% by 2020. No further legislation has been enacted at the time of this writing to addess waste diversion post-2020; thus, the emissions from 2030 and 2040 also reflect a 75% diversion rate.

Table 21-1: Summary of Disposed Waste Emissions

Year	Disposed Waste Emissions (MT CO2e)	Alternative Daily Cover Emissions (MT CO2e)	Total Solid Waste Disposal Emissions (MT CO2e)
2015	5,772.7	270.6	6,043.3
2020	6,045.7	283.4	6,329.1
2030	6,591.6	309.0	6,900.6
2040	7,137.6	334.6	7,472.1
2050	7,683.5	360.2	8,043.7

BAU Emissions Forecast - Water

Summary of Data on This Sheet

This worksheet forecasts BAU emissions associated with water conveyance. Forecast is based on service population growth. Emissions are based on electricity consumption with statewide energy efficiency presented in the CalEEMod appendix, as used in the Community-wide GHG Inventory.

Table 22-1: Summary of Water Embedded Electricity Use & Emissions

Year	Embedded Energy Usage in Water Consumed (kWh)	Total Emissions from Electricity Use (MTCO2e)
2015	3,812,033	707
2020	4,024,460	746
2030	4,449,314	825
2040	4,874,168	903
2050	5,299,022	982

ABAU Emissions Forecast - Water

Summary of Data on This Sheet

This worksheet forecasts BAU ABAU emissions associated with water conveyance. Forecast is based on service population growth, and energy intensity adjusted for RPS.

Table 23-1: Summary of Water Embedded Electricity Use & Emissions

Year	Water Use (gal/yr)	Embedded Energy Usage in Water Consumed (kWh)	Total Emissions from Electricity Use (MTCO2e)
2015	1,089,152,291	3,812,033	707
2020	1,149,845,720	4,024,460	708
2030	1,271,232,577	4,449,314	468
2040	1,392,619,434	4,874,168	512
2050	1,514,006,291	5,299,022	-

BAU and Adjusted BAU Emissions Forecast - Wastewater

Summary of Data on This Sheet

This worksheet forecasts BAU and Adjusted BAU emissions associated with wastewater treatment. Forecast is based on service population growth.

Table 24-1: Waste Water Treatment Emissions

Year	Emissions
2015	497
2020	520
2030	566
2040	612
2050	658

BAU and Adjusted BAU Emissions Forecast - Stationary Sources

Summary of Data on This Sheet

This worksheet forecasts BAU and Adjusted BAU emissions associated with City-owned stationary sources. Forecast is based on employment growth.

Table 25-1: Summary of City-Owned Stationary Source Emissions

Year	Stationary Source Emissions (MT CO2e)
2015	6.1
2020	6.5
2030	7.3
2040	8.1
2050	8.5

APPENDIX C

CITY OF BURLINGAME
2030 CLIMATE ACTION PLAN
UPDATE

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City of Burlingame: 2030 CAP Update Policy Quantification

Developed by MIG, Inc. in 2019 for the City's 2030 Climate Action Plan Update

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Introduction to the 2030 CAP Update Policy Quantification

This workbook serves to document the calculations associated with CAP measure implementation. Specific discussions for how emission reductions were estimated are summarized under their respective worksheets.

Version: August 29, 2019
MIG, Inc.

Contents:

Burlingame 2030 CAP Update GHG Reduction Summary

CAP Measure	2020	2030	2040	2050
1. Mixed Use Development, Transit Oriented Development, and Transit Supporting Land Use	95	166	233	328
2. Transporation Demand Management	-	4,563	8,632	9,286
3. Complete Streets	-	5,488	6,686	8,726
4. Caltrain Electrification	-	2,954	3,276	3,598
5. Bicycle Sharing	3,379	1,697	1,577	1,632
6. Electric Vehicle Infrastructure and Initiatives	5	29	53	79
7. Parking Pricing, Parking Requirements, and Creative Parking Approaches	-	424	821	1,209
8. Burlingame Shuttle Service	8	10	11	13
9. Electrifification of Yard and Garden Equipment	-	516	556	596
10. Construction Best Management Practices	-	3,618	4,871	5,218
11. Green Building Practices and Standards	-	53	124	133
12. Energy Efficiency	-	3,247	7,168	7,309
13. Peninsula Clean Energy ECO100	16,533	24,073	24,038	-
14. Residential Solar Power	345	617	1,028	-
15. Alternatively-Powered Residential Water Heaters	-	270	315	455
16. Water Conservation Retrofits for Businesses	-	1	2	-
17. Water Conservation for New Residential Development	-	2	3	-
18. Zero Waste	-	4,140	5,978	8,044
19. Municipal Green Building Measures	27	27	66	66
20. Increase the Public Tree Population	5	17	29	40
Total Reductions	**20,397**	**51,913**	**65,467**	**46,732**

Adjusted BAU	233,646	180,493	189,690	166,534
Emissions after Gap Analysis	213,249	128,581	124,222	119,802
Target	216,916	130,150	86,766	43,383
Remaining Reductions Required	(3,667)	(1,569)	37,456	76,418

1. Mixed Use Development, Transit Oriented Development, and Transit Supporting Land Use

Sources: Burlingame 2019; Table CX-1
CAPCOA 2010
Plan Bay Area 2040 (Land Use Modeling Report)

Methodology: Evaluate porportion of new housing development occuring in PDA with relation to overall growth and VMT in the City. Apply reduction measurable to percent of VMT attributable to new residential development (i.e., VMT attributable to persons living in the City).
Plan Bay Area 2040's supplemental report was used to estimate projected growth in the PDA through 2040. Applied VMT reductions identified in CAPCOA Measure LUT-3 and LUT-5 with additional support from CAPCOA Measure PDT-1.

Note: Household data for 2020, 2030, and 2050 was interpolated.

Supporting General Plan Policies: CC-1.2: Mixed Use, Transit Oriented Infill Development, M-6.1: Transit Supportive Land Use, CC-1.12: Public Education and Outreach; CC-6.3: Infill Development; CC-7.1: Mix of Uses and Activities; CC-7.3: Supporting Uses; CC-7.4: Scale of Development; CC-8.1: Mix of Uses and Activities; CC-9.1: Mix of Low-scale Uses; CC-9.3: Development Approaches; CC-10.1: Residential Character; CC-10.2: Commercial Uses; CC-11.1: Mix of Uses and Activities; CC-11.2: Transit-Oriented Development; CC-11.3: Housing; CC-12.1: Industrial Base; CC-12.3: Live/Work District; ED-2.5: Household-supporting Retail; M-6.2: Mixed Use Areas.

Assumptions

Assumption: Growth in the PDA would occur linearly from 2010 to 2050. Additionally, the reductions quantified in this measure do not account for potential, and likely, turnover of existing structures to newer, higher density developments. In actuality, realized reductions could be greater.

CAPCOA Measure LUT-3 indicates mixed-use development can result in a 9-30% reduction in VMT.
CAPCOA Measure LUT-5 indicates locating a project with high density near transit can result in a 0.5-24.6% reduction in VMT.

Percent Reduction Assumed by CAPCOA Measure LUT-3:	9%
Percent Reduction Assumed by CAPCOA Measure LUT-5:	15%

	2010	2015	2020	2030	2040	2050
Households in City		13,144	13,728	14,897	16,065	17,233
Households in PDA	7,000	7,200	7,400	7,800	8,200	8,600
New Households in PDA from 2015		-	200	600	1,000	1,400
Percent of New Households in PDA in Relation to Overall Housing Stock		-	1%	4%	6%	8%

New Residential Development in PDA

	2015	2020	2030	2040	2050
Unadjusted VMT Attributable to Persons Living in City	75,080,683	78,040,650	83,161,783	82,243,443	90,096,666
Live in area-Works in area	5,391,233	5,233,918	5,742,910	6,014,470	6,588,777
Live in area-Works out of area	43,960,053	44,804,663	45,675,735	43,656,738	47,825,411
Live in area-Non-worker	25,729,398	28,002,070	31,743,138	32,572,235	35,682,477

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1. Mixed Use Development, Transit Oriented Development, and Transit Supporting Land Use (Continued)

New Residential Development in PDA (con't)

	2015	2020	2030	2040	2050
Unadjusted VMT Attributable to New Housing in PDA	-	1,136,939	3,349,561	5,119,418	7,319,406
Live in area-Works in area	-	76,251	231,311	374,383	535,269
Live in area-Works out of area	-	652,739	1,839,711	2,717,506	3,885,312
Live in area-Non-worker	-	407,950	1,278,539	2,027,528	2,898,826
VMT Reductions Attributable to LUT-3	-	102,325	301,460	460,748	658,747
Live in area-Works in area	-	6,863	20,818	33,695	48,174
Live in area-Works out of area	-	58,747	165,574	244,576	349,678
Live in area-Non-worker	-	36,715	115,069	182,478	260,894
VMT Reductions Attributable to LUT-5	-	170,541	502,434	767,913	1,097,911
Live in area-Works in area	-	11,438	34,697	56,158	80,290
Live in area-Works out of area	-	97,911	275,957	407,626	582,797
Live in area-Non-worker	-	61,192	191,781	304,129	434,824
Total VMT Reductions Attributable to MU Dev & TOD	-	272,865	803,895	1,228,660	1,756,658
Live in area-Works in area	-	18,300	55,515	89,852	128,465
Live in area-Works out of area	-	156,657	441,531	652,201	932,475
Live in area-Non-worker	-	97,908	306,849	486,607	695,718
Adjusted VMT Based on Reductions from MU Dev & TOD	75,080,683	77,767,785	82,357,888	81,014,782	88,340,008
Live in area-Works in area	5,391,233	5,215,617	5,687,395	5,924,618	6,460,312
Live in area-Works out of area	43,960,053	44,648,005	45,234,204	43,004,536	46,892,937
Live in area-Non-worker	25,729,398	27,904,162	31,436,288	32,085,628	34,986,759
GHG Emissions per VMT (MTCO2e / mile)		0.000347381	0.000207061	0.000190043	0.000186908
GHG Reductions per year from MU Development, TOD, and Transit Supporting Land Use (MTCO2e)		***95***	***166***	***233***	***328***

2. Transporation Demand Management

Sources: Burlingame 2019; Table CX-1
CAPCOA 2010
Play Bay Area 2040 VMT Dataset

Methodology: Take VMT subsets (e.g., Live in area-Works in Area, Live out of area-Works in area, etc.) and identify the percentage of VMT associated with the service population (e.g., new commercial development, existing residnetial development, etc.) targeted. Apply reduction. Account for previous reductions to avoid double counting. Do not specifically target new residential PDA development, since reductions would be inherent in the land use quantified in 1. MU Dev and TOD.

Note: Employment growth for 2020, 2030, and 2050 was interpolated.

Supporting General Plan Policies: CC-1.5: Transporation Demand Management, CC-6.5: Pedestrian and Bicycle Access; CC-10.6: Collaboration with Transportation Agencies; ED-2.16: Permitting Processes; M-4.1: Interagency Collaboration; M-4.6: Broadway Station; M-5.1: TDM Guidelines and Programs; M-9.1: Vehicle Miles Traveled (VMT) Transportation Measures; M-9.2: Multimodal Impact Fee; HP-1.7: Active Transportation; HP-3.1: Regional Air Quality Standards

Assumptions

Assumption: CAPCOA Measure TRT-2 Percent Shift in Vehicle Mode Share of Commute Trips for Participating Employees (Commute Trip Reduction Programs with Monitoring) - Provides an effectiveness range of 4.2-21.0%. CAPCOA notes the preferred literature shows a 21% reduction in vehicle mode share.

Assumes 100% of new non-residential projects would be "major" and subject to TDM.

		2015	2020	2030	2040	2050
Employment in City		29,879	31,825	35,718	39,610	43,502
Employment Growth in the City from 2020		-	-	3,892	7,785	11,677
Percent of New Employment Subject to TDM				80%	80%	80%
New Employees Subject to TDM				3,114	6,228	9,341
Percent of New Employment subject to TDM in Relation to All Employment				9%	16%	21%
New Commercial / Non-Residential Development						
Unadjusted VMT Attributable to Employment in City		198,321,473	205,408,678	208,156,763	247,082,370	270,675,655
Live in area-Works in area		5,391,233	5,233,918	5,742,910	6,014,470	6,588,777
Live out of area-Works in area		119,451,725	121,023,415	121,497,368	150,621,265	165,003,717
Live out of area-Non-worker		30,354,130	32,050,285	34,424,610	40,198,545	44,037,005
Live out of area-Works out of area		43,124,385	47,101,060	46,491,875	50,248,090	55,046,156
Reductions from Other Measures						
Measure	Portion of Population					
1. MU Dev & TOD	Live in area-Works in area	-	18,300	55,515	89,852	128,465

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2. Transporation Demand Management (Continued)

	2015	2020	2030	2040	2050
Adjusted VMT Attributable to Employment in City	-	-	208,101,248	246,992,518	270,547,190
Live in area-Works in area (Adjusted; 1. MU Dev & TOD)	-	-	5,687,395	5,924,618	6,460,312
Live out of area-Works in area	-	-	121,497,368	150,621,265	165,003,717
Live out of area-Non-worker	-	-	34,424,610	40,198,545	44,037,005
Live out of area-Works out of area	-	-	46,491,875	50,248,090	55,046,156
VMT Attributable to New Employment	-	-	18,142,614	38,834,382	58,096,187
Live in area-Works in area	-	-	495,837	931,522	1,387,261
Live out of area-Works in area	-	-	10,592,343	23,682,028	35,432,217
Live out of area-Non-worker	-	-	3,001,195	6,320,376	9,456,325
Live out of area-Works out of area	-	-	4,053,239	7,900,456	11,820,384
VMT Reduction Required by TDM	-	-	20%	20%	20%
New Employment VMT Reductions Associated with TDM	-	-	3,628,523	7,766,876	11,619,237
Live in area-Works in area	-	-	99,167	186,304	277,452
Live out of area-Works in area	-	-	2,118,469	4,736,406	7,086,443
Live out of area-Non-worker	-	-	600,239	1,264,075	1,891,265
Live out of area-Works out of area	-	-	810,648	1,580,091	2,364,077
GHG Emissions per VMT (MTCO2e / mile)		0.000347381	0.000207061	0.000190043	0.000186908
GHG Reductions per year from TDM in New Commercial Development (MTCO2e/yr)		-	751	1,476	2,172

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2. Transporation Demand Management (Continued)

New, Non-PDA Residential Development

		2015	2020	2030	2040	2050
Households in City		13,144	13,728	14,897	16,065	17,233
New Households in City from 2020		-	-	1,168	2,337	3,505
Households in PDA		7,200	7,400	7,800	8,200	8,600
New Households in PDA from 2020		-	-	400	800	1,200
New, Non-PDA Households from 2020				768	1,537	2,305
Percent of New Non-PDA Households Subject to TDM		-	-	100%	100%	100%
New, Non-PDA Households Subject to TDM		-	-	768	1,537	2,305
Percent of New, Non-PDA Households in Relation to Overall Housing Stock		-	-	5%	10%	13%
Unadjusted VMT Attributable to Persons Living in City		75,080,683	78,040,650	83,161,783	82,243,443	90,096,666
Live in area-Works in area		5,391,233	5,233,918	5,742,910	6,014,470	6,588,777
Live in area-Works out of area		43,960,053	44,804,663	45,675,735	43,656,738	47,825,411
Live in area-Non-worker		25,729,398	28,002,070	31,743,138	32,572,235	35,682,477
Reductions from Other Measures						
Measure	Portion of Population					
1. MU Dev & TOD	Live in area-Works in area	-	18,300	55,515	89,852	128,465
1. MU Dev & TOD	Live in area-Works out of area	-	156,657	441,531	652,201	932,475
1. MU Dev & TOD	Live in area-Non-worker	-	97,908	306,849	486,607	695,718
2. TDM (New Com Dev)	Live in area-Works in area	-	-	99,167	186,304	277,452
Adjusted VMT Attributable to Persons Living in City		-	-	82,258,721	80,828,478	88,062,556
Live in area-Works in area (1. MU Dev & TOD and 2. TDM (New Com Dev))		-	-	5,588,228	5,738,314	6,182,860
Live in area-Works out of area (2. TDM (New Com Dev))		-	-	45,234,204	43,004,536	46,892,937
Live in area-Non-worker (2. TDM (New Com Dev))		-	-	31,436,288	32,085,628	34,986,759
New Housing in Non-PDA, Subject to TDM		-	-	4,243,089	7,732,163	11,777,786
Live in area-Works in area		-	-	288,253	548,935	826,917
Live in area-Works out of area		-	-	2,333,282	4,113,873	6,271,620.75
Live in area-Non-worker		-	-	1,621,554	3,069,355	4,679,248.08

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2. Transporation Demand Management (Continued)

	2015	2020	2030	2040	2050
VMT Reduction Required by TDM	-	-	20%	20%	20%
Non-PDA New Housing VMT Reductions Attributable to TDM	-	-	848,618	1,546,433	2,355,557
Live in area-Works in area	-	-	57,651	109,787	165,383
Live in area-Works out of area	-	-	466,656	822,775	1,254,324
Live in area-Non-worker	-	-	324,311	613,871	935,850
GHG Emissions per VMT (MTCO2e / mile)		0.000347381	0.000207061	0.000190043	0.000186908
GHG Reductions per year from New, Non-PDA Residential Development (MTCO2e/yr)		-	176	294	440

Existing Residential Development

	2015	2020	2030	2040	2050
Households in City	13,144	13,728	14,897	16,065	17,233
Existing Households in City from 2020	-	-	13,728	13,728	13,728
Percent of Existing Households Subject to TDM			20%	40%	40%
Number of Existing Households Subject to TDM			2,746	5,491	5,491
Percent of Existing Households Subject to TDM in Relation to Overall Housing			18%	34%	32%
Unadjusted VMT Attributable to Persons Living in City	75,080,683	78,040,650	83,161,783	82,243,443	90,096,666
Live in area-Works in area	5,391,233	5,233,918	5,742,910	6,014,470	6,588,777
Live in area-Works out of area	43,960,053	44,804,663	45,675,735	43,656,738	47,825,411
Live in area-Non-worker	25,729,398	28,002,070	31,743,138	32,572,235	35,682,477

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2. Transporation Demand Management (Continued)

Reductions from Other Measures		2015	2020	2030	2040	2050
Measure	Portion of Population					
1. MU Dev & TOD	Live in area-Works in area	-	18,300	55,515	89,852	128,465
1. MU Dev & TOD	Live in area-Works out of area	-	156,657	441,531	652,201	932,475
1. MU Dev & TOD	Live in area-Non-worker	-	97,908	306,849	486,607	695,718
2. TDM (New Com Dev)	Live in area-Works in area	-	-	99,167	186,304	277,452
2. TDM (New Non-PDA Res)	Live in area-Works in area	-	-	57,651	109,787	165,383
2. TDM (New Non-PDA Res)	Live in area-Works out of area	-	-	466,656	822,775	1,254,324
2. TDM (New Non-PDA Res)	Live in area-Non-worker	-	-	324,311	613,871	935,850
Adjusted VMT Attributable to Persons Living in City		75,080,683	77,767,785	81,410,103	79,282,045	85,706,999
Live in area-Works in area (1. MU Dev & TOD and 2. TDM (New Com + New Non-PDA Res))		5,391,233	5,215,617	5,530,577	5,628,527	6,017,477
Live in area-Works out of area (1. MU Dev & TOD and 2. TDM (New Non-PDA Res))		43,960,053	44,648,005	44,767,548	42,181,761	45,638,613
Live in area-Non-worker (1. MU Dev & TOD and 2. TDM (New Non-PDA Res))		25,729,398	27,904,162	31,111,977	31,471,757	34,050,909
Adjusted VMT Attributable to Existing Building Stock from 2020		-	-	15,004,956	27,099,901	27,310,458
Live in area-Works in area		-	-	1,019,358	1,923,923	1,917,464
Live in area-Works out of area		-	-	8,251,250	14,418,417	14,542,703
Live in area-Non-worker		-	-	5,734,348	10,757,562	10,850,292
VMT Reduction Required by TDM for Existing Residential Dev		-	-	20%	20%	20%
Existing Housing VMT Reductions Attributable to TDM		-	-	3,000,991	5,419,980	5,462,092
Live in area-Works in area		-	-	203,872	384,785	383,492.72
Live in area-Works out of area		-	-	1,650,250	2,883,683	2,908,541
Live in area-Non-worker		-	-	1,146,870	2,151,512	2,170,058
GHG Emissions per VMT (MTCO2e / mile)			0.000347381	0.000207061	0.000190043	0.000186908
GHG Reductions per year from Existing Residential Development (MTCO2e/yr)			-	621	1,030	1,021

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2. Transporation Demand Management (Continued)

		2015	2020	2030	2040	2050
Existing Commercial / Non-Residential Development						
Employment in City		29,879	31,825	35,718	39,610	43,502
Existing Employment in City from 2020		-	-	31,825	31,825	31,825
Percent of Existing Employment Subject to TDM by Year				40%	80%	80%
Number of Existing Employees Subject to TDM by Year				12,730	25,460	25,460
Percent of Existing Employment Subject to TDM in Relation to All				36%	64%	59%
Unadjusted VMT Attributable to Employment in City		198,321,473	205,408,678	208,156,763	247,082,370	270,675,655
Live in area-Works in area		5,391,233	5,233,918	5,742,910	6,014,470	6,588,777
Live out of area-Works in area		119,451,725	121,023,415	121,497,368	150,621,265	165,003,717
Live out of area-Non-worker		30,354,130	32,050,285	34,424,610	40,198,545	44,037,005
Live out of area-Works out of area		43,124,385	47,101,060	46,491,875	50,248,090	55,046,156
Reductions from Other Measures						
Measure	Portion of Population					
1. MU Dev & TOD	Live in area-Works in area	-	18,300	55,515	89,852	128,465
2. TDM (New Com Dev)	Live in area-Works in area	-	-	99,167	186,304	277,452
2. TDM (New Com Dev)	Live out of area-Works in area	-	-	2,118,469	4,736,406	7,086,443
2. TDM (New Com Dev)	Live out of area-Non-worker	-	-	600,239	1,264,075	1,891,265
2. TDM (New Com Dev)	Live out of area-Works out of area	-	-	810,648	1,580,091	2,364,077
2. TDM (New Non-PDA Res)	Live in area-Works in area	-	-	57,651	109,787	165,383
2. TDM (Existing Res)	Live in area-Works in area	-	-	203,872	384,785	383,493
Adjusted VMT Attributable to Employment in City		198,321,473	205,390,377	204,211,203	238,731,070	258,379,077
Live in area-Works in area (1. MU Dev & TOD and 2. TDM (New Com, New Non-PDA Res, Exist Res)		5,391,233	5,215,617	5,326,706	5,243,742	5,633,984
Live out of area-Works in area (2. TDM (New Com))		119,451,725	121,023,415	119,378,899	145,884,859	157,917,274
Live out of area-Non-worker (2. TDM (New Com))		30,354,130	32,050,285	33,824,371	38,934,470	42,145,740
Live out of area-Works out of area (2. TDM (New Com))		43,124,385	47,101,060	45,681,227	48,667,999	52,682,079

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2. Transporation Demand Management (Continued)

	2015	2020	2030	2040	2050
VMT Attributable to Existing Employment in City from 2020	-	-	72,782,744	153,449,413	151,220,005
Live in area-Works in area	-	-	1,898,487	3,370,525	3,297,369
Live out of area-Works in area	-	-	42,547,734	93,770,559	92,423,315
Live out of area-Non-worker	-	-	12,055,316	25,025,949	24,666,390
Live out of area-Works out of area	-	-	16,281,208	31,282,379	30,832,931
VMT Reduction Required by TDM for Existing, Commercial Dev	-	-	20%	20%	20%
Existing, Employment VMT Reductions Attributable to TDM	-	-	14,556,549	30,689,883	30,244,001
Live in area-Works in area	-	-	379,697	674,105	659,474
Live out of area-Works in area	-	-	8,509,547	18,754,112	18,484,663
Live out of area-Non-worker	-	-	2,411,063	5,005,190	4,933,278
Live out of area-Works out of area	-	-	3,256,242	6,256,476	6,166,586
GHG Emissions per VMT (MTCO2e / mile)		0.000347381	0.000207061	0.000190043	0.000186908
GHG Reductions per year from Existing, Non-PDA Residential Development (MTCO2e/yr)		-	3,014	5,832	5,653
Total VMT Reductions from TDM		-	22,034,681	45,423,172	49,680,887
Total GHG Reductions from Transportation Demand Management		**-**	***4,563***	***8,632***	***9,286***

3. Complete Streets

Sources: CAPCOA 2010
Play Bay Area 2040 VMT Dataset

Methodology: Indentify percent of streets and intersections to be upgraded within the City. Apply CAPCOA Measures LUT-8 and SDT-2 account for reductions associated with complete streets and traffic calming measures, respectively. SDT-2 provides up to a 1% reduction in VMT may be achieved through traffic calming measures, and LUT-9 pprovides a range of 3.0-21.3% reduction associated with better design (e.g., sidewalk coverage, street widths, bicycle lanes, etc.). The quantification of this measure focuses on improving pedestian walkways, improving bicycle infrastructure and parking, and calming measures for motorized vehicles, all which will enhance the experience and safety of those using pedestrian and bicycle infrastructure. Burligname has an existing intersection density of approximately 104 intersections per square mile (~460 intersection and land use area of 4.41 square miles).

Supporting General Plan Policies: M-1.1: Complete Streets; CC-1.3: Walkable Streets and Neighborhoods; CC-6.5: Pedestrian and Bicycle Access; CC-7.7: Pedestrian Safety; CC-7.8: Streetscape Improvements; CC-7.10: Connectivity; CC-8.6: Pedestrian Accommodations; CC-9.3: Development Approaches; CC-11.6: Access Lanes; CC-11.7: Connectivity; M-1.2: Connectivity to Destinations; M-1.4: Focus on Pedestrian and Bicycle Safety; M-2.1: Pedestrian Amenities and Access; M-2.2: Walkable Infrastructure and Access to Destinations; M-2.3: Pedestrian Priority; M-2.5: Assessment and Maintenance; M-3.1: Uninterrupted Bicycle Network; M-3.2: Safe and Functional Network; M-3.3: California Drive Bikeway; M-3.4: Bicycle-Transit Integration; M-3.6: Support Facilities for Cyclists; M-3.7: Bicycle Facility Maintenance; M-3.9: Bicycle Commission; M-4.4: Access to Transit; M-9.2: Multimodal Transportation Impact Fee; M-10.1: California Drive Roadway Redesign; M-11.1: El Camino Real Design Enhancements; M-12.1: Neighborhood Connections; M-13.1: Support Transit Access; M-14.1: Old Bayshore Highway and Airport Boulevard; M-15.2: Active Transportation Infrastructure; IF-1.1: Infrastructure Priority; HP-1.6: Community Safety through Design; HP-1.7: Active Transportation.

Assumptions

Assumption: The reduction associated with LUT-8 is less than the maximum since City streets are already established, and implementaion of measure M-1.1 would only enhance the non-vehicular infrastructure within the City.

		2020	2030	2040	2050
Unadjusted VMT in Burlingame		278,215,410	285,575,635	323,311,343	354,183,544
VMT Reductions From Other Measures	*1. MU Dev & TOD*	*272,865*	*803,895*	*1,228,660*	*1,756,658*
	2. TDM	*-*	*22,034,681*	*45,423,172*	*49,680,887*
	8. Shuttles	*24,061*	*48,121*	*60,151*	*72,182*
	Total Reductions from Other Measures	*296,926*	*22,886,697*	*46,711,984*	*51,509,726*
Adjusted VMT in Burlingame		277,918,484	262,688,938	276,599,359	302,673,817

CAPCOA SDT-2 (Percent Reduction in VMT)

	% of Streets with Improvements					
	5%	**10%**	25%	50%	75%	100%
% of Intersections with Improvements	VMT Reduction					
5%	0.01%	0.02%	0.05%	0.05%	0.10%	0.10%
10%	0.02%	0.04%	0.10%	0.10%	0.20%	0.20%
25%	0.05%	0.10%	0.25%	0.25%	0.50%	0.50%
50%	0.05%	0.10%	0.25%	0.50%	0.50%	0.75%
75%	0.10%	0.20%	0.50%	0.50%	0.75%	0.75%
100%	0.10%	0.20%	0.50%	0.75%	0.75%	1.00%

Note: Bolded percentage values were interpolated based on CAPCOA's estimates for 25%.

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3. Complete Streets (Continued)

	2020	2030	2040	2050
Targeted Percent of Intersections in Burlingame with Improvements		10%	25%	50%
Targeted Percent of Streets in Burlingame with Improvements		25%	50%	50%
Percent Reduction in VMT associated with CAPCOA Meause SDT-2		0.10%	0.25%	0.50%
VMT Reduced by CAPCOA Measure SDT-2		262,689	691,498	1,513,369
Adjusted VMT in City After Accounting for CAPCOA Measure SDT-2	277,918,484	262,426,249	275,907,861	301,160,448
Percent Reduction Assumed by CAPCOA Measure LUT-9 by X Year :	-	10%	12.5%	15%
VMT Reductions from CAPCOA Measure LUT-9	-	26,242,625	34,488,483	45,174,067
VMT Reductions from CAPCOA Measure SDT-2	-	262,689	691,498	1,513,369
VMT Reductions from CAPCOA Measure LUT-9	-	26,242,625	34,488,483	45,174,067
Total VMT Reductions from Complete Streets	-	26,505,314	35,179,981	46,687,436
GHG Emissions per VMT (MTCO2e / mile)	0.000347381	0.000207061	0.000190043	0.000186908
GHG Reductions from Complete Streets	***-***	***5,488***	***6,686***	***8,726***

4. Caltrain Electrification

Sources: Caltrain 2014

Caltrain 2019

Supporting General Plan Policies: M-4.2: Caltrain Electrification; M-4.1: Interagency Collaboration; HP-3.1: Regional Air Quality Standards; HP-3.2: Local Air Quality Standards; HP-3.4: Air Pollution Reduction.

Assumptions

Assumption: Based on the Caltrain Electrification EIR and recent news releases from Caltrain, the Caltrain Modernization Program is expected to be fully operational by 2022. The modernization program initially electrify 75 % of Caltrain's system initally. It is assumed that by 2030, all of Caltrain would be electrified. As discussed under the quantifiation of 13. Peninsula Clean Energy ECO100 will supply 100% GHG free electricity to San Mateo County (and therefore Burlingame) by 2030. Since Caltrain operations in Burlingame will be powered by 100% GHG energy (see quantification of 13. Peninsula Clean Energy ECO 100), emissions will drop to 0.

	2020	2030	2040	2050
BAU Caltrain Emissions	2,632	2,954	3,276	3598
Reductions from Caltrain Electrification and PCE	-	2,954	3,276	3,598
GHG Reductions from Caltrain Electrification	**-**	***2,954***	***3,276***	***3,598***

5. Bicycle Sharing

Sources: CAPCOA 2010

Play Bay Area 2040 VMT Dataset

Methodology: Estimate the VMT reduction associated with the implementation of a bicycle share program in Burlingame.

Supporting General Plan Policies: M-3.10: Bicycle Sharing; CC-1.12: Public Education and Outreach; CC-6.5: Pedestrian and Bicycle Access; ED-2.3: Transportation Access; M-3.8: Bicycle Education; M-3.9: Bicycle Commission

Assumptions

Assumption: Based on relatively short average ride distance indicated in data provided by Limebike, it is presumed most of the citizens / employees in Burlingame currently walk from regional transit to their destination, and that Limebike currently supplements and shortens many of these currently walked trips. Thus, all Limebike rides are not presumed to negate VMT. It is assumed that the bikeshare program will increase modes of transporation that are alternative to single occupancy vehicle trips (e.g., bus, Caltrain, etc.) since the bikeshare would reduce the commute time for the last mile connection.

Consistent with the inboundary approach, only half of the VMT associated with "Partially Inside" trips were included in the metric derived.

A 3.5% reduction in VMT is consistent with CAPCOA Measure TRT-12, which indicates case studies have shown approximately 5% of users would shift to bikes from driving.

			2020	2030	2040	2050
Unadjusted VMT Attributable to Persons in City			278,215,410	285,575,635	323,311,343	354,183,544
Reductions From Other Measures	*Measure*					
	1. MU Dev & TOD		*272,865*	*803,895*	*1,228,660*	*1,756,658*
	2. TDM		*-*	*22,034,681*	*45,423,172*	*49,680,887*
	3. Complete Streets		*-*	*26,505,314*	*35,179,981*	*46,687,436*
	7. Parking Strategies		*-*	*2,045,334*	*4,320,705*	*6,468,445*
	8. Shuttles		*24,061*	*48,121*	*60,151*	*72,182*
Adjusted VMT Attributable to Persons in City			277,918,484	234,138,290	237,098,673	249,517,936
Percent of Limebike Trips that Offset VMT:		3.5%				
Average Annual VMT Offset by Bicycle Sharing			9,727,147	8,194,840	8,298,454	8,733,128
GHG Emissions per VMT (MTCO2e / mile)			0.000347381	0.000207061	0.000190043	0.000186908
GHG Reduction Associated with Bicycle Sharing			***3,379***	***1,697***	***1,577***	***1,632***

6. Electric Vehicle Infrastructure and Initatives

Sources: ICLEI - Local Government for Sustainability Climate and Air Pollution Planning Assistant v 1.5

Methodology: Identify the number of public EV changing stations that would installed by target year, estimate number of gasoline/diesel/natural gas VMT emissions reduced per year, and evaluate corresponding additional electricity assumption associated with charging.

Supporting General Plan Policies: CC-1.13: Electric Vehicle Network; M-8.1: Electric Vehicle Infrastructure; HP-2.4: Electric Vehicles; IF-6.7: Electric Vehicles

Assumptions

Assumption: These EV charging stations will not be funded by LCFS credits and are in addition to the state's plan for EVs under LCFS.

	2020	2030	2040	2050
Public EV Chargers Installed by X Year	3	25	50	75
Annual Gasoline/Diesel VMT Reduced Per Charger	4,700	4,700	4,700	4,700
Effective Annual VMT Savings	14,100	117,500	235,000	352,500
Gasoline/Diesel/NG Combustion Reduction				
GHG Emissions per VMT (MTCO2e / mile) for gasoline, diesel, and NG vehicles	0.000352193	0.000246708	0.000226432	0.000222696
GHG Emissions Reduced from Gasoline/Diesel Combustion	5	29	53	79
Additional Electricity Required				
Electricity Required per 100mi (kW per 100mi)	34	34	34	34
Additional Annual Electricity Consumption (kW)	4,794	39,950	79,900	119,850
Additional Annual Electricity Consumption (MW)	0.005	0.040	0.080	0.120
PG&E Average Electicity Emissions Factor (RPS; MTCO2e/MWh)	0.176	0.105	0.105	0.000
Additional GHG Emissions from Electricity Consumption (MTCO2e)	0.00	0.00	0.01	-
Summary				
GHG Reduction Associated with EV Initatives and Infrastructure (MTCO2e)	***5***	***29***	***53***	***79***

7. Parking Pricing, Parking Requirements, and Creative Parking Approaches

Sources: CAPCOA 2010

Methodology: Estimate the VMT reductions from implementation of policies related to reducing and effectively managing non-residential parking in the City.

Supporting General Plan Policies: M-7.1: Parking Pricing; M-7.3: Parking Requirements; M-7.5: Creative Parking Approaches; CC-1.4: Parking Requirements; CC-6.3: Infill Development; CC-7.11: Parking; CC-8.11: Public Parking; CC-8.12: Private Parking; CC-12.4 Alternative Transportation; M-7.2: Public Parking Management; M-7.4: Parking Facility Design; M-7.6: Parking Demand Reductions

Assumptions

Assumption: Growth in the City would occur linearly from 2010 to 2050. Parking measures apply to non-residential development.

CAPCOA Measure PDT-1 provides the following can result in a 5 - 12.5% reduction in VMT.
A) Eliminating (or reducing) minimum parking requirements
B) Creating maximum parking requirements
C) Providing a provision for shared parking.

For non-residential development - parking restrictions would affect all those trying to use the facility / business. Reductions from 2. TDM not included, because this measure takes a percent of the new commute VMT seperate from 2. TDM.

Percent Reduction Assumed by CAPCOA Measure PDT-1: 10%

	2015	2020	2030	2040	2050
Employment in City	29,879	31,825	35,718	39,610	43,502
Employment Growth in the City from 2020	-	-	3,892	7,785	11,677
Percent of New Structures Subject to Parking Control Strategies			80%	80%	80%
New Structures Subject to Parking Control Strategies			3,114	6,228	9,341
Percent of New Structures Subject to Parking Control Strategies in Relation to All Commercial Development			9%	16%	21%
New Commercial / Non-Residential Development					
Unadjusted VMT Attributable to Commercial Development in City	224,050,870	233,410,748	239,899,900	279,654,605	306,358,132
Live in area-Works in area	5,391,233	5,233,918	5,742,910	6,014,470	6,588,777
Live out of area-Works in area	119,451,725	121,023,415	121,497,368	150,621,265	165,003,717
Live in area-Non-worker	25,729,398	28,002,070	31,743,138	32,572,235	35,682,477
Live out of area-Works out of area	43,124,385	47,101,060	46,491,875	50,248,090	55,046,156
Live out of area-Non-worker	30,354,130	32,050,285	34,424,610	40,198,545	44,037,005
New Commercial Development and Trips Affected by Parking Control Strategies	-	-	20,914,874	43,969,809	65,786,081
Live in area-Works in area	-	-	500,676	945,649	1,414,847
Live out of area-Works in area	-	-	10,592,343	23,682,028	35,432,217
Live in area-Non-worker	-	-	2,767,420	5,121,299	7,662,308
Live out of area-Works out of area	-	-	4,053,239	7,900,456	11,820,384
Live out of area-Non-worker	-	-	3,001,195	6,320,376	9,456,325

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7. Parking Pricing, Parking Requirements, and Creative Parking Approaches (Continued)

		2015	2020	2030	2040	2050
Reductions from Other Measures Applicable to Parking Control Strategies						
Measure	Portion of Population					
1. MU Dev & TOD	Live in area-Works in area	-	-	55,515	89,852	128,465
1. MU Dev & TOD	Live in area-Non-worker	-	-	306,849	486,607	695,718
2. TDM (New Com Dev)	Live in area-Works in area	-	-	99,167	186,304	277,452
2. TDM (New Com Dev)	Live out of area-Works in area	-	-	2,118,469	4,736,406	7,086,443
Adjusted VMT Attributable to New Employment in City		-	-	20,453,343	43,207,046	64,684,446
Live in area-Works in area (1. MU Dev & TOD and 2. TDM (New Com Dev))		-	-	345,995	669,493	1,008,930
Live out of area-Works in area (2. TDM (New Com Dev))		-	-	10,592,343	23,682,028	35,432,217
Live in area-Non-worker (1. MU Dev & TOD)		-	-	2,460,570	4,634,693	6,966,590
Live out of area-Works out of area		-	-	4,053,239	7,900,456	11,820,384
Live out of area-Non-worker		-	-	3,001,195	6,320,376	9,456,325
Target Percent VMT Reduction from Shared and Reduced Parking in New Non-Res Dev				10%	10%	10%
Calculated Percent Reduction in Parking Spaces at new Non-Residential Land Uses to Achieve Target				20%	20%	20%
New Non-Residential VMT Reductions Attributable to Parking Control Strategies		-	-	2,045,334	4,320,705	6,468,445
Live in area-Works in area		-	-	34,599	66,949	100,893
Live out of area-Works in area		-	-	1,059,234	2,368,203	3,543,222
Live in area-Non-worker		-	-	246,057	463,469	696,659
Live out of area-Works out of area		-	-	405,324	790,046	1,182,038
Live out of area-Non-worker		-	-	300,119	632,038	945,632
GHG Emissions per VMT (MTCO2e / mile)			0.000347381	0.000207061	0.000190043	0.000186908
GHG Reductions from New, Non-Res Development from Parking Control Strategies			***-***	***424***	***821***	***1,209***

8. Burlingame Shuttle Service

Sources: SamTrans 2018

Supporting General Plan Policies: M-4.7: Shuttle Service; CC-7.10: Connectivity; CC-10.6: Collaboration with Transit Agencies; M-4.1: Interagency Collaboration; M-5.2: Targeted Outreach

Assumptions

Assumption: Shuttle schedule would remain constant (i.e., no net change in emissions from existing conditions). Trip length reduce is approximately 4mi (i.e., the length of Burlingame; addresses trip into Burlingame and back out).

Year	Annual Ridership
2013-2014	113,728
2014-2015	124,931
2015-2016	133,221
2016-2017	122,266
2017-2018	120,303

		2020	2030	2040	2050
Target Increase in Annual Ridership from 2017-2018 (Percent)		5%	10%	12.5%	15%
Target Ridership (Based on 2017-2018 Ridership)		126,318	132,333	135,341	138,348
Change in Ridership Since 2017-2018		6,015	12,030	15,038	18,045
Average Length of Trip Diverted to Shuttle (mi)	4				
Total Annual VMT Reduced Under Shuttle Service		24,061	48,121	60,151	72,182
GHG Emissions per VMT (MTCO2e / mile)		0.000347381	0.000207061	0.000190043	0.000186908
GHG Reductions from Burlingame Shuttle Service		***8***	***10***	***11***	***13***

9. Electrification of Yard and Garden Equipment

Sources: OFFROAD2007

Methodology: Take the emissions data from the ABAU scenario for offroad equipment and vehicles under the "Lawn and Garden Equipment" sector. Target that subset of emissions for reductions per this measure.

Supporting General Plan Policies: HP-2.16: Electrification of Yard and Garden Equipment; IF-1.4: Sustainable Practices; IF-1.5: Sustainable Contracting; HP-1.1: Health in All Policies; HP-2.15: Alternative Fuel; HP-3.1: Regional Air Quality Standards; HP-3.2: Local Air Quality Standards; HP-3.4: Air Pollution Reduction

Assumptions

Assumption: By 2030, the City will adopt a policy requiring all lawn and garden equipment used in the City (residential and commercial) be electrically powered. As discussed under the quantification of 13. Peninsula Celean Energy ECO100, PCE will supply 100% GHG free electricity to San Mateo County (and therefore Burlingame) by 2030, thereby negating emissions from lawn and garden equipment.

		2020	2030	2040	2050
ABAU Emissions from Offroad Equipment and Vehicles (MTCO2e)		25,027	22,807	24,561	26,315
Percent of Yard and Garden Equipment in Relation to All Offroad Vehicles and Equipment	2.263%				
ABAU Emissions from Yard and Garden Equipment (MTCO2e)		566	516	556	596
Percent of Equipment Required to Comply with Measure		0%	100%	100%	100%
GHG Reductions Attributable to Electrification of Yard and Garden Equipment		***0***	***516***	***556***	***596***

10. Construction Best Management Practices

Sources: OFFROAD2007

Methodology: Take the emissions data from the ABAU scenario for offroad equipment and vehicles under the "Construction and Mining Equipment" sector. Evaluate the percent of equipment less than 120 horsepower that contribute to emissions. Target that subset of emissions for reductions per this measure.

Supporting General Plan: HP-3.12: Construction Best Management Practices; CC-1.12: Public Education and Outreach; ED-2.16: Permitting Processes; IF-1.5: Sustainable Contracting; HP-1.1: Health in All Policies; HP-3.1: Regional Air Quality Standards; HP-3.2: Local Air Quality Standards; HP-3.4: Air Pollution Reduction

Assumptions

Assumption: The City shall encourage developers in the City use electric / renewable diesel powered construction equipment for all engines 120 horsepower or less. By 2030, the City shall require this policy, to the maximum extent feasible.

		2020	2030	2040	2050
ABAU Emissions from Offroad Equipment and Vehicles (MTCO2e)		25,027	22,807	24,561	26,315
Percent of Construction Equipment in Relation to All Offroad Vehicles and Equipment	59.210%				
ABAU Emissions from Construction and Mining Equipment (MTCO2e)		14,818	13,504	14,542	15,581
Percent of Construction Equipment Emissions less than 120hp	33.493%				
ABAU Emissions from Construction and Mining Equipment less than 120HP (MTCO2e)		4,963	4,523	4,871	5,218
Percent of Equipment less than 120HP Required to Comply with Construction Best Management Practices		0%	80%	100%	100%
GHG Reductions from Construction Best Management Practices		-	***3,618***	***4,871***	***5,218***

11. Green Building Practices and Standards

Sources: Burlingame 2019; Table CX-1
CEC 2018
CA Department of Housing and Community Development

Methodology: Evaluate porportion of new housing and employment development occuring in within the City, and apply voluntary Title 24 building standards to some new residential and non-residential structures. The Tier I voluntary standards for residential developments are 30% more efficient than the baseline 2019 Title 24 standards, and the Tier II voluntary standards for non-residential development are 15% more efficient than the baseline 2019 Title 24 standards.

Supporting General Plan Policies: CC-1.9: Green Building Practices and Standards; CC-1.7: Solar Energy; CC-1.10: Site Design; CC-1.12: Public Education and Outreach; ED-1.6: Community Benefits of Development; ED-2.16: Permitting Processes; EE-1.5: Sustainable School Design

Assumptions

Assumption: It is assumed 10% of new residential and non-residential developments would voluntarially comply with Tier I and Tier II standards, respectively.

	2020	2030	2040	2050
PG&E Average Electicity Emissions Factor (RPS; MTCO2e/MWh)	0.176	0.105	0.105	0.000
Natural Gas Emissions Factor (MTCO2e/therm)	0.00532	0.00532	0.00532	0.00532

Note: For the Commercial/Industrial calculations, it is assumed none of the growth would source its electricity from Direct Access.

	2015	2020	2030	2040	2050
Households in City	13,144	13,728	14,897	16,065	17,233
Employment in City	29,879	31,825	35,718	39,610	43,502

Residential

	2015	2020	2030	2040	2050
Forecast energy usage (w/ 2016 code, scaled by households; Adj BAU)					
Electricity (MWh)	61,186	62,655	63,257	64,637	66,017
Natural Gas (therms)	5,058,785	5,180,200	5,229,981	5,344,111	5,458,242
New Energy Use Only (w/ 2016 code) from 2015					
Electricity (MWh)		1,469	2,071	3,451	4,831
Natural Gas (therms)		121,415	171,196	285,326	399,457

	2020	2030	2040	2050
Percent of New Residential Development Voluntarially Complying with Tier 1 standards	0%	10%	10%	10%
Percent better than 2019 Title 24 Standards for Residential Construction	0%	30%	30%	30%
Applicable standards for new construction	*Measure CC-1.9*	*Measure CC-1.9*	*Measure CC-1.9*	*Measure CC-1.9*

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11. Green Building Practices and Standards (Continued)

Cumulative Energy Use from New Buildings		2020	2030	2040	2050
Electricity (MWh)		1,469	2,053	3,392	4,731
Natural Gas (therms)		121,415	169,702	280,409	391,116
Energy Reductions from Baseline					
Electricity (MWh)		-	18	59	101
Natural Gas (therms)		-	1,493	4,917	8,341
Emissions Reductions (MTCO2e)					
Electricity			**2**	**6**	**-**
Natural Gas			**8**	**26**	**44**

Commercial/Industrial

Forecast energy usage (w/ 2016 code, scaled by employment; Adj BAU)	2015	2020	2030	2040	2050
Electricity (MWh)	159,007	165,843	175,723	186,868	198,012
Natural Gas (therms)	5,518,975	5,756,235	6,099,183	6,485,988	6,872,793
New Energy Use Only (w/ 2016 code) from 2015					
Electricity (MWh)		6,836	16,716	27,861	39,005
Natural Gas (therms)		237,260	580,208	967,013	1,353,818
Percent of Commercial/Industrial Development Voluntarially Complying with Tier 2 standards		0%	10%	10%	10%
Percent better than 2019 Title 24 Standards for Non-residential Construction		0%	15%	15%	15%
Applicable standards for new construction		*Measure CC-1.9*	*Measure CC-1.9*	*Measure CC-1.9*	*Measure CC-1.9*
Cumulative Energy Use from New Buildings					
Electricity (MWh)		6,836	16,568	27,545	38,522
Natural Gas (therms)		237,260	575,063	956,066	1,337,069

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11. Green Building Practices and Standards (Continued)

Energy Reductions from Baseline	2020	2030	2040	2050
Electricity (MWh)	-	148	315	483
Natural Gas (therms)	-	5,144	10,946	16,748
Emissions Reductions (MTCO2e)				
Electricity	**-**	**16**	**33**	**-**
Natural Gas	**-**	**27**	**58**	**89**
Commerical and Residential				
Emissions Reduction (MTCO2e)				
Electricity	**-**	**17**	**39**	**-**
Natural Gas	**-**	**35**	**84**	**133**
GHG Reductions from Green Building Practices and Standards (MTCO2e)	***-***	***53***	***124***	***133***

12. Energy Efficiency

Sources: CEC 2018

CA Department of Housing and Community Development

Methodology: Assess the number of residential and non-residential retrofits that would occur per year, and apply current building standards to the upgrades.

Supporting General Plan Policies: HP-2.8: Energy Efficiency; CC-1.12: Public Education and Outreach; CC-12.5: Reuse of Existing Buildings; ED-2.16: Permitting Processes

Assumptions

This calculation assumes participating buildings would have energy efficiency improvements (i.e., lights, electricty and natural gas consuming applicances, etc.) equivalent to the difference between 2008 and 2019 Title 24 standards. It is assumed 1% of the residential building stock would undergo a retrofit, annually, and 0.5% of the non-residential building stock would undergo an retrofit, annually.

For both residential and non-residential retrofits, it was assumed 70% of the retrofits would be partial, and 30% would be major/full remodels. Consistent with the approach for 11. Green Building Practices and Standards, it was assumed 10% of the major/full remodels would voluntarily comply with Tier I and Tier II standards for residential and non-residential developments, respectively. A partial residential remodel would be 50% more efficient than it's presumed efficiency before the remodel, and a partial non-resdiential remodel would be 37% more efficient than it's presumed efficiency before the remodel.

Participation Rates	2015	2020	2030	2040	2050
Participation rate of existing buildings becoming retrofitted to meet 2016 Energy Efficiency Standards under this measure					
Residential		0%	10%	20%	30%
Commercial		0%	5%	10%	15%

Residential Energy Reductions

	2015	2020	2030	2040	2050
Energy Use from existing buildings (w/o 2019 Title 24 Tier 1 Energy Efficiency Standards)					
Electricity (MWh)		61,186	61,186	61,186	61,186
Natural Gas (therms)		5,058,785	5,058,785	5,058,785	5,058,785
Participating Existing Energy Use Only (w/o 2019 Title 24 Tier 1 Energy Efficiency Standards)					
Electricity (MWh)		-	6,119	12,237	18,356
Natural Gas (therms)		-	505,879	1,011,757	1,517,636
Minimum % reduction from existing electricity use by upgrading 2019 Title 24 Energy Efficiency Standards (10% Tier 1)		-	58%	65%	65%
Minimum % reduction from existing natural gas use by upgrading to 2016 Title 24 Energy Efficiency Standards		-	58%	65%	65%

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12. Energy Efficiency (Continued)

	2015	2020	2030	2040	2050
Existing Energy Use Only (w/ Title 24 Energy Efficiency Standards)					
Electricity (MWh)		-	2,593	4,735	6,876
Natural Gas (therms)		-	214,420	391,477	568,534
Energy Reductions					
Electricity (MWh)		-	3,525	7,502	11,479
Natural Gas (therms)		-	291,459	620,280	949,101
Emissions Reductions (MTCO2e)					
Electricity		**-**	**370**	**788**	**-**
Natural Gas		**-**	**1,550**	**3,299**	**5,048**

Commercial/Industrial Energy Reductions

	2015	2020	2030	2040	2050
Energy Use from existing buildings (w/o 2016 Title 24 Energy Efficiency Standards)					
Electricity (MWh)		159,007	159,007	159,007	159,007
Natural Gas (therms)		5,518,975	5,518,975	5,518,975	5,518,975
Participating Existing Energy Use Only (w/o 2016 Title 24 Energy Efficiency Standards)					
Electricity (MWh)		-	15,901	31,801	47,702
Natural Gas (therms)		-	275,949	551,898	827,846
Minimum % reduction from existing electricity use by upgrading to 2019 Title 24 Energy Efficiency Standards		-	42%	56%	56%
Minimum % reduction from existing natural gas use by upgrading to 2019 Title 24 Energy Efficiency Standards		-	42%	56%	56%
Existing Energy Use Only (w/ Title 24 Energy Efficiency Standards)					
Electricity (MWh)		-	9,183	16,195	23,207
Natural Gas (therms)		-	159,366	281,060	402,753
Energy Reductions					
Electricity (MWh)		-	6,718	15,606	24,495
Natural Gas (therms)		-	116,583	270,838	425,093

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12. Energy Efficiency (Continued)

Emissions Reductions (MTCO2e)				
Electricity	**-**	**706**	**1,640**	**-**
Natural Gas	**-**	**620**	**1,440**	**2,261**
Commerical and Residential Emissions Reductions (MTCO2e)				
Electricity	**-**	**1,076**	**2,428**	**-**
Natural Gas	**-**	**2,170**	**4,740**	**7,309**
GHG Reductions from Energy Efficiency	**-**	**3,247**	**7,168**	**7,309**

13. Peninsula Clean Energy ECO100

Source: PCE 2018

Methodology: Evaluate the amount of electricity consumed in residential and non-residential development (excluding direct access energy). Apply reductions from PCE goals moving forward.

Background: Peninsula Clean Energy, or PCE, is San Mateo County's official electricity provider. Peninsula Clean Energy was launched collaboratively by the County of San Mateo and all twenty of its cities to meet local climate action goals. PCE offers a choice of two electricity options, each with a different percentage of sustainable energy. ECOplus is the default, with 50% of the electricity provided to its customers being sourced renewably, and ECO100 where 100% of the electricity is sourced from renewable sources.

PCE was rolled out in 2017, and all residents and businesses were enrolled over the course of the year. By the end of 2017, the City of Burlingame, in its Annual Sustainability Report, indicated 98% of all accounts within the City were enrolled in PCE, with 2% having opted in for ECO100. PCE has a strategic goal of sourcing 100% GHG electricity by 2021 and 100% CA RPS eligible renewable energy by 2025. Thus, it is assumed by 2030 the entire portfolio will be 100% GHG free and customers will no longer have to opt into ECO100 to realize the strides made by PCE (i..e, 100% GHG free electricity will be the default plan).

Supporting General Plan Policies: H-2.6: Renewable Energy

		2020	2030	2040	2050
Background Calculations					
Adjusted BAU - forecasted City electricity from existing and new development (MWh)		228,497	245,106	261,714	278,322
Reductions From Other Measures (MWh)	*Existing or New*				
6. EV Infrastructure and Initiatives	*New*	*0.00*	*-0.04*	*-0.08*	*-0.12*
11. Green Building Practices and Standards	*New*	*-*	*166*	*375*	*583*
12. Energy Efficiency	*Existing*	*-*	*10,243*	*23,108*	*35,974*
14. Residential Solar Power	*Existing*	*1,957*	*5,872*	*9,787*	*13,702*
15. Alternatively-Powered Residential Water Heaters	*Both*	*0*	*-270*	*-315*	*-455*
Total Reductions from Other Measures		*1,957*	*16,011*	*32,956*	*49,805*
PCE ECOplus Emission Factor (MTCO2e/MWh)		0.107	0.000	0.000	0.000
ECO100 Emission Factor (MTCO2e/MWh)		0	0	0	0
PCE Participation Rate		98%	100%	100%	100%
ECOplus Participation Rate		93%	0%	0%	0%
ECO100 Participation Rate		5%	100%	100%	100%
Adjusted City Electricity Use (MWh)		226,540	229,094	228,758	228,518

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13. Peninsula Clean Energy ECO100 (Continued)

	2020	2030	2040	2050
Electricity Use of Customers Enrolled in PCE	222,009	229,094	228,758	228,518
Electricity Use from ECOplus Customers	210,682	-	-	-
Electricity Use from ECO100 Customers	11,327	229,094	228,758	228,518
Emissions Related to Electricity Use if Customers Were Enrolled in PG&E but not PCE (MTCO2e)	-	39,076	24,073	24,038
Emissions from ECOplus Customers	37,082	-	-	-
Emissions from ECO100 Customers	1,994	24,073	24,038	-
Emissions Related to Electricity Use if Customers Enrolled in PCE (MTCO2e)	22,543	-	-	-
Emissions from ECOplus Customers	22,543	-	-	-
Emissions from ECO100 Customers	-	-	-	-
Emissions Reductions (MTCO2e)	16,533	24,073	24,038	-
Emissions from ECOplus Customers	14,539	-	-	-
Emissions from ECO100 Customers	1,994	24,073	24,038	-
GHG Reductions from Peninsula Clean Energy ECO100	**16,533**	**24,073**	**24,038**	**-**

14. Residential Solar Power

Sources: Burlingame 2018 (PV permit data)

CSI 2018

NREL 2018

Methodology: Calculate the average size of the solar panel installed in Burlingame. Apply metric to average number of PV systems installed in Burliname per year, as tracked by the California Solar Initiative (CSI) in their NEM Currently Interconnected Dataset. Use the National Renewable energy Laboratory's PVWatts Calculator to estimate the amount of kilowatt hours produced per solar panel, per year.

Supporting General Plan Policies: H-2.6: Renewable Energy

Assumptions

Assumptions: Based on Burlingame building permit data from 2013-2017, it was determined there were approximately 62 residential PV systems installed per year. Using 2014-2016 data obtained from the California solar initiative (CSI) it was determined these PV systems have an average DC system size of 4.7 kW. It is presumed solar panels that are construced moving forward would also have a DC system size of 4.7 kW. Of those permitted, it is estimated that only 95 percent of them are actually constructed. Based on the PVWatts calculator, it was determined a Pv systems of 4.7 kW would produce approximately 6,690 kWh/yr.

Average Solar Panel Size for Residential Units Permitted Between 2014 and 2016 (DC kW)	4.7
Average Number of Solar Panels Installed per Year	190

Residential Solar Permits Approved Between January 2013 and 2017 for Existing Homes / Remodels

Year	Permits
2013	45
2014	50
2015	75
2016	94
2017	44
Average PV Systems Installed on Existing Residential Units per Year	62

	2016-2020	2021-2030	2031-2040	2041-2050
Target Number of Solar Permits for Existing Residential Buildings Approved within these Years	308	616	616	616
Size of solar permits approved within these years (DC kW)	1,440	2,879	2,879	2,879

Installation Rate	95%

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14. Residential Solar Power (Continued)

		2020	2030	2040	2050
Cumulative Size of Existing Residential Units with Solar From 2016 (DC kW)		1,368	4,103	6,838	9,573
Target Cumulative Number of Existing Residential Units with Solar Since 2001		293	878	1,463	2,048
Future (2016-2040) Annual kWh Generated per DC kW of Solar PV in Burlingame	1,431				
Annual Electricity Generated by New Solar PVs from New Permits in Existing Reidences (MWh)		1,957	5,872	9,787	13,702
Feasibility Assessment					
Existing Electricity Usage in Residential Land Uses (MWh)		61,186	61,186	61,186	61,186
Electricity Reductions from Existing Residential Land Uses from other Measures (MWh) *(excludes measures that only affect non-residential, new construction, or any energy use not used on existing residential land uses, such as water consumption)*					
	12. Energy Efficiency	-	6,718	15,606	24,495
Adjusted Electricity Usage from Existing Residential Land Uses (MWh)		61,186	54,468	45,580	36,691
Number of Existing Residential Units		13,144	13,144	13,144	13,144
Average Electricity Consumed from the Grid (MWh/residence)		4.7	4.1	3.5	2.8
Number of Existing Residences Under this Measure		293	878	1,463	2,048
Electricity Use in Participating Residences (MWh)		1,362	3,638	5,073	5,718
Annual Electricity Generated by New PVs from New Permits (MWh)		1,957	5,872	9,787	13,702
Unused Electricity Generated (MWh)		595	2,235	4,714	7,985
Percent of Electricity Sent Back to the Grid		30%	38%	48%	58%
Percent of Electricity Use in Existing Homes Offset by Solar		3%	10%	16%	22%
GHG Reductions from Residential Solar Power (MTCO2e)		**345**	**617**	**1,028**	**-**

15. Alternatively-Powered Residential Water Heaters

Source: EIA 2018a
EIA 2018b
EIA 2018c
CEC 2018

Methodology:
Determine percent of natural gas use in home by end use in the Pacific for water heating. Find average life of water heater. Find reductions assoicated with water heater replacement.

Supporting General Plan Policies: HP-2.17: Alternatively-Powered Residential Water Heaters; HP-2.6: Renewable Energy

Assumptions

Assumption: All water heaters in Burlingame assumed to fueled by natural gas, not propane. Therefore the natural gas and propane's percentage of water heating usage by fuel type has been combined for the two fuels.

10% of natural gas water heaters would be replaced with water heaters that use alternative sources of energy to heat the water. This measure would not overlap with reductions associated with 12. Energy Efficiency.

Percent of natural gas use in home by end use in California	2015
Space Heating	30%
Water Heating	38%
Cooking	29%
Other	3%

Water heating usage by fuel type	
Natural Gas*	75%
Electric	25%

Average age of natural gas water heater at replacement (years): 14

	Percent of existing NG water heaters by age (EIA 2018)	Assumed percent of NG water heaters replaced by this year by age			
	2015	2020	2030	2040	2050
Less than 2 Tears	13%	0%	100%	100%	100%
2 to 4 Years	23%	0%	100%	100%	100%
5 to 9 Years	30%	50%	100%	100%	100%
10 to 14 Years	19%	86%	100%	100%	100%
15 to 19 Years	8%	100%	100%	100%	100%
20 Years or More	7%	100%	100%	100%	100%

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15. Alternatively-Powered Residential Water Heaters (Continued)

		2015	2020	2030	2040	2050
ABAU Residential Natural Gas Use in Burlingame (therms)		5,058,785	5,180,200	5,423,031	5,665,862	5,908,693
Reductions From Other Measures (MWh)	*Existing or New*					
11. Green Building Practices and Standards	*New*		*-*	*1,493*	*4,917*	*8,341*
12. Energy Efficiency	*Existing*		*-*	*291,459*	*620,280*	*949,101*
Total Reductions from Other Measures			*-*	*292,952*	*625,197*	*957,442*
Adjusted Residential Natural Gas Use in Burlingame (therms)		5,058,785	5,180,200	5,130,079	5,040,665	4,951,251
Natural Gas Usage from Existing Water Heaters (i.e., w/out replacement)		1,456,930	1,491,898	1,477,463	1,451,712	1,425,960
Natural Gas Use from Currently Installed Water Heaters After Replacement (therms)				232,173	-	-
Total Reduction in Natural Gas Use due to Measure (therms)				1,245,290	1,451,712	1,425,960
GHG Reductions from Natural Gas Savings				6,623	7,721	7,584
Percent of Replacement Water Heaters that are Natural Gas Tank-Based			0%	90%	90%	90%
Percent of Replacement Water Heaters that are Natural Gas Tankless			0%	5%	5%	5%
Percent of Replacement Water Heaters that are Electric			0%	5%	5%	5%
Emissions from Natural Gas Tank-Based Water Heaters						
Total Natural Gas Use from the Replacement of Natural Gas Water Heaters (therms)				1,120,761.03	1,306,540	1,283,364
Remaining GHG Emissions from the Replacement of Tank-Based Natural Gas Water Heaters (MTCO2e)				5,961	6,949	6,826
Emissions from Natural Gas Tankless Water Heaters						
Percent Savings from Installation of Tankless Natural Gas Water Heaters is Existing Natural Gas Homes	20%					
Total Natural Gas Use Needed for New, Tankless Natural Gas Water Heaters (therms)				49,812	58,068	57,038
Additional GHG Emissions from New, Tankless Natural Gas Water Heaters (MTCO2e)				265	309	303

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15. Alternatively-Powered Residential Water Heaters (Continued)

Emissions from Electric Water Heaters

Therms Needed to Heat 45 Gallons of Hot Water (61% efficiency)	0.49203			
kWh Needed to Heat 45 Gallons of Hot Water (92% efficiency)	9.56			
kWh per therm Conversion for Water Heating	19.4			
Electricity Needed to Offset Natural Gas Water Heating (kWh)		1,209,781	1,410,317	1,385,300
Electricity Needed to Offset Natural Gas Water Heating (MWh)		1,210	1,410	1,385
Additional GHG Emissions from Electricity Use (MTCO2e)		127	148	-
GHG Reductions from Alternatively-Powered Residential Water Heaters (MTCO2e)		**270**	**315**	**455**

16. Water Conservation Retrofits for Businesses

Methodology: Calculate the imbedded energy cost in water transport, distribution, and treatment, determine the amount of indoor water consumption for non-residential land uses, calculate reductions associated with reducing that water consumption by 20%.

Background: This calculation assumes participating business and private institutions would install newer, low flow faucets, toilets, and other plumbing fixtures in the existing building stock.

Sources: Burlingame 2019 (Andrea Pappajohn)

Supporting General Plan Policies: IF-2.11: Retrofits; CC-12.5: Reuse of Existing Buildings; IF-2.9: Water Conservation Standards

Assumptions

Assumptions: No changes in behavior with regard to water consumption would occur from 2015 to 2050 for existing, non-residential land uses.

Non-residential water consumption comprises approximately 27.7 percent of overall water demand in Burlingame (BAWSCA 15-16 survey)

Indoor water consumption is approximately 70 percent of non-residential water consumption (i.e., outdoor is 30 percent).

Emissions Derivation	2015	2020	2030	2040	2050
Water Use in Burlingame (Million Gallons)	1,089	1,150	1,271	1,393	1,514
ABAU Emissions from Water Use (MTCO2e)	707	708	468	512	-
Emissions Per Gallon (MTCO2e/MG)	0.65	0.62	0.37	0.37	-
Percent Reduction in Potable Water Consumption		0%	20%	20%	20%
Participation Rates					
Participation rate of existing, non-residential buildings being retrofitted		0%	5%	10%	15%
Water Use Reductions					
Existing, Non-Residential, Indoor Building Water Use (MG/yr)		223	246	270	294
Mllion Gallons (MG) of Water Reduced Annually through IF-2.11		-	2.46	5.40	8.81
GHG Reductions from Water Conservation Retrofits (MTCO2e)		***-***	***0.9***	***2.0***	***-***

17. Water Conservation for New Residential Development

Methodology: Take the average water efficiency of applicanes and evaluate them against Energy Star standards.

Background: The quantification of this measure focuses on the water efficiency in new residential units that are developed between 2015 and 2040.

Sources: Energy Star 2014
Energy Star 2018
FSEC 2008
USGS 2016

Supporting General Plan Policies: HP-2.6: Water Conservation; CC-1.6: Water Conservation; CC-1.8: Green Infrastructure; CC-1.10: Site Design; IF-2.10: Water Conservation Programs

	Mandatory Req/ Standard Equivalent	Measure Req/ Energy Star Rating	Requirement Metric
Kitchen Faucet Flow rate (gal per minute)	2	1.5	Flow Rate
Dishwasher Water Use (gal/cycle)	6	3.5	Energy Star Applicance - Standard Size
Clothes Washer (gal/cycle)	20	14	Energy Star Applicance - Standard Size
Kitchen faucet water use per day per household with dishwasher (minutes)	5		Assumes time for washing produce, filling a pot for boiling water, etc.
Average Dishwasher Cycles per Year per household	215		
Average Cycles for Clothes Washer per Year per household	300		

	2015	2020	2030	2040	2050
Households in City	13,144	13,728	14,897	16,065	17,233
New Households in City since 2015		584	1,753	2,921	4,089
Activity in New Households					
Water use with Standard Equipment (MG per year)					
Kitchen Faucets			6.4	10.7	14.9
Dishwasher			2.3	3.8	5.3
Clothes Washer			10.5	17.5	24.5
Total			19.2	32.0	44.7

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17. Water Conservation (Conservation)

	2015	2020	2030	2040	2050
Water use with Measure Req / Energy Star Rating (MG per year)					
Kitchen Faucets			4.8	8.0	11.2
Dishwasher			1.3	2.2	3.1
Clothes Washer			7.4	12.3	17.2
Total			13.5	22.5	31.4
Water Savings (MG per year)					
Kitchen Faucets			1.6	2.7	3.7
Dishwasher			0.9	1.6	2.2
Clothes Washer			3.2	5.3	7.4
Total			5.7	9.5	13.3
Emissions per million gallons of water (MTCO2e/MG) (for derivation, 16. Water Conservation Retrofits)			0.37	0.37	-
GHG Reductions from Water Conservation (MTCO2e)			***2***	***3***	-

Built Environment and Transportation Reduction Measure Quantification (Continued)

18. Zero Waste

Backgound:	Per SB 341, Burlingame is required to achieve a waste diversion rate of 75 percent by 2020. This measure evaluates additional reductions that would be achieved through Burlingame pursuing a goal of achieving zero waste (i.e., a 100 percent diversion rate).
Supporting General Plan Policies:	IF-5.16: Zero Waste; IF-1.4 Sustainable Practices; IF-1.5: Sustainable Contracting; IF-5.1: Effective Collection Services; IF-5.3: Municipal Waste Reduction; IF-5.7: Composting; IF-5.8: Regional Coordination; IF-5.9: Outreach; IF-5.11: Preferential Purchasing; IF-5.12: Reuse; IF-5.13: Collaboration; IF-5.15: Composting

Assumptions

Assumptions:	Burlingame will strive to achieve a communitywide goal of 90 percent waste diversion by the year 2030, 95 percent by the year 2040, and 100 percent by the year 2050.

	2020	2030	2040	2050
Solid Waste Emissions Under SB 341 (Adjusted BAU Scenario; MTCO2e/yr)	6,329	6,901	7,472	8,044
Waste Diversion Goals	75%	90%	95%	100%
Emissions Under IF-5.16 Waste Diversion Goals	6,329	2,760	1,494	-
GHG Reductions from Zero Waste (MTCO2e)	***-***	***4,140***	***5,978***	***8,044***

19. Municipal Green Building Measures

Sources: Burlingame 2018

Supporting General Plan Policies: HP-2.10: Zero Net Energy; CC-8.8: City Hall; HP-4.6: Community Center

Assumptions

It is anticipated that by 2020 the new Recreation Center will be constructed and be ZNE. Also, by 2040, it is anticpated City Hall would be reconstructed and designed to ZNE standards. The electricy emission reductions associated with City functions being moved to these ZNE buildings are accounted for in 13. Peninsula Clean Energy ECO100; this measure quantifies the reductions in natural gas consumption. Though the City will strive for ZNE development, it may not be be financially feasible to offset all natual gas emissions. Therefore, only an 80% in natural gas reduction is accounted for in the following quantification.

Facility	Existing, Annual Natural Gas Emissions (MTCO2e)
Recreation Center	34
City Hall	48

		2020	2030	2040	2050
Natural Gas Consumption From New Development Absent CAP Measure 19 (MTCO2e)					
Recreation Center		34	34	34	34
City Hall		-	-	48	48
Percent of Natural Gas Emissions Reduced and/or Offset	80%				
GHG Reductions from Municipal Green Building		***27***	***27***	***66***	***66***

20. Increase the Public Tree Population

Sources: CalEEMod 2016, Burlingame 2018

Supporting General Plan Policies: CC-2.2: Increase the Public Tree Population

Historical Tree Planting in Burlingame

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018 (est)
Tree Plantings	230	198	271	240	254
Tree Removals	164	212	281	184	188
Net	66	-14	-10	56	66

Average Trees Planted Per Year	33
Target Tree Planting Per Year	33

		2020	2030	2040	2050
Targeted Trees Planted Since Since 2015		154	482	810	1,138
Default Annual CO2 accumulation per tree	0.0354				
Annual GHG sequestration (MTCO2e)		5	17	29	40
GHG Reductions from Increase the Public Tree Population		***5***	***17***	***29***	***40***