

Appendix D

GHG Calculations

GHG Gap Analysis (MT CO2e / YEAR)		
SECTOR	2030	2040
Building Energy Total	285,079	225,567
Transportation Total	487,058	446,355
Solid Waste Total	278,381	270,289
Water and Wastewater Total	13,148	13,148
Off Road Equipment Total	52	52
Agriculture Total	248,882	241,541
Stationary Source Total	314,526	343,679
Legislatively Adjusted GHG Emissions Total	1,627,124	1,540,630
Target for Consistency with State Climate Policies	1,113,972	742,648
Reductions Needed to meet GPU Targets	513153	797982
CTM-B	-3454	-5111
CTM-C	-47231	-78405
COS-S	-2019	-3367
COS-8.4	-59972	-20445
COS-W	-5042	-6677
COS-H	-354	-708
AG-H	-33830	-39236
Quantified Reductions	(151,903)	(153,950)
Gap Remaining	361,250	644,032

AG-H**Reduced Inorganic Nitrogen Fertilizer**

	2015	2030	2040
Existing N2O Emissions from Nitrogen Fertilizer Use (MTCO2e)	146,983	144,068	142,124
Tons Applied	43,631	42,766	42,189
Percent substitution w/organic fertilizer from locally sourced organic waste from 2015 levels		25%	30%
Forecasted N2O tons of inorganic nitrogen fertilizer applied after reduction (MTCO2e)		32,723	30,542
N2O Emissions from Inorganic Nitrogen Fertilizer Use (MTCO2e)		110,237	102,888
Net GHG Reduction from AG-4 (MTCO2e)		(33,830)	(39,236)

CCA Enrollment				
Clean Power Alliance City or County	Default Tier			
Ventura County	100% Green Power			
	Residential		Non-Residential	
Total Eligible Accounts	100%	31,214	100%	7,110
	%	Number	%	Number
Opt Up (Ineligible due to default tier)	0.00%	0	0.00%	0
Opt Mid (Green --> Clean)	0.84%	262	1.34%	95
Opt Down (Green --> Lean)	4.31%	1,345	3.05%	217
Opt Out (CPA --> SCE)	10.73%	3,349	17.05%	1,212
Enrollments	Residential		Non-Residential	
Total Remaining Enrollments	100.00%	27,865	100.00%	5,898
100% Green Power	94.23%	26,257	94.71%	5,586
Clean Power	0.94%	262	1.62%	95
Lean Power	4.83%	1,345	3.68%	217

CCA Enrollment

Clean Power Alliance City or County **Default Tier**
Ventura County **100% Green Power**

	Residential		Non-Residential	
Total Eligible Accounts	100%	31,214	100%	7,110
	%	Number	%	Number
Opt Up (Ineligible due to default tier)	0.00%	0	0.00%	0
Opt Mid (Green --> Clean)	0.84%	262	1.34%	95
Opt Down (Green --> Lean)	4.31%	1,345	3.05%	217
Opt Out (CPA --> SCE)	10.73%	3,349	17.05%	1,212
Enrollments	Residential		Non-Residential	
Total Remaining Enrollments	100.00%	27,865	100.00%	5,898
100% Green Power	94.23%	26,257	94.71%	5,586
Clean Power	0.94%	262	1.62%	95
Lean Power	4.83%	1,345	3.68%	217

	2015	2020	2030	2040
Residential electricity consumption (kWh) - existing buildings	262,750,031	264,831,397	269,018,616	273,205,835
Commercial electricity consumption (kWh) - existing buildings	118,867,785	119,225,592	124,892,675	129,659,819
Number of DU	32,191	32,446	32,959	33,472
kWh/DU	8,162.22	8,162.22	8,162.22	8,162.22

Business Accounts	7,110	7,466	7,839
Residential Units on CPA	28,965	29,422	29,880
Res 100 % Green Power (Current)	27,293	27,725	28,156
Res 100 % Green Power (97 percent target)	32,446	31,311	31,798
*Target Rate for 100% Green enrollment 95% by 2030			
Commercial on CPA	5,898	6,193	6,502
Com 100 % Green Power (Target)	5,586	5,865	6,158
Com 100 % Green Power (Current)		7,092	7,447
kWh from CPA 100% Green Power (Residential)	222,773,843	255,567,685	259,545,543
kWh from CPA 100% Green Power (Commercial)	93,665,944	118,648,041	123,176,828
Total kWh switched	316,439,787	374,215,726	382,722,371
CO2e Reduced under BAU Target	(67,954.79)	(59,971.68)	(20,444.99)

COS-H		
Urban Forest		
	2030	2040
Total trees planted	10000	20000
Default Annual CO2 accumulation per tree for Miscellaneous Trees (MT CO2e/tree/year) (From Appendix A of CalEEMod v2016.3.1)	0.0354	-0.0354
GHG Reduction from Measure (MTCO2e/year)	(354)	(708)

COS-S**Residential Green Building Ordinance**

Mixed-Fuel, Code Compliant Single Family Home	2030	2040
Annual kWh consumption DU - 2019 Title 24	5007	5007
Annual therms demand/DU - 2019 Title 24	381.7	381.7
Annual PV/storage kWh/DU - 2019 Title 24	5007	5007
Net kWh demand/DU - 2019 Title 24	0	0
All-Electric Residential		
Annual kWh demand/DU	7745	7745
Annual therms demand/DU	0	0
Annual PV/storage kWh/DU	7745	7745
Net kWh demand/DU	0	0
Difference in kWh demand/DU	0	0
Difference in therms demand/DU	-381.7	-381.7
Forecasted Housing Units in Ventura County		
New Dwelling Units in Ventura County	32959	33472
	768	1281
Total kWh reduction	0	0
Total therms reduced	-293146	-488958
MT CO2e Reduced	-2019	-3367

COS-W

	2030	2040
Residential electricity consumption (kWh) - existing buildings	269,018,616	273,205,835
Residential natural gas consumption (therms)	14,392,361	14,616,375
Commercial electricity consumption (kWh) - existing buildings	124,892,675	129,659,819
Commercial natural gas consumption	10,452,853	10,851,838
Number of Res DU	32,959	33,472
kWh/DU	8,162.22	8,162.22
therms/DU	436.67	436.67
Commercial Accounts	7,466	7,839
Target DU participation in outreach program	20%	25%
Target DU participation in monitoring program	20%	25%
Percent savings per DU from aggressive outreach	1%	1%
Percent savings per DU from in-home monitoring	4%	4%
Energy Savings		
Outreach - Electricity (kWh)	81.62	81.62
Outreach - Natural Gas (therms)	4.37	4.37
Monitoring - Electricity (kWh)	326.49	326.49
Monitoring - Natural Gas (therms)	17.47	17.47
Outreach - Total electricity savings (kWh)	538,037	683,015
Outreach - Total natural gas savings (therms)	28,785	36,541
Monitoring - Total electricity savings (kWh)	107,607	109,282
Monitoring - Total natural gas savings (therms)	23,028	23,028
Total electricity savings (kWh)	645,645	792,297
Total natural gas savings (therms)	51,813	59,569

GHG Reductions from electricity savings (MTCO2e)	(103.47)	(84.65)
GHG Reductions from natural gas savings (MTCO2e)	(356.83)	(410.25)

Total Residential GHG Reductions (MTCO2e)	(460)	(495)
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	2030	2040
Commercial electricity consumption (kWh) - existing buildings	124,892,675	129,659,819
Commercial natural gas consumption	10,452,853	10,851,838

Target Reductions	5%	7%	
Reduction in energy consumption from behavior mod programs			
	kWh	(6,244,634)	(9,076,187)
	Therms	(522,643)	(759,629)

Total Commercial GHG Reductions (MTCO2e)	(4,582)	(6,182)
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CTM-B		
	2030	2040
New VMT from 2015 baseline	90,240,682	150,401,136
Light Duty	84,189,124	140,315,481
Heavy Duty	6,045,830	10,076,404
Buses	5,727	9,252
Percent reduction target for VMT in new growth (relative to business as usual in 2030 and 2040)	15%	15%
Post program VMT	76,704,579	127,840,966
Light Duty	71,560,756	119,268,158
Heavy Duty	5,138,956	8,564,943
Buses	4,868	7,864
Pre-Program GHG Emissions (CO2e)	23029	34072
Post-Program GHG Emissions (CO2e)	19575	28962
GHG Savings	-3454	-5111
gCO2e/mi	2030	2040
Light Duty	235.9523762	209.2510967
Heavy Duty	522.1202114	466.3473808
Buses	1403.489593	1320.060821

CTM-C		
	2030	2040
Forecast VMT from light duty vehicles	1,770,625,968	1,826,755,613
Forecast VMT from heavy duty vehicles	127,153,053	131,183,863
Adjustment for new growth VMT analyzed in CTM-B ¹	-4.8%	-7.7%
Adjusted VMT light duty	1,597,900,202	1,503,755,939
Adjusted VMT heavy duty	114,749,187	107,988,453
Pre Program GHG Emissions (CO ₂ e)	484,173	443,428
Percent VMT Reduction Goal from program implementation (relative to 2030 and 2040)	-5%	-10%
Post program VMT light duty	1,518,005,192	1,428,568,143
Post program VMT heavy duty	109,011,727	102,589,030
Post Program GHG Emissions(CO ₂ e)	436,941	365,023
GHG reductions from Countywide VMT Reduction Program	-47231	-78405
gCO ₂ e/mi	2030	2040
Light Duty	235.95238	209.25110
Heavy Duty	522.12021	466.34738
Source: Ascent Environmental GHG Forecasting using 2017 EMFAC emissions factors		

Assumptions

Category				Source/Notes	
Conversions					
g/MT	1000000				
g/lb	453.592				
lb/MT	2204.622622				
kg/MT	1000				
MT/ton	1.10231				
g/ton	907185				
lb/kg	2.20462				
kWh/MWh	1000				
MWh/GWh	1000				
Btu/therm	100000				
BTU/gal diesel	139000				
MMBtu/therm	0.1				
MMBtu/MWh	3.41214148				
LPG Gallons/GGE	1.344086022				
LNG Gallons/GGE	1.572327044				
gal/cubic foot	7.480519481				
gal/Liter	3.785411784				
gallon/acrefoot	325851.429				
million gal/acre-feet	0.325851429				
GWP					
Source (Select)	IPCC Fifth Assessment Report GWP Values 100-year horizon				
CO2	1				
CH4	28				
N2O	265				
Electricity Emission Factors					
SCE					
RPS Status	2015	2020	2030	2035	2040
	25%	33%	50%	67%	83%
SCE Power Mix 2015					
Natural Gas	26%				
Unspecified Sources	41%				
GHG Free Sources	33%				
SCE 2015 Calculated EFs					
lb CO2/MWh	529	472.67	352.74	235.16	117.58
lb CH4/GWh	14.95	13.35	9.97	6.64	3.32
lb N2O/GWh	1.66	1.48	1.11	0.74	0.37
MT CO2e/MWh	0.240	0.215	0.160	0.107	0.053
eGrid 2016 Emission Factors (For Calculation of California Average EFs)				Updated February 2017	
<i>Natural Gas EFs: eGRID2016 Average of California Natural Gas Electricity Plant EFs</i>				https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid	
lb CO2/MWh	867.88			Weighted average based on annual plant net generation	
lb CH4/GWh	16.50			Weighted average based on annual plant net generation	
lb N2O/GWh	1.66			Weighted average based on annual plant net generation	
MT CO2e/MWh	0.3941			Calculated	
<i>Coal EFs: eGRID2016 Average of California Coal Electricity Plant EFs</i>				https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid	
lb CO2/MWh	1157.82			Weighted average based on annual plant net generation	
lb CH4/GWh	13.41			Weighted average based on annual plant net generation	
lb N2O/GWh	18.98			Weighted average based on annual plant net generation	
MT CO2e/MWh	0.5276			Calculated	
<i>Unspecified EFs: eGRID2016 CAMX Emission Factors</i>				Assumed to represent unspecified power sources	
lb CO2/MWh	452.50			CAMX avg	
lb CH4/GWh	26.00			CAMX avg	

SCE 2015 Power Content Label
https://www.energy.ca.gov/pcl/labels/2015_index.html

2016 SCE Corporate Responsibility Report
 Calculated from eGrid 2016 NG and Other Efs
 Calculated from eGrid 2016 NG and Other Efs
 Calculated

Assumptions

lb N2O/GWh	3.00			CAMX avg
kg/MWh	205.25			Calculated
kg/GWh	11.79			Calculated
kg/GWh	1.36			Calculated
Utility Natural Gas Emission Factors				
kg CO ₂ /MMBtu	53.06		Natural Gas - US Weighted Average	2017 Climate Registry Emission Factors. Table 12.1.
g CH ₄ /MMBtu	4.7		Natural Gas - Residential/Commercial	2017 Climate Registry Emission Factors. Table 12.9.
g N ₂ O/MMBtu	0.1		Natural Gas - Residential/Commercial	2017 Climate Registry Emission Factors. Table 12.9.
MT CO ₂ /therm	0.005306			Calculated
MT CH ₄ /therm	0.000047			Calculated
MT N ₂ O/therm	0.000001			Calculated
MT CO₂e/therm	0.0069			Calculated
The Climate Registry 2017 Default Emission Factors				



Ventura County 2015 GHG Inventory Update and 2040 Forecast

Updated 12/19/19

Workbook Description

This workbook contains the calculations for Ventura County's 2015 Greenhouse Gas (GHG) inventory and forecast through 2040.

Tab Descriptions and Update Instructions

Tab Name	Description	Category
Inventory and Forecast	This tab consolidates and summarizes the results from all emissions sectors for the business-as-usual (BAU) and Adjusted BAU (ABAU), or legislative adjusted, scenarios. Charts and inventory summaries are located further down on the sheet. This tab also calculates emissions forecasts for some sources (e.g., septic systems).	Summary
Demographics	This tab houses the population, housing, and employment data and forecasts from 2015 through 2040. This tab also calculates the unincorporated County's portion of this data by subtracting out Vandenberg Air Force Base and UC Ventura values.	Demographics
Transportation	This tab calculates on-road transportation based on Vehicle Travelled.	Calculations
Building Energy	This tab calculates the emissions from residential, commercial, industrial, and agricultural energy use.	Calculations
Offroad	This tab calculates the emissions from off-road equipment.	Calculations
Solid Waste	This tab calculates the emissions from waste generation and waste-in-place.	Calculations
Imported Water	This tab calculates emissions from water imported to the unincorporated County.	Calculations
Wastewater	This tab calculates the emissions from wastewater treatment processes from centralized wastewater treatment facilities and septic systems.	Calculations
Agriculture	This tab summarizes the emissions from agricultural sources.	Calculations
Stationary Source	This tab calculates provides the data for major stationary sources in the County.	Calculations
Assumptions	Includes reference material necessary for GHG calculations, including: Conversion factors, mode split, global warming potential (GWP) factors, electricity emission factors (provided by EPA eGRID), electricity emission factors as-calculated for each utility, natural gas emission factors, and more.	Background Data and Calculations
EMFAC	Includes emission factor outputs and calculations for on-road vehicles from CARB's Emissions FACTors model.	Background Data and Calculations

Targets

GHG Reduction Targets			
Milestone Year	Statewide Existing and Target Emissions (MMTCO2e)	Statewide Target Percent Reduction below 1990 levels by Target Years	Adjusted Target Percent Reduction below 2015 levels by Target Years
1990 (Historical)	431	NA	NA
2015 (Historical)	440	NA	NA
2020 (Target)	431	0%	2.1%
2030 (Target)*	258.60	40.0%	41.3%
2040 (Target)	172.40	60.0%	60.9%

Source: https://www.arb.ca.gov/cc/inventory/pubs/reports/appendix_a1_inventory_ipcc_sum_1

Source: https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf

AB 32

SB 32

* State emissions calculated from ARB's scoping plan
 Source: California GHG Inventory. ARB 2014 and 2016

Targets

Ventura County

Community Inventory

	2015	2020	2030	2040
Population	97,733	99,755	100,918	101,832
BAU Emissions (MTCO2e)	1,897,112	1,902,823	1,934,846	1,980,736
BAU with Legislative Reductions (MTCO2e)	1,897,112	1,793,971	1,627,124	1,540,630
With Measures (MTCO2e)				
Percent below BAU				

Community Targets

	2020	2030	2040
Mass Emissions	1,856,620	1,113,972	742,648
Needed Reductions	62,649	(513,153)	(797,982)

Forecast- Leg Adjusted

DETAIL (MT CO2e / YEAR) SECTOR	Inventory 2015	Legislative Adjustment Scenario		
		2020	2030	2040
Building Energy	322,048	308,629	285,079	225,567
Transportation	692,753	625,263	487,058	446,355
Solid Waste	333,167	302,811	278,381	270,289
Water and Wastewater	13,148	13,148	13,148	13,148
Off Road Equipment	52	52	52	52
Agriculture	260,849	256,223	248,882	241,541
Stationary Source	275,096	287,845	314,526	343,679
TOTAL	1,897,112	1,793,971	1,627,124	1,540,630

Demographics

Demographics				
Ventura County Greenhouse Gas Emissions Inventory - Unincorporated County Population, Employment, Housing Forecast				
	Inventory	Forecast		
	2015	2020	2030	2040
Population	97,733	99,755	100,918	101,832
Employment	32,889	32,988	34,556	35,875
Housing Units	32,191	32,446	32,959	33,472

Transportation

Transportation										
Ventura County Greenhouse Gas Emissions Inventory - 2015										
Emissions Summary (MTCO2e)										
BAU Forecast	2015	2020	2030	2040	2050					
On-Road Transportation	690,265	701,749	724,717	747,685	770,653					
Rail	2,488	2,616	2,716	2,768	2,814					
Total	692,753	704,364	727,433	750,452	773,467					
Adjusted Forecast	2015	2020	2030	2040	2050					
On-Road Transportation (Leg Adjusted)	690,265	622,647	484,342	443,587	447,418					
Rail	2,488	2,616	2,716	2,768	2,814					
Total	692,753	625,263	487,058	446,355	450,232					
On-Road Transportation Activity in 2015										
Unincorporated County VMT										
VMT Calculations	Source	2015 Annual VMT	2020 Annual VMT	2030 Annual VMT	2035 Annual VMT	2040 Annual VMT	2050 Annual VMT			
100% Internal, 50% I-E *	Adjusted from County-wide based on unincorporated VMT percentage	1,807,538,340	1,837,618,567	1,897,779,022	1,927,859,249	1,957,939,476	2,018,099,931			
Urban Bus VMT**		120,450	120,450	120,450	120,450	120,450	120,450	Scaling Factor: Unincorporated County Population Growth		
Total Annual VMT		1,807,658,790	1,837,739,017	1,897,899,472	1,927,979,699	1,958,059,926	2,018,220,381			
County-wide VMT										
VMT Calculations	Source	2012 Average Daily VMT	2012 Annual VMT	2040 Average Daily VMT	2040 Annual VMT	2015 Annual VMT (Interpolated)	2020 Annual VMT (Interpolated)	2030 Annual VMT (Interpolate	2035 VMT (Interpolated)	2050 VMT
Internal-Internal	VCTC Model	10,746,259	3,922,384,526	11,731,596	4,282,032,422	3,960,918,229	4,025,141,068	4,153,586,745	4,217,809,584	4,410,478,099
Internal-External (unincorporated Ventura to areas south and east of Ventura County)	VCTC Model *	15,537,451	5,671,169,732	17,026,660	6,214,730,729	5,729,408,411	5,826,472,874	6,020,601,802	6,117,666,265	6,408,859,656
Internal-External (unincorporated Ventura to north areas of Ventura County)	Calculated				35,472,890	25,050,315	27,134,830	31,303,860	33,388,375	39,641,920
50% Internal-External	Calculation (RTAC Method)				3,125,101,810	2,877,229,363	2,926,803,852	3,025,952,831	3,075,527,320	3,224,250,788
100% Internal, 50% I-E *	Calculation (RTAC Method)				7,407,134,232	6,838,147,592	6,951,944,920	7,179,539,576	7,293,336,904	7,634,728,888
*Source: Jim Damkowitz 11/7/2018 - Email to Ascent Environmental. Note: This VMT only includes light duty and heavy duty vehicle trips. It is assumed that this VMT does not include bus trips. Bus VMT is added separately.										
** There is only one bus route in Ventura County that stops in the unincorporated area: Line 16 of Gold Coast Transit. The distance travelled by that route within the unincorporated area is about 10 miles. It travels along Ventura Ave between Ventura and Ojai, with stops in between. There are 17 northbound trips and 16 southbound trips daily, according to Gold Coast Transit route schedules. This results in an annual VMT of 120,450 VMT per year. This excludes bus VMT not associated with this route.										
Note: The Regional Transportation Advisory Committee's recommended approach to calculating VMT is based on CARB's guidance for MPOS (https://www.arb.ca.gov/cc/sb375/staff_report_sb375_targets_update.pdf)										
Adjustment for I-X trips north of Ventura*										
	Source	2010	2012	2020	2040	2015 (Interpolated)	2030	2035	2050	
Daily VMT I-X/X-I Santa Barbara County - Entire Ventura County (SB/VC)**	SBCAG		62,920		74,342	97,186	68,631	85,764	91,475	108,608
Daily VMT I-X/X-I South and East Areas - Entire Ventura County (SE/VC)**	VCTC Model			15,537,451	15,962,939	17,026,660	15,697,009	16,494,799	16,760,729	17,558,519.61

Transportation

Ratio of SB/VC to SE/VC ***	Calculated			0.00466	0.00571	0.00437	0.00520	0.00546	0.00619		
*According to Jim Damkowitz, the VCTC model excludes trips north of Ventura County because the VCTC model is based on SCAG's model which does not include Santa Barbara County.											
** Includes unincorporated areas AND cities											
*** This ratio is applied to SB/VC VMT to estimate the VMT between SB County and Unincorporated Ventura County.											
Unincorporated VMT Adjustment											
VMT Split by Boundary Method According to HPMS data											
Unincorporated County Local Road VMT (Boundary)		1,394,030	HPMS								
Unincorporated County VMT SHS VMT Boundary		3,519,851	GHD via Caltrans Volume Report								
Other Unincorporated VMT Boundary		22,950	HPMS								
Total Unincorporated VMT (Boundary)		4,936,831									
Total Incorporated Local Road VMT (Boundary)		6,689,160	HPMS								
Total Incorporated SHS VMT (Boundary)		7,037,589	GHD via Caltrans Volume Report								
Other Incorporated VMT		13,080	HPMS								
Total Incorporated VMT (Boundary)		13,739,829									
Percent Nonincorporated		26.4%									
VMT Background Data											
VMT Distribution in Unincorporated County by vehicle class											
Light Duty		93%									
Heavy Duty		7%									
Buses		0.054%									
Source: SCAG 2016 RTP model. Provided by Annabel Drayton VCREA - Email to Ascent Environmental 11/15/2018											

On-Road Transportation Emissions Calculations						
Annual VMT	2015	2020	2030	2035	2040	2050
Light Duty and Heavy Duty VMT	1,807,538,340	1,837,618,567	1,897,779,022	1,927,859,249	1,957,939,476	2,018,099,931
Bus VMT	120,450	120,450	120,450	120,450	120,450	120,450
VMT Distribution	2015	2020	2030	2035	2040	2050
Light Duty	1,686,431,501	1,714,496,323	1,770,625,968	1,798,690,791	1,826,755,613	1,882,885,258
Heavy Duty	121,106,839	123,122,244	127,153,053	129,168,458	131,183,863	135,214,672
Buses	120,450	120,450	120,450	120,450	120,450	120,450
EMFAC 2017 Weighted Vehicle Emission Factors for Ventura County	2015	2020	2030	2035	2040	2050
gCO2/mi						
Light Duty	360	317.047	235.859	217.894	209.180	204.4384
Heavy Duty	677	637.628	521.578	486.947	465.748	459.3973089
Buses	1,502	1461.054	1358.058	1305.580	1273.023	1242.449754
gCH4/mi						
Light Duty	0.011	0.006	0.003	0.002	0.002	0.002025088
Heavy Duty	0.019	0.015	0.016	0.017	0.017	0.018022341
Buses	1.622	1.584	1.563	1.580	1.602	1.620750263
gN2O/mi						
Light Duty	0.0001	0.00008	0.000	0.000	0.00004	3.88601E-05
Heavy Duty	0.0003	0.00029	0.000	0.000	0.00044	0.000474812
Buses	0.0039	0.00388	0.006	0.007	0.00828	0.010049969
gCO2e/mi						
Light Duty	361	317	236	218	209	205
Heavy Duty	677	638	522	488	466	460
Buses	1,549	1,506	1,403	1,352	1,320	1,290
TOTAL On-Road Vehicle Emissions (Legislatively Adjusted)	2015	2020	2030	2035	2040	2050
MTCO2e						
Light Duty	608,051	543,897	417,783	392,066	382,251	385,060
Heavy Duty	82,027	78,569	66,389	62,973	61,177	62,203
Buses	187	181	169	163	159	155
	690,265	622,647	484,342	455,201	443,587	447,418
TOTAL On-Road Vehicle Emissions (BAU)	2015	2020	2030	2035	2040	2050
MTCO2e						
Light Duty	608,051	618,170	638,408	648,527	658,646	678,884
Heavy Duty	82,027	83,392	86,122	87,487	88,852	91,582
Buses	187	187	187	187	187	187
	690,265	701,749	724,717	736,201	747,685	770,653
Vehicle Category assignments based on EMFAC 2007 Vehicle Categories used in EMFAC 2017						
SCAG Vehicle Category	EMFAC 2007 Vehicle Category					
Light Duty	LDA					
Light Duty	LDT1					
Light Duty	LDT2					
Light Duty	LHDT1					
Light Duty	LHDT2					
Light Duty	MCY					
Heavy Duty	HHDT					
Heavy Duty	MDV					
Heavy Duty	MH					
Heavy Duty	MHDT					
Buses	OBUS					
Buses	SBUS					
Buses	UBUS					

Transportation

Locomotive Emissions in 2015				Emissions per BTU of Diesel				Locomotive Emissions			
	Track length through the unincorporated Count (mi)	Number of One Way Trips per year	Annual Locomotive Miles Travelled	2015 BTU per train-mile	g CO2/BTU	g CH4/BTU	g N2O/BTU	MT CO2/BTU	MT CH4/BTU	MT N2O/BTU	MT CO2e
Amtrak Passenger Rail	27.1	3640	98,644	288,375	0.073453237	5.7554E-06	1.8705E-06	2,089	0.164	0.053	2,108
Metrolink Passenger Rail	11.4	1560	17,784	288,375	0.073453237	5.7554E-06	1.8705E-06	377	0.030	0.010	380
Total								2,466	0.193	0.063	2,488
Source	GIS	Amtrak schedule, Metrolink schedule,		Transportation Energy Data Book 2017 (Table 9.10 - passenger rail, Table 9.8 - freight rail)							
Method: U.S. Community Protocol - Equation TR.5.1.											

Offroad

Off-Road Vehicles and Equipment									
Ventura County Greenhouse Gas Emissions Inventory - 2015									
Emissions Summary (MTCO2e)									
	2015	2020	2030	2035	2040	2050			
ConstMin	15	15	14.90	14.90	14.90	14.90			
Industrial	8	8	8	8	8	8			
Light Commercial	4	4	4	4	4	4			
Portable Equipment	4	4	4	4	4	4			
Oil Drilling	20	20	20	20	20	20			
TRU	1	1	1	1	1	1			
Offroad Emissions	52	52	52	52	52	52			
Offroad Emissions in 2015 for Unincorporated Ventura County									
	MT CO2	MT CH4	MT N2O	MT CO2e	Scaled to unincorporated area by		% total GHG		
ConstMin	14.626	0.003	0.001	15	Jobs		28.7%		
Industrial	7.929	0.001	0.001	8	Jobs		16.0%		
Light Commercial	3.298	0.004	0.001	4	Jobs		6.9%		
Oil Drilling	20.212	0.002	0.001	20	All in unincorporated		39.4%		
Portable Equipment	3.834	0.001	0.000	4	Population		7.5%		
TRU	0.728	0.001	0.000	1	Jobs		1.4%		
Total	50.626	0.013	0.003	52			100.0%		
Note: Agricultural equipment included under the Agriculture Sector									
OFFROAD 2017 outputs for 2015 for Entire Ventura County									
	Fuel Type	Fuel Use (gal/year)	Tons CO2/day	Tons CH4/day	Tons N2O/day	MT CO2e	Tons NOx/day (to calculate N2O)		
AirGrSupp	Diesel	1,874	0.06	0.00	0.00	0	0.001		
AirGrSupp	Gasoline	11,067	0.27	0.00	0.00	0	0.001		
AirGrSupp	Nat Gas	1,241	0.02	0.00	0.00	0	0.000		
Commercial Harborcraft	Diesel	4,874,984	21.18	0.03	0.00	26	1.951		
Cargo Handling Equipment	Diesel	69,035	2.13	0.00	0.00	2	0.008		
ConstMin	Diesel	4,022,763	123.93	0.02	0.00	138	1.235		
ConstMin	Gasoline	309,600	5.00	0.01	0.00	6	0.042		
Industrial	Diesel	463,136	14.27	0.00	0.00	16	0.148		
Industrial	Gasoline	1,020,595	22.82	0.01	0.00	27	0.104		
Industrial	Nat Gas	1,815,674	32.81	0.00	0.01	38	0.155		
Light Commercial	Diesel	249,415	7.42	0.00	0.00	8	0.066		
Light Commercial	Gasoline	1,082,860	17.29	0.03	0.01	22	0.137		
Light Commercial	Nat Gas	239,429	4.36	0.00	0.00	5	0.014		
Locomotive	Diesel	-	0.00	0.00	0.00	0	0.071		
Military	Diesel	66,324	2.00	0.00	0.00	2	0.015		
Ocean Going Vessels	Diesel	14,249,266	451.29	0.15	0.01	506	13.513		
Oil Drilling	Diesel	594,860	18.34	0.00	0.00	20	0.133		

Offroad

Portable Equipment	Diesel	981,997	30.27	0.00	0.00	34	0.259	
TRU	Diesel	4,074	6.42	0.01	0.00	7	0.361	
Total		30,058,194	759.87	0.27	0.04	859	18.216	
<i>Source: OFFROAD2017 (https://www.arb.ca.gov/orion/)</i>		25,577,728	677.30	0.22	0.03	761	18	diesel only
OFFROAD 2017 outputs for 2015 for Entire Ventura County								
Demographics Category	Percent in Unincorporated Area	Source						
Population	11%	Department of Finance						
New Housing Units	34%	DOF 2017/2018 (http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-5/)						
Households	12%	Background Report						
Jobs	10%	Background Report						

Solid Waste

Solid Waste GHG Emissions										
Ventura County Greenhouse Gas Emissions Inventory - 2015										
Emissions Summary (MTCO2e)										
	2015	2020	2030	2040	2050					
Waste Generation	34,568	34,808	35,289	35,769	36,250					
Waste in Place	298,599	282,580	261,438	252,966	244,856					
Total	333,167	317,388	296,727	288,735	281,106					
Scaling & Legislative Adjustment										
	2014	2015	2020	2030	2040	2050				
Delivered Tonnage from Unincorporated Ventura Co	124,057	116,403	117,212	118,831	120,450	122,069				
Emissions MTCO2e		34,568	34,808	35,289	35,769	36,250				
AB 341 Commercial Recycling - 75% Diversion for Commercial Solid Waste			(24,368)	(24,705)	(25,041)	(25,378)				
SB 1383 Organic Waste Diversion Regs			(24,716)	(37,075)	(37,075)	(37,075)				
Tonnage w/legislative adjustments			68,128	57,052	58,334	59,616				
GHG Emissions w/Legislative Adjustments			20,232	16,942	17,323	17,704				
Source: CalRecycle Annual Solid Waste Disposal Reports https://www2.calrecycle.ca.gov/LGCentral/DisposalReporting/Statewide/Disposal										
Scaling Factor: Population Growth										
Solid Waste Emissions in 2015										
Source	MT CO2	MT CH4	MT N2O	MT CO2e						
Waste Generation	0	1,235	0	34,568						
Waste-in-Place	0	10,663	0	298,599						
Total	0	11,897	0	333,167						
Waste Generation Emissions in 2015										
Receiving Landfill	Tonnage Delivered from Unincorporated Ventura County Only	Total ADC	Percent of Total Tonnage	Percent of year under LFG collection or control in 2016 (%)	Generated Methane Emissions with LFG Capture (MT CH4)	MT CO2	MT CH4	MT N2O	MT CO2e	% total
Antelope Valley Public Landfill	47	3	0%	0%	2		2		52	0.1%
Azusa Land Reclamation Co. Landfill	84		0%	0%	3		3		87	0.3%
Bakersfield Metropolitan (Bena) SLF	353		0%	0%	13		13		364	1.1%
Calabasas Landfill	3,160	2,597	3%	100%	53		53		1,483	4.3%
Chiquita Canyon Sanitary Landfill	5,954		5%	100%	55		55		1,534	4.4%
Commerce Refuse-To-Energy Facility			0%	100%	-		-		-	0.0%
El Sobrante Landfill	32		0%	100%	0		0		8	0.0%
Frank R. Bowerman Sanitary LF	23		0%	100%	0		0		6	0.0%
H.M. Holloway Inc.	27		0%	0%	1		1		28	0.1%
Lancaster Landfill and Recycling Center	1	2	0%	0%	0		0		3	0.0%
Olinda Alpha Sanitary Landfill	90		0%	100%	1		1		23	0.1%
Simi Valley Landfill & Recycling Center	27,984	4,463	24%	100%	298		298		8,357	24.2%
Southeast Resource Recovery Facility			0%	0%	-		-		-	0.0%
Tajiguas Sanitary Landfill	94	34	0%	100%	1		1		33	0.1%
Toland Road Landfill	78,554	9,153	67%	100%	807		807		22,591	65.4%
Total Ventura Unincorporated	116,403	16,252			1,235		1,235		34,568	100.0%
Source: CalRecycle, EPA LMOP Database, US Community Protocol Equation SW.4.1										
Landfill Gas Collection Start Dates										

Solid Waste

Waste-in-Place Emissions at Landfills Located in the Unincorporated County in 2015										
Landfill/Disposal Site	Waste-in-Place (Tons) *	Status	Has LFG Capture?	Date Open	Date Closed	Average Tons Disposed Annually	Fugitive Emissions			
							MT CO2	MT CH4	MT N2O	MT CO2e
Alden V Johnson	?	Closed	No	?	1967					
Arnaz Road	?	Closed	No	?	?					
Bailard Landfill	3,150,000	Closed	Yes	1961	1996	90,000		1,848		51,751
Balcom Canyon II	?	Closed/unpermitted	No	?	1986					
Balcom Canyon III	?	Closed/unpermitted	No	?	1997					
BMB Norcom 355	inert debris/engineered	Inactive	No	?	?					
Burns Property DS	400 CY construction/de	Closed	No	?	2008					
Elkins Ranch 1980	?	Closed/unpermitted	No	?	?					
Fishback Illegal Disposal Site (IDS)	?	Closing	No	?	?					
Lagoon Landfill	?	Closed/Naval with r	No	1952	1975					
Ojai County 1964	?	Closed	No	?	1964					
Otto Hopkins	?	Closed	No	?	1996					
Ozena 1967 Converted	?	Closed/unpermitted	No	?	?					
Ozena Modified Sanitary Landfill	3,120	Closed	No	1975	1986	283.64		2		55
Phillip and Alice Lee Property	?	To Be Determined/	No	?	?					
Piru Dump	?	Closed/violation	No	?	1971					
Rockwell International - Old Area I LF	?	Closed (artillery field)	No	1955	2005					
Rockwell International - Old Area II LF	?	Closed (artillery field)	No	?	?					
Runway Landfill/Pt Mugu	?	Closed (electroplating)	No	?	?					
Saticoy County 1962	?	Closed	Facility currently studying LFG potential	1946	1963					
Somis Dump	?	Closed/unpermitted	No	?	?					
Simi Valley Landfill	19,966,988	Open	Yes	1970	2024	489,107		6,145	0.126	172,093
Toland Road Landfill	7,046,887	Active	Yes	1970	2027	123,630		2,668	0.028	74,701
TOTAL							0	10,663	0	298,599
Total from Closed Landfills	23,120,108						0	10,663	0	298,599
			Average year of closed LFs	1969	2022					
* Tonnage data for landfills with "?" were not available. Based on the sparse documentation available for these individual landfills, many of these landfills without tonnage data are small unpermitted sites or military disposal sites. It is assumed that waste-in-place emissions from these landfills are minimal. Thus, calculations exclude landfills without tonnage data.										
Source: CalRecycle, EPA LMOP Database, EPA Greenhouse Gas Emissions from Large Facilities, CARB Landfill Emissions Tool model (https://www.arb.ca.gov/cc/landfills/tool.htm)										
Note: Excludes composting facilities, transfer stations, inert debris disposal sites, and planned landfills not yet in operation.										
Waste In Place Forecast										
	2020		2030		2035		2040		2050	
Landfill/Disposal Site	MT CH4	MT CO2e	MT CH4	MT CO2e	MT CH4	MT CO2e	MT CH4	MT CO2e	MT CH4	MT CO2e
Bailard Landfill	1598	44731	1308	36623	1183	33137	1071	29984	808	22,611
Ozena Modified Sanitary Landfill	2	49	1.428571429	40	1.285714286	36	1.19047619	33	0.90	25
Toland Road Landfill	2366	66248	1937	54,236	1777	49,756	1618	45,304	1244	34,832
Simi Valley Landfill*	6127	171,552	6091	170,540	6073	170,037	6055	169,535	6019	168,527
		282580		261438		252966		244856		225995
*Scaled from 2015 using 2015-2040 annual decay rate of -0.00059 from LET modeling										

Additional Background Data and Assumptions									
Method									
Equation SW.4.1 Methane Emissions									
$CH_4 \text{ Emissions} = GWP_{CH_4} * (1 - CE) * (1 - OX) * M * \sum_i P_i * EF_i$									
Where:									
Term	Description	Value							
CH ₄ emissions	= Community generated waste emissions from waste M (mtCO ₂ e)	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									
Mixed MSW for Unincorporated Ventura County	0.041	CalRecycle Waste Characterization for Unincorporated Ventura County and WARM emission factors.							
For Future Forecasting work									
Diversion Rate									
	2015	2020	2030	2040	2040	Source			
Unincorporated Ventura County Disposal rate per resident (lb/person-day)	4.1	2.7	2.7	2.7	2.7	CalRecycle			
Percent change from 2015		-34%	-34%	-34%	-34%				

Imported Water

Imported Water							
Ventura County Greenhouse Gas Emissions Inventory - 2015							
Emissions Summary (MTCO2e)							
	2015	2020	2030	2035	2040	2050	
Imported Water (BAU)	5,002	5,002	5,002	5,002	5,002	5,002	
Imported Water (Leg Adjusted)	5,002	4,468	3,334	2,221	1,114	0	
Imported Water Emissions in 2015							
Source	MG Supplied/year	Electricity Use (kWh/MG)	Electricity Use (kWh)	EF Source	Percent of MG		
Groundwater	73,043	240	17,558,763	SCE	83%		
SWP	3,598	236	848,885	CA Avg	4%		
Surface Water	7,387	240	1,775,646	SCE	8%		
Recycled Water	3,635	240	873,888	SCE	4%		
TOTAL	87,663		21,057,182				
TOTAL Local	84,065		20,208,297		96%		
TOTAL Imported	3,598		848,885		4%		
Note: Private groundwater was not available from the Ventura County Water Agencies							
Electricity Emissions Factors (g/kWh)							
EF Source	2015	2020	2030	2035	2040	2050	
SCE	240.39	214.75	160.26	106.84	53.42	0.00	
CA Avg	235.94	210.77	157.29	104.76	52.54	0.00	
Electricity Use (kWh)							
Source	2015	2020	2030	2035	2040	2050	
Groundwater	118,064,545	118,064,545	118,064,545	118,064,545	118,064,545	118,064,545	
SWP	21,198,226	21,198,226	21,198,226	21,198,226	21,198,226	21,198,226	
Surface Water	8,877,349	8,877,349	8,877,349	8,877,349	8,877,349	8,877,349	
Recycled Water	331,407	331,407	331,407	331,407	331,407	331,407	
Total	148,471,528	148,471,528	148,471,528	148,471,528	148,471,528	148,471,528	
GHG Emissions (MTCO2e) (BAU)							
Source	EF Source	2015	2020	2030	2035	2040	2050
Groundwater	SCE	28,381	28,381	28,381	28,381	28,381	28,381
SWP	CA Avg	5,002	5,002	5,002	5,002	5,002	5,002
Surface Water	SCE	2,134	2,134	2,134	2,134	2,134	2,134
Recycled Water	SCE	80	80	80	80	80	80
TOTAL		35,597	35,597	35,597	35,597	35,597	35,597
TOTAL Local		30,595	30,595	30,595	30,595	30,595	30,595
TOTAL Imported		5,002	5,002	5,002	5,002	5,002	5,002
GHG Emissions (MTCO2e) (Legislatively Adjusted)							
Source	EF Source	2015	2020	2030	2035	2040	2050
Groundwater	SCE	28,381	25,354	18,921	12,614	6,307	0
SWP	CA Avg	5,002	4,468	3,334	2,221	1,114	0
Surface Water	SCE	2,134	1,906	1,423	948	474	0
Recycled Water	SCE	80	71	53	35	18	0
TOTAL		35,597	31,800	23,731	15,819	7,913	0
TOTAL Local		30,595	27,332	20,397	13,598	6,799	0
TOTAL Imported		5,002	4,468	3,334	2,221	1,114	0
Note: Emissions associated with electricity used to power pumps within the unincorporated County are assumed to be captured in the Building Energy sector.							

Imported Water

2015 Water Use													
Water User/Agency		2013 Ventura County Water Supply and Demand (Acre-Feet)			2015 Unincorporated County Water Supply and Demand (Acre Feet) (Calculated)			2015 Water-Related Electricity Use and Emissions					
		Agriculture	Municipal & Industrial	Total	Agriculture	Municipal & Industrial	Total	Electricity Use (MWh)				Emissions (MTCO2e)	
								Supply	Conveyance	Treatment	Distribution	Total Electricity Use	
Surface Water	Casitas MWD	8,305	9,990	18,295	8,023	997	9,020	0	0	32	3,527	3,559	856
	City of Ventura	0	4,200	4,200	0	582	582	0	0	19	228	247	59
	UWCD	6,257	0	6,257	6,257	0	6,257	0	0	0	2,447	2,447	588
	Private	7,974	0	7,974	7,974	0	7,974	0	0	0	3,118	3,118	750
Surface Water Total		22,536	14,190	36,726	22,254	414	22,668	0	0	14	8,864	8,877	2,134
Imported Water	UWCD	0	0	0	0	0	0	0	0	0	0	0	0
	Calleguas MWD	5,537	105,747	111,283	4,349	6,693	11,041	0	21,542	308	-651.44	21,198	5,002
	Imported SWP Total	5,537	105,747	111,283	4,349	6,693	11,041	0	21,542	308	-651	21,198	4,899
Groundwater	Casitas MWD				25	3	28	1	0	0	11	12	3
	Ojai GMA	3,401	2,037	5,438	3,401	237	3,638	1,067	0	8	1,422	2,497	600
	FCGMA	105,346	44,949	150,295	105,346	5,224	110,570	13,147	0	170	43,235	56,553	13,595
	UWCD	83,243	13,115	96,358	83,243	1,524	84,767	12,304	0	50	33,146	45,499	10,938
	Private (unreported)	24,591	4,868	29,459	24,591	566	25,157	3,648	0	18	9,837	13,503	3,246
	Groundwater Total	216,581	64,969	281,550	216,606	7,554	224,160	30,167	0	246	87,652	118,065	28,382
Recycled Water	Oak Park Water Service	0	790	790	0	92	92	0	0	63		63	15
	Lake Sherwood CSD	0	484	484	0	56	56	0	0	38		38	9
	California Water Service Co.	0	644	644	0	75	75	0	0	51		51	12
	City of Simi Valley/ County Waterworks No. 8	0	56	56	0	7	7	0	0	4		4	1
	Camarillo San. District	1,840	46	1,886	1,840	5	1,845	0	0	4		4	1
	Camrosa Water District Non-Potable	4,687	1,372	6,059	4,687	159	4,846	0	0	109		109	26
	Camrosa Water District Non-Potable to PVCWD	3,241	0	3,241	3,241	0	3,241	0	0	0		0	0
	Camrosa Water District CWRF Recycled (Title 22)	901	268	1,170	901	31	932	0	0	21		21	5
	Moorpark WWTP/County Waterworks No. 1	3	718	721	3	83	86	0	0	57		57	14
	City of Ventura/Ventura Water Reclamation Facility	0	700	700	0	25	25	0	0	17		17	4
Recycled Water Total	10,672	5,078	15,751	10,672	484	11,156	0	0	331		331	80	
TOTAL	255,325	189,984	445,310	255,325	22,082	277,407	30,167	21,542	96,763		148,472	35,495	
		Source: Table 8 of the County of Ventura. 2013 Water Supply and Demand. Prepared for: Ventura County Watershed Protection District. January 2015. No updates as of July 2018			Note: Assumes municipal and industrial water use is proportional to population. Assumes all agricultural water use takes place in the unincorporated County. Agricultural water			Note: Calleguas purchases water from the Metropolitan Water District of Southern California, which gets its water from surface water, SWP, CRA, and the LA Aqueduct.					
Source: Ventura County 2013 Water Supply and Demand Report													

Imported Water

Urban Water Energy Intensity Matrix in kWh/MG							
Supply	Conveyance	Treatment	Distribution				
Surface Water	0	SWP-L.A. Basin	8325	EPRI (Avg)	100	EPRI Avg.	1200
Groundwater	4.45/MG/Foot	SWP-Bay Area	3150			Flat Topography	proposed
Ocean Desalination	13800	SWP-Central Coast	3150			Moderate Topography	proposed
Brackish Water Desal	1,240- 5,220	SWP-San Joaquin Valley	1510			Hilly Topography	proposed
Recycled Water	0	CRA-L.A. Basin	6140			Recycled Water	1,200-3,000
		Hetch Hetchy- Bay Area	0				
		Mokelumne Aqueduct	160				
		Local/Intrabasin	120				
in kWh/AF							
Supply	Conveyance	Treatment	Distribution				
Surface Water	-	SWP-L.A. Basin	2,713	EPRI (Avg)	33	EPRI Avg.	391
Groundwater (AF/MG/Foot)	1.45	SWP-Bay Area	1,026			Flat Topography	proposed
Ocean Desalination	4,497	SWP-Central Coast	1,026			Moderate Topography	proposed
Brackish Water Desal	1,053	SWP-San Joaquin Valley	492			Hilly Topography	proposed
Recycled Water	-	CRA-L.A. Basin	2,001			Recycled Water	684
		Hetch Hetchy- Bay Area	-				
		Mokelumne Aqueduct	52				
		Local/Intrabasin	39				
<i>Source: CEC-500-2006-118</i>							
Additional Background Data and Assumptions							
Metropolitan Water District of Southern California Energy Intensity for 2014 (used as a proxy for Calleguas water)							
	kWh/AF						
Conveyance	1,951						
Treatment	46						
Distribution	-59						
<i>Source: Metropolitan 2015 UWMP</i>							
Average Groundwater Depth in Ventura County							
	Well Depth (ft)	Source					
Mira Monte Well	20	Well located in Upper Ventura River Groundwater Basin. This is the average depth of groundwater in that area. CMWD UWMP AND AWMP - 2016 UPDATE					
Ojai GMA	202.3	Appendix B of Ventura's 2013 Groundwater Section					
FCGMA	82	Appendix B of Ventura's 2013 Groundwater SectionAnnual Report					
UWCD	100.1	Appendix B of Ventura's 2013 Groundwater SectionAnnual Report					
Private (unreported)	100	Assumed					

Wastewater

Wastewater									
Ventura County Greenhouse Gas Emissions Inventory - 2015									
The unincorporated area uses a combination of centralized WWTP treatment at fringe communities near cities and on-site septic tank systems.									
Wastewater Emissions in 2015					Forecasted Wastewater Emissions (MT CO2e)				
Source	MT CO2	MTCH4	MTN2O	MT CO2e	2020	2030	2035	2040	2050
Septic Methane Emissions	0	202	0	5,648	5648	5648	5648	5648	5648
WWTP Process Emissions	0	75	1	2,498	2498	2498	2498	2498	2498
Total	0	277	1	8,146					
Wastewater Emission Calculations									
Wastewater Treatment Emissions									
Type of Treatment	WWTP Service by Percent of Unincorporated Population	Served Population	MT CH4*	MT N2O	Total CO ₂ e Emissions (MT CO ₂ e/yr)				
Septic Tank Treatment	53%	51,613	202	0.00	5,648				
Centralized Sewer Treatment	47%	46,120	75.08	1.50	2,498				
Centralized Aerobic Treatment	41%	40,500							
Process N2O Emissions from Effluent Discharge (default N load data)				0.94					
Centralized Anaerobic Treatment with Cogeneration	6%	5,620							
Process emissions			74.83						
Stationary CH4 from Incomplete Combustion of Digester Gas			0.25						
Process N2O Emissions from Effluent Discharge (default N load data)				0.15					
Process N2O Emissions from WWTP with Nitrification/Denitrification	<i>assume this applies to all WWTPs</i>			0.40					
Total Septic			202	0	5,648				
Total WWTP Process Emissions			75	1	2,498				
Total			277	1	8,146				
* See methods below from EPA Inventory of US GHG Emissions and Sinks									
Note: Aerobic treatment does not result in CH4 emissions									
Background Data and Assumptions									
Demographics Summary									
		2015	Source						
	Unincorporated Population	97,733	Background Report						
	Unincorporated Households	32,191	Background Report						
	Approximate Number of Private Septic Systems in County	17,000	Email from Ventura County (Shelley Sussman) to Ascent Environmental (Brenda Hom/Erik de Kok) (10/17/2018)						
	Number of Unincorporated HH's on Septic	17,000	Assumption						
	Number of Unincorporated HH's on Sewer	15,191	Calculation						
	Percent of Unincorporated Population on Septic	53%	Calculation						
Wastewater Treatment Capacity and Service									
Ventura County									
					From Table 7-3 of the background report				
Agency	WWTP Name	Rated Capacity (MGD ¹)	Percent of WW treated from Unincorporated County	Unincorporated WW treated in WWTPs (MGD)	Anaerobic Treatment?	Total Number of Connections			
County Service Area No. 29	treated by City of Ventura	N/A				317			
County Service Area No. 30	treated by City of Oxnard	N/A				510			
County Service Area No. 32	countywide individual sewage disposal	N/A				N/A			
County Service Area No. 34	treated by City of Oxnard	N/A				N/A			
Camarillo Utility Enterprise	treated by Camarillo Sanitary District	N/A	0%			57			
Todd Road Jail	On site WWTP	0.085	100%	0.09	No	N/A			
Ventura County Waterworks District No. 1	Moorpark Wastewater Treatment Plant	5	15%	0.75	No	10,000 (population)			
Ventura County Waterworks District No. 16	On site WWTP	0.5	100%	0.50	No	400 (population)			

Wastewater

Residential Wastewater Methods

Data Source: Total unincorporated population. Percentage breakdown of population served by Septic and Sewer systems. Percent breakdown of aerobic and anaerobic

Domestic Wastewater CH4 Emission Estimates from EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2014

$$\begin{aligned} \text{Emissions from Septic Systems} &= A \\ &= US_{POP} \times (\% \text{ onsite}) \times (EF_{SEPTIC}) \times 1/10^9 \times \text{Days} \end{aligned}$$

$$\begin{aligned} \text{Emissions from Centrally Treated Aerobic Systems} &= B \\ &= [(\% \text{ collected}) \times (\text{total BOD}_5 \text{ produced}) \times (\% \text{ aerobic}) \times (\% \text{ aerobic w/out primary}) + (\% \text{ collected}) \times \\ &(\text{total BOD}_5 \text{ produced}) \times (\% \text{ aerobic}) \times (\% \text{ aerobic w/primary}) \times (1 - \% \text{ BOD removed in prim. treat.})] \times (\% \\ &\text{ operations not well managed}) \times (B_o) \times (MCF\text{-aerobic_not_well_man}) \end{aligned}$$

$$\begin{aligned} \text{Emissions from Centrally Treated Anaerobic Systems} &= C \\ &= [(\% \text{ collected}) \times (\text{total BOD}_5 \text{ produced}) \times (\% \text{ anaerobic}) \times (\% \text{ anaerobic w/out primary}) + (\% \text{ collected}) \\ &\times (\text{total BOD}_5 \text{ produced}) \times (\% \text{ anaerobic}) \times (\% \text{ anaerobic w/primary}) \times (1 - \% \text{ BOD removed in prim. treat.})] \\ &\times (B_o) \times (MCF\text{-anaerobic}) \end{aligned}$$

$$\begin{aligned} \text{Emissions from Anaerobic Digesters} &= D \\ &= [(POTW_flow_AD) \times (\text{digester gas}) / (\text{per capita flow})] \times \text{conversion to m}^3 \times (FRAC_CH_4) \times (365.25) \times \\ &(\text{density of CH}_4) \times (1 - DE) \times 1/10^9 \end{aligned}$$

$$\text{Total CH}_4 \text{ Emissions (kt)} = A + B + C + D$$

where,

US_{POP} = U.S. population

- % onsite = Flow to septic systems / total flow
- % collected = Flow to POTWs / total flow
- % aerobic = Flow to aerobic systems / total flow to POTWs
- % anaerobic = Flow to anaerobic systems / total flow to POTWs
- % aerobic w/out primary = Percent of aerobic systems that do not employ primary treatment
- % aerobic w/primary = Percent of aerobic systems that employ primary treatment
- % BOD removed in prim. treat. = 32.5%
- % operations not well managed = Percent of aerobic systems that are not well managed and in which some anaerobic degradation occurs
- % anaerobic w/out primary = Percent of anaerobic systems that do not employ primary treatment
- % anaerobic w/primary = Percent of anaerobic systems that employ primary treatment
- EF_{SEPTIC} = Methane emission factor (10.7 g CH₄/capita/day) – septic systems
- Days = days per year (365.25)
- Total BOD₅ produced = kg BOD/capita/day × U.S. population × 365.25 days/yr
- B_o = Maximum CH₄-producing capacity for domestic wastewater (0.60 kg CH₄/kg BOD)
- $1/10^6$ = Conversion factor, kg to kt
- MCF-aerobic_not_well_man. = CH₄ correction factor for aerobic systems that are not well managed (0.3)
- MCF-anaerobic = CH₄ correction factor for anaerobic systems (0.8)
- DE = CH₄ destruction efficiency from flaring or burning in engine (0.99 for enclosed flares)
- POTW_flow_AD = Wastewater influent flow to POTWs that have anaerobic digesters (MGD)
- digester gas = Cubic feet of digester gas produced per person per day (1.0 ft³/person/day)
- per capita flow = Wastewater flow to POTW per person per day (100 gal/person/day)
- conversion to m³ = Conversion factor, ft³ to m³ (0.0283)
- FRAC_CH₄ = Proportion CH₄ in biogas (0.65)
- density of CH₄ = 662 (g CH₄/m³ CH₄)
- $1/10^9$ = Conversion factor, g to kt

Source: EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2014. Waste. Chapter 7. 7-18

Process CH4 Emissions from Anaerobic and facultative treatment lagoons

Equation 10.4 from the LGOP

Equation 10.4	Process CH₄ from Wastewater Treatment Lagoons (default values)
Annual CH ₄ emissions (metric tons CO ₂ e) =	
$((P \times F_{ind-com}) \times BOD_5 \text{ load} \times (1 - F_P) \times B_o \times MCF_{anaerobic} \times 365.25 \times 10^{-3}) \times GWP$	

Wastewater

Where:									
Term	Description	Value							
P	= population served by lagoons adjusted for industrial discharge, if applicable [person]	user input							
$F_{ind-com}$	= factor for industrial and commercial co-discharge waste into the sewer system	1.25							
BOD ₅ load	= amount of BOD ₅ produced per person per day [kg BOD ₅ /person/day]	0.090							
F_p	= fraction of BOD ₅ removed in primary treatment, if present	0.325*							
Bo	= maximum CH ₄ -producing capacity for domestic wastewater [kg CH ₄ /kg BOD ₅ removed]	0.6							
$MCF_{anaerobic}$	= CH ₄ correction factor for anaerobic systems	0.8							
365.25	= conversion factor [day/year]	365.25							
10 ⁻³	= conversion from kg to metric ton [metric ton/kg]	10 ⁻³							
GWP	= Global Warming Potential	21							
Source: EPA <i>Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2007</i> , Chapter 8, 8-9 (2009) except:									
* F_p : Tchobanoglous, G., F.L. Burton, and H.D. Stensel, <i>Wastewater Engineering: Treatment and Reuse</i> , p. 396, 4th Edition (2003).									

Wastewater

Stationary CH₄ from Incomplete Combustion of Digester Gas (default)

Equation 10.2 from the LGOP

Equation 10.2	Stationary CH ₄ from Incomplete Combustion of Digester Gas (default)
Annual CH ₄ emissions (metric tons CO ₂ e) =	
$(P \times \text{Digester Gas} \times F_{\text{CH}_4} \times \rho(\text{CH}_4) \times (1-\text{DE}) \times 0.0283 \times 365.25 \times 10^{-6}) \times \text{GWP}$	

Where:

Term	Description	Value
P	= population served by the WWTP with anaerobic digesters	user input
Digester Gas	= cubic feet of digester gas produced per person per day [ft ³ /person/day]	1.0
F _{CH₄}	= fraction of CH ₄ in biogas	0.65
ρ(CH ₄)	= density of methane [g/m ³]	662.00
DE	= CH ₄ Destruction Efficiency	.99
0.0283	= conversion from ft ³ to m ³ [m ³ /ft ³]	0.0283
365.25	= conversion factor [day/year]	365.25
10 ⁻⁶	= conversion from g to metric ton [metric ton/g]	10 ⁻⁶
GWP	= Global Warming Potential	21

Source: EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2007, Chapter 8, 8-7 (2009).

Process N₂O Emissions from WWTP with Nitrification/Denitrification

Equation 10.7 from the LGOP

Equation 10.7	Process N ₂ O Emissions from WWTP with Nitrification/Denitrification
Annual N ₂ O emissions (metric tons CO ₂ e) =	
$((P_{\text{total}} \times F_{\text{ind-com}}) \times \text{EF nit/denit} \times 10^{-6}) \times \text{GWP}$	

Where:

Term	Description	Value
P _{total}	= total population that is served by the centralized WWTP adjusted for industrial discharge, if applicable [person]	user input
F _{ind-com}	= factor for industrial and commercial co-discharge waste into the sewer system	1.25
EF nit/denit	= emission factor for a WWTP with nitrification/denitrification [g N ₂ O/person/year]	7
10 ⁻⁶	= conversion from g to metric ton [metric ton/g]	10 ⁻⁶
GWP	= N ₂ O Global Warming Potential	310

Source: EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2007, Chapter 8, 8-13 (2009).

Process N₂O Emissions from Effluent Discharge (default N load data)

Equation 10.10 from the LGOP

Equation 10.10	Process N ₂ O Emissions from Effluent Discharge (default N load data)
Annual N ₂ O emissions (metric tons CO ₂ e) =	
$((P_{\text{total}} \times F_{\text{ind-com}}) \times (\text{Total N Load} - \text{N uptake} \times \text{BOD}_5 \text{ load}) \times \text{EF effluent} \times 44/28 \times (1 - F_{\text{plant nit/denit}}) \times 365.25 \times 10^{-3}) \times \text{GWP}$	

Where:

Term	Description	Value
P _{total}	= population served [person]	user input
F _{ind-com}	= factor for industrial and commercial co-discharge waste into the sewer system	1.25
Total N Load ²⁷	= total nitrogen load [kg N/person/day]	0.026
N uptake ²⁸	= nitrogen uptake for cell growth in aerobic system (kg N/kg BOD ₅)	0.05 ¹
	= nitrogen uptake for cell growth in anaerobic system (e.g., lagoon) (kg N/kg BOD ₅)	0.005 ¹
BOD ₅ load	= amount of BOD ₅ produced per person per day [kg BOD ₅ /person/day]	0.090
EF effluent	= emission factor [kg N ₂ O-N/kg sewage-N produced]	0.005
44/28	= molecular weight ratio of N ₂ O to N ₂	1.57
F plant nit/denit	= fraction of nitrogen removed for the centralized WWTP with nitrification/denitrification	0.7 ¹

Wastewater

	=	fraction of nitrogen removed for the centralized WWTP w/o nitrification/denitrification	0.0 ¹						
365.25	=	conversion factor [day/year]	365.25						
10 ⁻³	=	conversion from kg to metric ton [metric ton/kg]	10 ⁻³						
GWP	=	Global Warming Potential	310						
Source: EPA <i>Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2007</i> , Chapter 8, 8-13 (2009), except:									
¹ Grady, C. P. L., Jr., G. T. Daigger, and H. C. Lim, <i>Biological Wastewater Treatment</i> , p. 108-109, 644									
2nd Edition (1999).									

Agriculture

Agriculture							
Ventura County Greenhouse Gas Emissions Inventory - 2015							
Agricultural Emissions in 2015							
	MT CO2	MT CH4	MT N2O	MT CO2e	Scaled MTCO2e	% of total Ag	Year
Residue Burn	7,928	8	1	8,494	8,514	3%	2015
Enteric Fermentation	0	329	0	9,212	8,225	4%	2015
Manure Management	0	16	2	864	869	0%	2015
Farm Equipment	67,410	7	1	67,829	67,834	28%	2015
Agricultural Irrigation Pumps	22,257	0	0	22,257	21,625	9%	2015
Pesticide	0	0	0	0	658	0%	2015
Fertilizer	0	0	495	131,113	146,983	54%	2015
Lime Application	294	0	0	294	291	0%	2015
Urea Fertilization	4,941	0	0	4,941	4,894	2%	2015
Total	102,830	360	499	245,004	259,894	54%	
Agricultural Emissions Forecasting 2020-2040							
	2020	2030	2035	2040	2050		
Residue Burn	8,298	7,864	7,647	7,430	6,996		
Enteric Fermentation	8,171	8,062	8,007	7,953	7,844		
Manure Management	864	852	846	841	829		
Farm Equipment	66,107	62,651	60,923	59,196	55,740		
Agricultural Irrigation Pumps	21,074	19,972	19,422	18,871	17,769		
Pesticide	641	608	591	574	541		
Fertilizer	146,011	144,068	143,096	142,124	140,181		
Lime Application	289	285	283	282	278		
Urea Fertilization	4,769	4,520	4,395	4,270	4,021		
Total	256,223	248,882	245,211	241,541	234,200		

Stationary Sources

Stationary Sources								
Ventura County Greenhouse Gas Emissions Inventory - 2015								
Stationary Source Emissions (Oil and Gas Emissions) in 2015								
Emissions Source	Activity	MT CO2 (non-biomass)	MT CH4	MT N2O	MT CO2e			
Fuel combustion	Associated gas	170,161	3	0.26	170,305			
Fuel combustion	Distillate	4,568	0	0.04	4,583			
Fuel combustion	Natural gas	-	-	-	0			
Fuel combustion	Residual fuel oil	-	-	-	0			
Fugitive emissions	Processing	6,931	303	-	14,507			
Fugitive emissions	Production	13,278	2,585	-	77,912			
Fugitive emissions	Storage	-	311	-	7,787			
Fugitive emissions	Wastewater Treatment	-	0	-	1			
Total		194,939	3,203	0	275,096			0.1037
Source: CARB Mandatory Reporting Rule - 2016 (Latest available as of 11/6/2017)								
Estimating Ventura County Stationary Source Emissions from Oil and Gas								
Ventura County Emissions								
Main Activity	Activity Subset	Ventura County Scaling Factor	County percent of state emissions	Ventura County Emissions (MMT)*	Ventura County Emissions (MT)*	Ventura County Emissions (MTCO2e)*	% of Stat. Source O&G Emissions	GHG
Fuel combustion	Associated gas	Associated Gas (Mcf)	5%	2.61E-07	0	69.23	0.0%	N2O
Fuel combustion	Associated gas	Associated Gas (Mcf)	5%	1.70E-01	170,161	170,161.45	59.8%	CO2
Fuel combustion	Associated gas	Associated Gas (Mcf)	5%	2.61E-06	2.61	73.15	0.0%	CH4
Fuel combustion	Distillate	Oil Produced (bbls)**	4%	1.85E-07	0	5.19	0.0%	CH4
Fuel combustion	Distillate	Oil Produced (bbls)**	4%	4.57E-03	4,567.58	4,567.58	1.6%	CO2
Fuel combustion	Distillate	Oil Produced (bbls)**	4%	3.71E-08	0.04	9.82	0.0%	N2O
Fuel combustion	Natural gas	Non Associated Gas (Mcf)	0%	0.00E+00	-	-	0.0%	CH4
Fuel combustion	Natural gas	Non Associated Gas (Mcf)	0%	0.00E+00	-	-	0.0%	CO2
Fuel combustion	Natural gas	Non Associated Gas (Mcf)	0%	0.00E+00	-	-	0.0%	N2O
Fuel combustion	Residual fuel oil	Oil Produced (bbls)**	0%	0.00E+00	-	-	0.0%	CO2
Fuel combustion	Residual fuel oil	Oil Produced (bbls)**	0%	0.00E+00	-	-	0.0%	N2O
Fuel combustion	Residual fuel oil	Oil Produced (bbls)**	0%	0.00E+00	-	-	0.0%	CH4
Fugitive emissions	NA	Overall production	4%	3.03E-04	303	8,485.31	3.0%	CH4
Fugitive emissions	NA	Overall production	4%	6.93E-03	6,931	6,931.20	2.4%	CO2
Fugitive emissions	NA	Overall production	4%	2.59E-03	2,585	72,389.42	25.4%	CH4
Fugitive emissions	NA	Overall production	4%	1.33E-02	13,278	13,278.42	4.7%	CO2
Fugitive emissions	NA	Overall production	4%	3.11E-04	311	8,721.78	3.1%	CH4
Fugitive emissions	NA	Water Produced (bbls)	2%	2.00E-08	0	0.56	0.0%	CH4
				TOTAL	198,142	284,693	100.0%	
* Scaled to Ventura County based on county's relative production in the state. Note that non-associated gases are generally natural gas. Associated gases are unwanted byproducts of crude oil production.								

Stationary Sources

Statewide Stationary Source Emissions from Oil and Gas (Output from CARB's Statewide GHG Inventory)							
GHG Emission Inventory Summary [2000 - 2016]							
Sub Sector Level 1: Oil & Gas Extraction							
Inventory Accounting: Included							
Measurement: Gas Mass							
Unit: million tonnes							
Statewide Emissions							
Sub Sector Level 1	Sub Sector Level 2	Sub Sector Level 3	Main Activity	Activity Subset	GHG	2015 (Million Metric Tons)	2015 (Metric Tons CO2e)
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Associated gas	N2O	5.1372E-06	1,361
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Associated gas	CO2	3.346208708	3,346,209
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Associated gas	CH4	5.13724E-05	1,438
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Distillate	CH4	4.4397E-06	124
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Distillate	CO2	0.109454292	109,454
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Distillate	N2O	8.879E-07	235
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Natural gas	CH4	0.00025934	7,262
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Natural gas	CO2	13.75020079	13,750,201
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Natural gas	N2O	0.000025934	6,873
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Residual fuel oil	CO2	0	-
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Residual fuel oil	N2O	0	-
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Residual fuel oil	CH4	0	-
Oil & Gas: Production & Processing	Processing	Fugitives	Fugitive emissions	NA	CH4	0.007122541	199,431
Oil & Gas: Production & Processing	Processing	Fugitives	Fugitive emissions	NA	CO2	0.162904835	162,905
Oil & Gas: Production & Processing	Production	Fugitives	Fugitive emissions	NA	CH4	0.060763449	1,701,377
Oil & Gas: Production & Processing	Production	Fugitives	Fugitive emissions	NA	CO2	0.312084267	312,084
Oil & Gas: Production & Processing	Storage	Fugitives	Fugitive emissions	NA	CH4	0.007321038	204,989
Oil & Gas: Production & Processing	Wastewater Treatment	Fugitives	Fugitive emissions	NA	CH4	1.1401E-06	32
Source: CARB's California GHG Emission Inventory Summary [2000 - 2016] (https://www.arb.ca.gov/app/ghg/2000_2016/ghg_sector.php)					TOTAL	18	19,803,975
State Report on Well Count and Production of Oil, Gas, and Water by County - 2015							
WELL COUNT AND PRODUCTION OF OIL, GAS AND WATER BY COUNTY - 2015							
County	Well Count*		Oil Produced (bbls)**	Net Gas Production			Water Produced (bbls)
	Active	Inactive		Associated Gas (Mcf)	Non Associated Gas (Mcf)	Total Net Gas (Mcf)	
Alameda	6	2	9687	847	0	847	30156
Butte	26	1	0	0	11,054	11,054	87
Colusa	188	176	0	0	4,157,952	4,157,952	59,722
Contra Costa	38	23	93	0	333,759	333,759	7,418
Fresno	2,113	1,597	7,232,606	477,027	3,381	480,408	81,983,297
Glenn	22,08,00	5,04,00	0,01,00	0,01,00	4,10,48	4,10,48	27,07,23
Humboldt	25	33	0	0	468,543	468,543	8,700
Kern	44,284	16,643	144,472,957	129,102,663	1,842,826	130,945,489	1,991,303,876
Kings	181	207	271,000	219,930	0	219,930	706,767
Lassen	0	5	0	0	0	0	0
Los Angeles	3,885	1,736	23,808,695	17,015,642	225,814	17,241,456	913,784,022
Madera	18	18	0	0	637,923	637,923	1,070
Merced	0	2	0	0	0	0	0
Monterey	729	522	8,100,648	1,022,578	0	1,022,578	125,737,028
Orange	1,030	455	4,667,014	2,530,180	0	2,530,180	105,367,969
Riverside	0	4	0	0	0	0	0

Stationary Sources

Sacramento	92	114	11,805	0	5,558,920	5,558,920	211,853	
San Benito	20	25	14,813	18,791	0	18,791	102,474	
San Bernardino	25	13	8000	695	0	695	7479	
San Joaquin	141	88	0	0	1,829,324	1,829,324	87,139	
San Luis Obispo	231	129	536,845	174,226	0	174,226	11,533,722	
San Mateo	2	11	75	0	0	0	3	
Santa Barbara	1,129	1,028	4,338,695	3,065,153	1,158	3,066,311	113,516,855	
Santa Clara	13	2	26,784	8,363	0	8,363	26,243	
Solano	99	146	4,707	0	2,559,654	2,559,654	66,004	
Stanislaus	1	1	0	0	61,332	61,332	35	
Sutter	237	182	0	0	4,833,949	4,833,949	71,961	
Tehama	99	51	0	0	1,239,748	1,239,748	23,813	
Tulare	75	15	39237	0	0	0	3783973	
Ventura	1,705	1,303	8,428,402	8,231,282	0	8,231,282	59,853,491	
Yolo	25	56	170	0	171,736	171,736	2,476	
Yuba	1	0	0	0	1,131	1,131	0	
TOTAL	56,653	24,684	201,972,233	161,867,377	27,948,252	189,815,629	3,408,359,291	
<i>Ventura County percent of total</i>	<i>3%</i>	<i>5%</i>	<i>4.2%</i>	<i>5.1%</i>	<i>0.0%</i>	<i>4.3%</i>	<i>1.8%</i>	
*Includes Oil & Gas (OG), Dry Gas (DG) and Gas Storage (GS)								
** Includes condensate from Dry Gas (DG) and Gas Storage (GS)								
Source: ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2015/County_Production_2015.pdf								
Oil and Gas Production Forecast								
	2015	2020	2030	2040	2050			
Ventura County Oil Production	8,428,402	8,819,019	8,152,109	9,648,506	9,499,223			
Scaled Emissions	275,096	287,845	314,526	343,679	375,535			

Assumptions

Category		Source/Notes				
Conversions						
g/MT	1000000					
g/lb	453.592					
lb/MT	2204.622622					
kg/MT	1000					
MT/ton	1.10231					
g/ton	907185					
lb/kg	2.20462					
kWh/MWh	1000					
MWh/GWh	1000					
Btu/therm	100000					
BTU/gal diesel	139000					
MMBtu/therm	0.1					
MMBtu/MWh	3.41214148					
LPG Gallons/GGE	1.344086022					
LNG Gallons/GGE	1.572327044					
gal/cubic foot	7.480519481					
gal/Liter	3.785411784					
gallon/acrefoot	325851.429					
million gal/acre-feet	0.325851429					
GWP						
Source (Select)	IPCC Fifth Assessment Report GWP Values 100-year horizon	<--drop down selection (note: Agricultural emissions will need to be updated separately.)				
CO2	1					
CH4	28					
N2O	265					
	IPCC Fourth Assessment Report (w/o climate carbon feedback)	IPCC Fourth Assessment Report (Avg)	IPCC Second Assessment Report	IPCC Fourth Assessment Report (with climate carbon feedback)	IPCC Fifth Assessment Report GWP Values 100-year horizon	IPCC Fifth Assessment Report GWP Values 20-year horizon
CO2	1	1	1	1	1	1
CH4	25	25	21	34	28	84
N2O	265	298	310	298	265	264
Electricity Emission Factors						
SCE	2015	2020	2030	2035	2040	2045
RPS Status	25%	33%	50%	66.7%	83.3%	100%
SCE Power Mix 2015						
Natural Gas	26%					
Unspecified Sources	41%					
GHG Free Sources	33%					
SCE 2015 Calculated EFs						
lb CO2/MWh	529	472.67	352.74	235.16	117.58	0.00
lb CH4/GWh	14.95	13.35	9.97	6.64	3.32	0.00
lb N2O/GWh	1.66	1.48	1.11	0.74	0.37	0.00
MT CO2e/MWh	0.240	0.215	0.160	0.107	0.053	0.000
California Average						
RPS Status	25.0%	33.0%	50%	67%	83%	100%
CA Average Power Mix 2015						
Natural Gas	44%					
Unspecified Sources	15%					
Coal	6%					
GHG Free Sources	41%					
CA Average 2015 Calculated EFs						
lb CO2/MWh	519.21	463.8	346.1	230.5	115.6	0.0
lb CH4/GWh	11.96	10.7	8.0	5.3	2.7	0.0
lb N2O/GWh	2.32	2.1	1.5	1.0	0.5	0.0
MT CO2e/MWh	0.236	0.211	0.157	0.105	0.053	0.000

SCE 2015 Power Content Label
(https://www.energy.ca.gov/pcl/labels/2015_index.html)

SCE 2015 Power Content Label
(https://www.energy.ca.gov/pcl/labels/2015_index.html)

2016 SCE Corporate Responsibility Report

Calculated from eGrid 2016 NG & Other Efs

Calculated from eGrid 2016 NG & Other Efs

Calculated

Calculated from eGrid 2016 NG & Other Efs

Calculated from eGrid 2016 NG & Other Efs

Calculated from eGrid 2016 NG & Other Efs

Calculated

Assumptions

eGrid 2016 Emission Factors (For Calculation of California Average EFs)			Updated February 2017
<i>Natural Gas EFs: eGRID2016 Average of California Natural Gas Electricity Plant EFs</i>			https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid
lb CO2/MWh	867.88		Weighted average based on annual plant net generation
lb CH4/GWh	16.50		Weighted average based on annual plant net generation
lb N2O/GWh	1.66		Weighted average based on annual plant net generation
MT CO2e/MWh	0.3941		Calculated
<i>Coal EFs: eGRID2016 Average of California Coal Electricity Plant EFs</i>			https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid
lb CO2/MWh	1157.82		Weighted average based on annual plant net generation
lb CH4/GWh	13.41		Weighted average based on annual plant net generation
lb N2O/GWh	18.98		Weighted average based on annual plant net generation
MT CO2e/MWh	0.5276		Calculated
<i>Unspecified EFs: eGRID2016 CAMX Emission Factors</i>			unspecified power sources
lb CO2/MWh	452.50		CAMX avg
lb CH4/GWh	26.00		CAMX avg
lb N2O/GWh	3.00		CAMX avg
kg/MWh	205.25		Calculated
kg/GWh	11.79		Calculated
kg/GWh	1.36		Calculated
Utility Natural Gas Emission Factors			
kg CO ₂ /MMBtu	53.06	Natural Gas - US Weighted Average	2017 Climate Registry Emission Factors. Table 12.1.
g CH4/MMBtu	4.7	Natural Gas - Residential/Commer	2017 Climate Registry Emission Factors. Table 12.9.
g N2O/MMBtu	0.1	Natural Gas - Residential/Commer	2017 Climate Registry Emission Factors. Table 12.9.
MT CO2/therm	0.005306		Calculated
MT CH4/therm	0.000047		Calculated
MT N2O/therm	0.000001		Calculated
MT CO2e/therm	0.0069		Calculated
The Climate Registry 2017 Default Emission Factors			
Fuel Type	Carbon Content (Per Unit Energy)	CO2 Emission Factor (Per Unit Volume)	
Fuels Measured in Gallons	kg C / MMBtu	kg CO2 / gallon	
Gasoline	19.2	8.78	
Diesel Fuel	20.2	10.21	
Aviation Gasoline	18.9	8.31	
Jet Fuel (Jet A or A-1)	19.7	9.75	
Kerosene	20.5	10.15	

Assumptions

Residual Fuel Oil No. 5	19.9	10.21					
Residual Fuel Oil No. 6	20.5	11.27					
Crude Oil	20.3	10.29					
Biodiesel (B100)	20.1	9.45					
Ethanol (E100)	18.7	5.75					
Methanol	n/a	4.10					
Liquefied Natural Gas (LNG)*	n/a	4.46					
Liquefied Petroleum Gas (LPG)	17.2	5.68					
Propane (Liquid)	16.8	5.72					
Ethane	17.1	4.11					
Isobutane	17.7	6.30					
Butane	17.8	6.54					

Assumptions

Fuels Measured in Standard Cubic Feet	kg C / MMBtu	kg CO2 / Standard cubic foot					
Compressed Natural Gas (CNG)*	14.47	0.054					
Propane (Gas)	16.76	0.1546					
<p>Source: Heat content and default emission factors are from EPA Final Mandatory Reporting of Greenhouse Gases Rule Table C-1. Carbon content derived using the heat content and default emission factor. Except those marked * are from EPA Climate Leaders, Mobile Combustion Guidance, Tables B-4, B-5, (2008). A fraction oxidized value of 1.00 is from the IPCC, <i>Guidelines for National Greenhouse Gas Inventories</i> (2006). Methanol emission factor is calculated from the properties of the pure compounds. Note: Carbon contents are calculated using the following equation: (Emission Factor / (44/12)) / Heat Content × Conversion Factor. Heat content factors are based on higher heating values (HHV). NA = data not available.</p>							
Vehicle Type / Fuel Type	CH4 (g / gallon)	N2O (g / gallon)					
Ships and Boats							
Residual Fuel Oil	0.11	0.60					
Diesel Fuel	0.74	0.45					
Gasoline	0.06	0.22					
Locomotives							
Diesel Fuel	0.80	0.26					
Agricultural Equipment							
Gasoline	1.26	0.22					
Diesel Fuel	1.44	0.26					
Construction/Mining Equipment							
Gasoline	0.50	0.22					
Diesel Fuel	0.58	0.26					
Other Non-Highway							
Snowmobiles (Gasoline)	0.50	0.22					
Other Recreational (Gasoline)	0.50	0.22					
Other Small Utility (Gasoline)	0.50	0.22					
Other Large Utility (Gasoline)	0.50	0.22					
Other Large Utility (Diesel)	0.58	0.26					
Aircraft							
Jet Fuel	0.00	0.31					
Aviation Gasoline	7.05	0.11					
<p>Source: US Inventory of Greenhouse Gas Emissions and Sinks 1990-2011 (April 2013) Annex 3, Table A-106. Original factors converted to g/gallon fuel using fuel density defaults from U.S. EPA Climate Leaders, Mobile Combustion Guidance (2008) Table A-6.</p>							
Vehicle Type / Fuel Type	CH4 (g / L)	N2O (g / L)					
Diesel Passenger Cars							
Advanced	0.0005	0.0010					
Moderate	0.0005	0.0010					
Uncontrolled	0.0006	0.0012					
Diesel Light Trucks							
Advanced	0.0010	0.0015					
Moderate	0.0009	0.0014					
Uncontrolled	0.0011	0.0017					
Diesel Medium and Heavy-Duty Vehicles (Trucks and Busses)							
Aftertreatment	0.0051	0.0048					
Advanced	0.0051	0.0048					
Moderate	0.0051	0.0048					
Uncontrolled	0.0051	0.0048					
CNG Medium and Heavy-Duty Vehicles (Trucks and Busses)							
CNG	1.9660	0.1750					

Assumptions

Scaling Factor	0.0093	-0.0076	0.0184	-0.0015	-0.0159	0.0184		
Solid Waste Characterization								
Commercial Waste (w/o) organics	12,296	0.277195619		2014 Commercial Waste Stream by Material Type				
Residential Waste (w/o) organics	14,387	0.324338338		2014 Residential Waste Stream by Material Type				
Organics - Commercial	7,936							
Organics - Residential	9,739							
Organics - Combined	17,675	0.398468357						
Solid Waste	44,358							

EMFAC

EMFAC 2017 Emission Factor Summary by SCAG Vehicle Category															
SCAG Vehicle Category	CO2 g/mi	CH4 g/mi	N2O g/mi		VMT Test										
Light Duty	360.2	0.0113	0.0001		15,367,891	81%									
Heavy Duty	676.7	0.0190	0.0003		3,498,707	18%									
Buses	1502.3	1.6224	0.0039		51,641	0.27%									
g per ton	907185														
Output from EMFAC 2017															
EMFAC2017 (v1.0.2) Emissions Inventory															
Region Type: County															
Region: VENTURA															
Calendar Year: 2015															
Season: Annual															
Vehicle Classification: EMFAC2007 Categories															
Units: miles/day for VMT, trips/day for Trips, tons/day for Emissions, 1000 gallons/day for Fuel Consumption															
													Weighted by VMT and SCAG Vehicle Category		
Region	Calendar Y	Vehicle Cat	SCAG VEH	Model Year	Speed	Fuel	Population	VMT	Trips	CO2 g/mi	CH4 g/mi	N2O g/mi	CO2 g/mi	CH4 g/mi	N2O g/mi
VENTURA	2015	HHDT	Heavy Duty	Aggregated	Aggregated	GAS	10.45532	201.3982	209.1899	2785.411	0.881322	0	0.160338	5.07E-05	0
VENTURA	2015	HHDT	Heavy Duty	Aggregated	Aggregated	DSL	2856.269	284092.6	26805.65	1751.784	0.017333	0.002129	142.2437	0.001407	0.000173
VENTURA	2015	HHDT	Heavy Duty	Aggregated	Aggregated	NG	56.59271	2269.64	220.7116	3747.758	8.386015	0.051671	2.431202	0.00544	3.35E-05
VENTURA	2015	LDA	Light Duty	Aggregated	Aggregated	GAS	257764.5	9735877	1202803	316.1007	0.007679	0	200.2563	0.004865	0
VENTURA	2015	LDA	Light Duty	Aggregated	Aggregated	DSL	2796.395	112916.6	13162.62	235.6607	0.001433	0	1.731533	1.05E-05	0
VENTURA	2015	LDA	Light Duty	Aggregated	Aggregated	ELEC	1140.434	40720.84	5813.706	0	0	0	0	0	0
VENTURA	2015	LDT1	Light Duty	Aggregated	Aggregated	GAS	29792.02	997682.6	132083.3	373.7735	0.01987	0	24.26536	0.00129	0
VENTURA	2015	LDT1	Light Duty	Aggregated	Aggregated	DSL	54.68934	1029.592	191.4097	436.7623	0.013292	0	0.029261	8.91E-07	0
VENTURA	2015	LDT1	Light Duty	Aggregated	Aggregated	ELEC	32.97446	940.8672	155.8403	0	0	0	0	0	0
VENTURA	2015	LDT2	Light Duty	Aggregated	Aggregated	GAS	97569.81	3640831	453078.5	416.0682	0.010528	0	98.57137	0.002494	0
VENTURA	2015	LDT2	Light Duty	Aggregated	Aggregated	DSL	322.5063	14907.64	1592.299	330.01	0.001343	0	0.320127	1.3E-06	0
VENTURA	2015	LDT2	Light Duty	Aggregated	Aggregated	ELEC	11.25957	370.4754	55.94908	0	0	0	0	0	0
VENTURA	2015	LHDT1	Light Duty	Aggregated	Aggregated	GAS	9667.95	322240.2	144038	850.1204	0.019494	0.003761	17.82567	0.000409	7.89E-05
VENTURA	2015	LHDT1	Light Duty	Aggregated	Aggregated	DSL	7012.299	267489	88205.91	518.1401	0.006361	0.000134	9.018595	0.000111	2.33E-06
VENTURA	2015	LHDT2	Light Duty	Aggregated	Aggregated	GAS	1520.846	55364.76	22658.34	967.5943	0.010591	0.003614	3.48588	3.82E-05	1.3E-05
VENTURA	2015	LHDT2	Light Duty	Aggregated	Aggregated	DSL	2290.518	91034.81	28811.84	569.3862	0.005418	0.000128	3.372874	3.21E-05	7.6E-07
VENTURA	2015	MCY	Light Duty	Aggregated	Aggregated	GAS	16078.67	86485.62	32157.33	237.4706	0.364528	0	1.336409	0.002051	0
VENTURA	2015	MDV	Heavy Duty	Aggregated	Aggregated	GAS	80904.03	2792548	373672.3	495.8916	0.011941	0	395.8037	0.009531	0
VENTURA	2015	MDV	Heavy Duty	Aggregated	Aggregated	DSL	929.7188	41024.04	4600.713	428.7903	0.000916	0	5.027774	1.07E-05	0
VENTURA	2015	MDV	Heavy Duty	Aggregated	Aggregated	ELEC	3.21702	65.62526	13.79356	0	0	0	0	0	0
VENTURA	2015	MH	Heavy Duty	Aggregated	Aggregated	GAS	4449.139	39906.79	445.0918	1749.411	0.037777	0	19.95405	0.000431	0
VENTURA	2015	MH	Heavy Duty	Aggregated	Aggregated	DSL	1116.306	11871.49	111.6306	991.4394	0.003869	0	3.364061	1.31E-05	0
VENTURA	2015	MHDT	Heavy Duty	Aggregated	Aggregated	GAS	827.5784	33933.13	16558.19	1791.462	0.054889	0.005401	17.37496	0.000532	5.24E-05
VENTURA	2015	MHDT	Heavy Duty	Aggregated	Aggregated	DSL	5433.838	292793.9	55084.74	1079.564	0.018522	0.000259	90.34478	0.00155	2.17E-05
VENTURA	2015	OBUS	Buses	Aggregated	Aggregated	GAS	258.9701	10905.03	5181.474	1775.904	0.028466	0.004441	375.0179	0.006011	0.000938
VENTURA	2015	OBUS	Buses	Aggregated	Aggregated	DSL	159.1362	8932.726	1405.788	1176.573	0.021539	0.000867	203.5207	0.003726	0.00015
VENTURA	2015	SBUS	Buses	Aggregated	Aggregated	GAS	63.61691	2522.652	254.4676	1018.277	0.130735	0.05242	49.74267	0.006386	0.002561
VENTURA	2015	SBUS	Buses	Aggregated	Aggregated	DSL	331.64	10257.16	3827.08	1448.399	0.013532	0.00103	287.6876	0.002688	0.000205
VENTURA	2015	UBUS	Buses	Aggregated	Aggregated	GAS	56.68692	4226.761	226.7477	1688.447	0.004711	0	138.1977	0.000386	0
VENTURA	2015	UBUS	Buses	Aggregated	Aggregated	DSL	43.9393	3327.786	175.7572	1690.819	0.091868	0	108.9578	0.00592	0
VENTURA	2015	UBUS	Buses	Aggregated	Aggregated	ELEC	0.114167	2.640406	0.456668	0	0	0	0	0	0
VENTURA	2015	UBUS	Buses	Aggregated	Aggregated	NG	107.2596	11466.2	429.0385	1527.621	7.193905	0	339.1884	1.597313	0