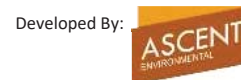




## **Attachment 1 to Appendix B: Greenhouse Gas Emissions Inventory Technical Documentation**

*Note: Attachment 1 contains technical data and documentation used to prepare the County's 2015 Greenhouse Gas Emissions Inventory. Attachment 1 will be included in the Greenhouse Technical Appendix to the EIR and removed from Appendix B in future drafts of the General Plan.*





## Unincorporated Ventura County 2015 GHG Inventory

Updated: 4/29/2019

These pages contain the spreadsheets used to calculate the 2015 Greenhouse Gas (GHG) inventory in unincorporated Ventura County.

### GHG Inventory Sections

		Category
Inventory Summary	Consolidates and summarizes the results from all emissions sectors for 2015.	Summary
Demographics	Includes population, housing, and employment data and forecasts for 2015. Calculations exclude Vandenberg Air Force Base and UC Ventura values for unincorporated county totals.	Demographics
Transportation	Calculates the on-road transportation and passenger rail emissions with respect to activity in the unincorporated county.	Calculations
Building Energy	Calculates the emissions from residential, commercial, industrial, and agricultural land uses that consume electricity and natural gas.	Calculations
Offroad	Calculates the emissions from off-road equipment.	Calculations
Solid Waste	Calculates the emissions from waste generation and waste-in-place.	Calculations
Imported Water	Calculates emissions from water imported to the unincorporated County.	Calculations
Wastewater	Calculates the emissions from wastewater treatment processes from centralized wastewater treatment facilities and septic systems.	Calculations
Agriculture	Calculates the emissions from agricultural sources.	Calculations
Stationary Source	Calculates 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, 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

TOTAL UNINCORPORATED EMISSIONS DETAIL (MT CO2e / YEAR)		
SECTOR	SUBSECTOR	2015
Residential	Electricity	63,164
Residential	Natural Gas	95,292
Commercial	Electricity	28,575
Commercial	Natural Gas	67,442
Industrial	Natural Gas	14,960
Agricultural	Electricity	49,787
<b>Building Energy Total</b>		<b>319,220</b>
Transportation	On-Road Transportation	690,207
Transportation	Rail	2,490
<b>Transportation Total</b>		<b>692,696</b>
Solid Waste	Waste Generation	30,864
Solid Waste	Waste In Place	266,616
<b>Solid Waste Total</b>		<b>297,480</b>
Water	Electricity used by water systems outside Unincorporated County	5,002
Wastewater	Septic Systems	5,043
Wastewater	WWTP Process Emissions	2,322
<b>Water and Wastewater Total</b>		<b>12,367</b>
Off-road	Construction and Mining Equipment	15
Off-road	Industrial Equipment (Forklifts, Sweepers)	8
Off-road	Light Commercial (Generators, Pumps, Compressors)	4
Off-road	Oil Drilling (Drill Rigs, Lifts, Pumps, Generators)	20
Off-road	Portable Equipment	4
Off-road	Transportation Refrigeration Units	1
<b>Off Road Equipment Total</b>		<b>52</b>
Agriculture	Residue Burn	8,514
Agriculture	Enteric Fermentation	8,225
Agriculture	Manure Management	869
Agriculture	Farm Equipment	67,834
Agriculture	Agricultural Irrigation Pumps - Diesel	21,625
Agriculture	Pesticide	658
Agriculture	Fertilizer	146,983
Agriculture	Lime Application	291
Agriculture	Urea Fertilization	4,894
<b>Agriculture Total</b>		<b>259,894</b>
Stationary Sources	Oil and Gas Production	275,096
<b>Stationary Source Total</b>		<b>275,096</b>
<b>TOTAL</b>		<b>1,856,804</b>

Notes: Inventory excludes high GWP gases, such as refrigerants and sulfuryl fluoride. High-GWP gases are regulated exclusively by State and Federal agencies and are not within jurisdictional control of the County. Industrial Electricity excluded because data request did not meet sample size requirements of SCE's 5/25 Aggregation Rule.

**Demographics**

## Ventura County Greenhouse Gas Emissions Inventory - 2015

<b>Population</b>		2015 Source
County	850,491	Department of Finance
Incorporated	752,758	Department of Finance
Unincorporated	97,733	Department of Finance
Percent Unincorporated	11.49%	
<b>Jobs (Civilian)</b>		2015
County	319,588	Ventura County Background Report (p. 2-37)
Incorporated	286,699	Ventura County Background Report (p. 2-37)
Unincorporated	32,889	Ventura County Background Report (p. 2-37)
Percent Unincorporated	10.29%	
<b>Housing Units</b>		2015
County	273,286	Ventura County Background Report (p. 2-37)
Incorporated	241,095	Ventura County Background Report (p. 2-37)
Unincorporated	32,191	Ventura County Background Report (p. 2-37)
Percent Unincorporated	11.78%	

**Transportation**

Ventura County Greenhouse Gas Emissions Inventory - 2015

**Emissions Summary (MTCO<sub>2</sub>e)**

	2015
On-Road Transportation	690,207
Rail	2,490
Total	692,696

**On-Road Transportation Activity in 2015**

**Unincorporated County VMT**

VMT Calculations	Source	2015 Annual VMT
100% Internal, 50% I-E *	Adjusted from County-wide based on unincorporated VMT percentage	1,807,538,340
Urban Bus VMT**		120,450
Total Annual VMT		1,807,658,790

**County-wide VMT**

VMT Calculations	Source	2012 Average Daily VMT	2012 Annual VMT	2040 Average Daily VMT	2040 Annual VMT	2015 Annual VMT (Interpolated)
Internal-Internal	VCTC Model	10,746,259	3,922,384,526	11,731,596	4,282,032,422	3,960,918,229
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
Internal-External (unincorporated Ventura to north areas of Ventura County)	Calculated					25,050,315
50% Internal-External	Calculation (RTAC Method)					2,877,229,363
100% Internal, 50% I-E *	Calculation (RTAC Method)					6,838,147,592

\*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](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)
Daily VMT I-X/X-I Santa Barbara County - Entire Ventura County (SB/VC)**	62,920			74,342	68,631
Daily VMT I-X/X-I South and East Areas - Entire Ventura County (SE/VC)**		15,537,451		17,026,660	15,697,009
Ratio of SB/VC to SE/VC ***	Calculated				0.00437

\*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
<b>Total Unincorporated VMT (Boundary)</b>	<b>4,936,831</b>	
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
<b>Total Incorporated VMT (Boundary)</b>	<b>13,739,829</b>	
Percent Nonincorporated	26.4%	

**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	
	<b>2015</b>
Light Duty and Heavy Duty VMT	1,807,538,340
Bus VMT	120,450

VMT Distribution	
	<b>2015</b>
Light Duty	1,686,431,501
Heavy Duty	121,106,839
Buses	120,450

**EMFAC 2017 Weighted Vehicle Emission Factors for Ventura County**

gCO <sub>2</sub> /mi	
	<b>2015</b>
Light Duty	360
Heavy Duty	677
Buses	1,502

gCH <sub>4</sub> /mi	
	<b>2015</b>
Light Duty	0.011
Heavy Duty	0.019
Buses	1.622

gN <sub>2</sub> O/mi	
	<b>2015</b>
Light Duty	0.0001
Heavy Duty	0.0003
Buses	0.0039

gCO <sub>2</sub> e/mi	
	<b>2015</b>
Light Duty	361
Heavy Duty	677
Buses	1,544

**TOTAL On-Road Vehicle Emissions**

MTCO <sub>2</sub> e	
	<b>2015</b>
Light Duty	608,000
Heavy Duty	82,021
Buses	186

**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

## Building Energy

### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

#### Emissions Summary (MTCO2e)

	2015
Residential	158,456
Commercial	96,017
Industrial	14,960
Agricultural	49,787
<b>Total</b>	<b>319,220</b>

#### Building Energy Emissions in 2015

Energy Type (and Utility)	Energy Unit	Emission Factor per Energy Unit*	2015 MT CO2e
Electricity - SCE	kWh	MT/MWh	0.240
Natural Gas - So Cal Gas	Therm	MT/therm	0.006779
<b>County Average Electricity EF (g/kWh)</b>			<b>240.39</b>

\* See Assumptions Tab

Sector	Customer Type	Energy Type	Utility/Source	Energy Unit	2015 Annual Usage
Residential Energy	Residential	Electricity	SCE	kWh	262,750,031
Commercial Energy	Commercial	Electricity	SCE	kWh	118,867,785
Industrial Energy	Industrial	Electricity	SCE	kWh	-
Agricultural Energy	Agricultural	Electricity	SCE	kWh	207,106,250
Residential Energy	Residential	Natural Gas	SoCal Gas	Therms	14,056,995
Commercial Energy	Commercial	Natural Gas	SoCal Gas	Therms	9,948,602
Industrial Energy	Industrial	Natural Gas	SoCal Gas	Therms	2,206,808
<b>Total Electricity</b>				<b>kWh</b>	<b>588,724,066</b>
<b>Total Natural Gas</b>				<b>Therms</b>	<b>26,212,405</b>
				<b>PG&amp;E</b>	<b>0</b>
				<b>SCE</b>	<b>588,724,066</b>

Sector	Customer Type	Energy Type	Utility/Source	Energy Unit	2015 MT CO2e
Residential Energy	Residential	Electricity	SCE	kWh	63,164
Commercial Energy	Commercial	Electricity	SCE	kWh	28,575
Industrial Energy	Industrial	Electricity	SCE	kWh	-
Agricultural Energy	Agricultural	Electricity	SCE	kWh	49,787
Residential Energy	Residential	Natural Gas	SoCal Gas	Therms	95,292
Commercial Energy	Commercial	Natural Gas	SoCal Gas	Therms	67,442
Industrial Energy	Industrial	Natural Gas	SoCal Gas	Therms	14,960
<b>Total Electricity</b>				<b>kWh</b>	<b>141,526</b>
<b>Total Natural Gas</b>				<b>Therms</b>	<b>177,694</b>
<b>TOTAL</b>					<b>319,220</b>

Note: No propane usage is assumed because the number of SoCal Gas residential customers in 2015 (32,717) is more than the number of households in the unincorporated area according to the County's background report (32,191). This means there could be more than one natural gas bill sent to a household considered by the County (See the Demographics tab).

Source: Data requests from SoCal Gas and Southern California Edison for customers in the unincorporated County. Industrial electricity use was not available due to SCE's 5/25 rule that states that any industrial data provided by a utility must have more than 5 customers and no single customer's data accounts for more than 25 percent of total aggregated data.

**Off-Road Vehicles and Equipment**

Unincorporated Ventura County Greenhouse Gas Emissions Inventory

**Emissions Summary (MTCO2e)**

	<b>2015</b>
Offroad Emissions	860

**Offroad Emissions in 2015 for Unincorporated Ventura County**

	MT CO2	MT CH4	MT N2O	MT CO2e	Scaled to unincorporated area	% total GHG
ConstMin	14.626	0.003	0.001	15	Jobs	28.7%
Industrial	7.929	0.001	0.001	8	Jobs	16.1%
Light Commercial	3.298	0.004	0.001	4	Jobs	7.0%
Oil Drilling	20.212	0.002	0.001	20	All in	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%
<b>Total</b>	<b>50.626</b>	<b>0.013</b>	<b>0.003</b>	<b>52</b>		<b>100.0%</b>

Note: Agricultural equipment included under the Agriculture Sector

**OFFROAD 2017 outputs for 2015 for Entire Ventura County**

	Fuel Type	Fuel Use (gal/year)	Tons ROG/day	Tons TOG/day	Tons CO2/day	Tons CH4/day	Tons N2O/day	MT CO2e	Tons NOx/day (to calculate N2O)
AirGrSupp	Diesel	1,874	6.78E-05	8.07E-05	0.06	1.29E-05	1.88E-06	0.06	6.40E-04
AirGrSupp	Gasoline	11,067	2.63E-04	3.15E-04	0.27	5.17E-05	5.61E-05	0.32	1.35E-03
AirGrSupp	Nat Gas	1,241	0.00E+00	3.38E-06	0.02	3.38E-06	6.10E-06	0.03	1.47E-04
Commercial Harborcraft	Diesel	4,874,984	1.71E-01	2.03E-01	21.18	3.24E-02	4.88E-03	25.85	1.95E+00
Cargo Handling Equipment	Diesel	69,035	5.60E-04	6.66E-04	2.13	1.06E-04	6.91E-05	2.37	7.57E-03
ConstMin	Diesel	4,022,763	1.11E-01	1.33E-01	123.93	2.12E-02	4.03E-03	138.52	1.24E+00
ConstMin	Gasoline	309,600	4.59E-02	5.49E-02	5.00	9.02E-03	1.75E-03	6.34	4.22E-02
Industrial	Diesel	463,136	1.72E-02	2.05E-02	14.27	3.28E-03	4.64E-04	15.97	1.48E-01
Industrial	Gasoline	1,020,595	2.62E-02	3.14E-02	22.82	5.15E-03	4.34E-03	26.72	1.04E-01
Industrial	Nat Gas	1,815,674	0.00E+00	3.42E-03	32.81	3.42E-03	6.47E-03	38.38	1.55E-01
Light Commercial	Diesel	249,415	1.49E-02	1.80E-02	7.42	3.13E-03	2.50E-04	8.35	6.63E-02
Light Commercial	Gasoline	1,082,860	1.58E-01	1.89E-01	17.29	3.11E-02	5.71E-03	21.79	1.37E-01
Light Commercial	Nat Gas	239,429	0.00E+00	3.34E-04	4.36	3.34E-04	5.86E-04	5.01	1.41E-02
Locomotive	Diesel	-	3.44E-03	4.10E-03	0.00	6.55E-04	0.00E+00	0.02	7.08E-02
Military	Diesel	66,324	1.34E-03	1.62E-03	2.00	2.81E-04	6.64E-05	2.23	1.45E-02
Ocean Going Vessels	Diesel	14,249,266	7.53E-01	9.00E-01	451.29	1.47E-01	1.43E-02	506.20	1.35E+01
Oil Drilling	Diesel	594,860	1.17E-02	1.39E-02	18.34	2.22E-03	5.96E-04	20.47	1.33E-01
Portable Equipment	Diesel	981,997	2.17E-02	2.58E-02	30.27	4.13E-03	9.83E-04	33.80	2.59E-01
TRU	Diesel	4,074	3.75E-02	4.46E-02	6.42	7.12E-03	4.08E-06	7.27	3.61E-01
<b>Total</b>		<b>30,058,194</b>	<b>1.37</b>	<b>1.65</b>	<b>759.87</b>	<b>0.27</b>	<b>0.04</b>	<b>860</b>	<b>18.216</b>

Source: OFFROAD2017 (<https://www.arb.ca.gov/orion/>)

**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 ( <a href="http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-5/">http://www.dof.ca.gov/Forecasting/Demographics/Estimates/E-5/</a> )
Households	12%	Background Report
Jobs	10%	Background Report



**Solid Waste GHG Emissions**

Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

**Emissions Summary (MTCO2e)**

	2015
Waste Generation	30,864
Waste in Place	266,616
Total	297,480

**Solid Waste Emissions in 2015**

Source	MT CO2	MT CH4	MT N2O	MT CO2e
Waste Generation	0.00	1,235	0	30,864
Waste-in-Place	0.00	10,663	0	266,616
Total	0.00	11,897	0	297,480

**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		46	0.1%
Azusa Land Reclamation Co. Landfill	84		0%	0%	3		3		77	0.3%
Bakersfield Metropolitan (Bena) SLF	353		0%	0%	13		13		325	1.1%
Calabasas Landfill	3,160	2,597	3%	100%	53		53		1,324	4.3%
Chiquita Canyon Sanitary Landfill	5,954		5%	100%	55		55		1,369	4.4%
Commerce Refuse-To-Energy Facility			0%	100%	-		-		-	0.0%
El Sobrante Landfill	32		0%	100%	0		0		7	0.0%
Frank R. Bowerman Sanitary LF	23		0%	100%	0		0		5	0.0%
H.M. Holloway Inc.	27		0%	0%	1		1		25	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		21	0.1%
Simi Valley Landfill & Recycling Center	27,984	4,463	24%	100%	298		298		7,462	24.2%
Southeast Resource Recovery Facility			0%	0%	-		-		-	0.0%
Tajiguas Sanitary Landfill	94	34	0%	100%	1		1		29	0.1%
Toland Road Landfill	78,554	9,153	67%	100%	807		807		20,170	65.4%
<b>Total Ventura Unincorporated</b>	<b>116,403</b>	<b>16,252</b>			<b>1,235</b>		<b>1,235</b>		<b>30,864</b>	<b>100.0%</b>

Source: CalRecycle, EPA LMOP Database, US Community Protocol Equation SW.4.1

**Landfill Gas Collection Start Dates**

Landfill	LFG Project Start date	
Antelope Valley Public Landfill	1/1/2020	<-indicates planned but no current project. No start date indicated
Azusa Land Reclamation Co. Landfill	1/1/2020	<-indicates planned but no current project. No start date indicated
Bakersfield Metropolitan (Bena) SLF	6/30/2016	
Calabasas Landfill	10/1/2002	
Chiquita Canyon Sanitary Landfill	11/23/2010	
Commerce Refuse-To-Energy Facility	1/1/1981	Started in 1981. No date provided.
El Sobrante Landfill	4/1/2004	
Frank R. Bowerman Sanitary LF	12/8/2007	
H.M. Holloway Inc.	1/1/2020	<-supplier of ag gypsum
Lancaster Landfill and Recycling Center	1/1/2020	<-indicates no current project
Olinda Alpha Sanitary Landfill	6/28/2012	
Simi Valley Landfill & Recycling Center	4/1/2004	
Southeast Resource Recovery Facility	1/1/2020	project shut down in 1993
Tajiguas Sanitary Landfill	3/31/2000	
Toland Road Landfill	8/1/2004	

Source: EPA's LMOP database

**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	46,206	
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/der	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	284		2	49	
Phillip and Alice Lee Property	?	To Be Determined/	No	?	?					
Piru Dump	?	Closed/violation	No	?	1971					
Rockwell International - Old Area I LF	?	Closed (artillery fiel	No	1955	2005					
Rockwell International - Old Area II LF	?	Closed (artillery fiel	No	?	?					
Runway Landfill/Pt Mugu	?	Closed (electroplati	No	?	?					
Saticoy County 1962	?	Closed	Facility currently studying LFG potential	1946	1963					
Simi Valley Landfill	19966988	Open	Yes	1970	2024	489106.8904		6145	0.126	
Somis Dump	?	Closed/unpermitted	No	?	?					
Toland Road Landfill	7046886.846	Active	Yes	1970	2027	156597.4855		2668	0.028	
<b>TOTAL</b>							0	10,663	0	
<b>Total from Closed Landfills</b>	<b>23,120,108</b>						<b>0</b>	<b>10,663</b>	<b>0</b>	
			<b>Average year of closed LFs</b>	<b>1969</b>	<b>2022</b>				<b>266,616</b>	

\* 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 Facility Reports, 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.

Solid Waste: Additional Background Data and Assumptions & Methods

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 <sub>4</sub> emissions	= Community generated waste emissions from waste M (mtCO <sub>2</sub> e)	Result
GWP <sub>CH<sub>4</sub></sub>	= CH <sub>4</sub> global warming potential	
M	= Total mass of waste entering landfill (wet short ton)	User Input
P <sub>i</sub>	= Mass fraction of waste component i	User Input
EF <sub>i</sub>	= Emission factor for material i (mtCH <sub>4</sub> /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 <a href="http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw2008data.pdf">http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw2008data.pdf</a>		

Mixed MSW for Unincorporated Ventura County	0.041	CalRecycle Waste Characterization for Unincorporated Ventura County and WARM emission factors.
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**Solid Waste GHG Emissions**

## Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

Landfill	Methane (MT CH <sub>4</sub> )	N <sub>2</sub> O (MT N <sub>2</sub> O)	MT CO <sub>2</sub> e
Fugitive Landfill and LFG Combustion Emissions			
Toland Road Landfill	2,667.63	0.028	66,699
Sub Total	2,668		66,699
<b>TOTAL</b>	<b>2,668</b>	<b>0</b>	<b>66,699</b>

**GWP (AR4 factors)**

Methane (CH <sub>4</sub> )	25
Nitrous Oxide (N <sub>2</sub> O)	298

**Note**

Methane emissions are found in the MRR report under "Subpart HH" under "Methane Generation and Emission Values" as either the result of Methane Emissions Equation HH6 or HH8. They are reported as CO<sub>2</sub>e using AR4 GWP factors.

All other gases are combusted through landfill gas collection.

Uses recommended Reporting Approach using EPA's Mandatory Reporting Rule

No unincorporated waste was reported to be disposed at any of these sites.

Note that Ascent performed separate calculations of HH6 for the two landfills that resulted in slightly higher emissions than reported in EPA MRR. (e.g. 2060 MT CH<sub>4</sub> for American Canyon and 500 MT CH<sub>4</sub> for clover flat)

**Sources**

EPA Mandatory Reporting Rule (March 2015) (<http://ghgdata.epa.gov/ghgp/main.do>)

IPCC Fourth Assessment Report Factors used (Chapter 2. Table 2.14)

**Imported Water**

Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

**Emissions Summary (MTCO<sub>2</sub>e)**

	2015
Imported Water	5,002

**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	17,559,093	SCE	83%
SWP	3,598	236	848,951	CA Avg	4%
Surface Water	7,387	240	1,775,679	SCE	8%
Recycled Water	3,635	240	873,904	SCE	4%
<b>TOTAL</b>	87,663		21,057,628		
<b>TOTAL Local</b>	84,065		20,208,676		96%
<b>TOTAL Imported</b>	3,598		848,951		4%

Note: Private groundwater was not available from the Ventura County Water Agencies

**Electricity Emissions Factors (g/kWh)**

EF Source	2015
SCE	240.39
CA Avg	235.96

**Electricity Use (kWh)**

Source	2015
Groundwater	118,064,545
SWP	21,198,226
Surface Water	8,877,349
Recycled Water	331,407
<b>Total</b>	148,471,528

**GHG Emissions (MTCO<sub>2</sub>e)**

Source	EF Source	2015
Groundwater	SCE	28,382
SWP	CA Avg	5,002
Surface Water	SCE	2,134
Recycled Water	SCE	80
<b>TOTAL</b>		35,598
<b>TOTAL Local</b>		30,596
<b>TOTAL Imported</b>		5,002

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	Supply	Conveyance	Treatment	Distribution	Total Electricity Use	Emissions (MTCO2e)	
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
	<b>Surface Water Total</b>	<b>22,536</b>	<b>14,190</b>	<b>36,726</b>	<b>22,254</b>	<b>414</b>	<b>22,668</b>	<b>0</b>	<b>0</b>	<b>14</b>	<b>8,864</b>	<b>8,877</b>	<b>2,134</b>
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
	<b>Imported SWP Total</b>	<b>5,537</b>	<b>105,747</b>	<b>111,283</b>	<b>4,349</b>	<b>6,693</b>	<b>11,041</b>	<b>0</b>	<b>21,542</b>	<b>308</b>	<b>-651</b>	<b>21,198</b>	<b>4,899</b>
Groundwater	Casitas MWD				25	3	28	1	0	0	11	12	3
	Ojai GMA	3401	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
	<b>Groundwater Total</b>	<b>216,581</b>	<b>64,969</b>	<b>281,550</b>	<b>216,606</b>	<b>7,554</b>	<b>224,160</b>	<b>30,167</b>	<b>0</b>	<b>246</b>	<b>87,652</b>	<b>118,065</b>	<b>28,382</b>
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 0 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 CWRP 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
	<b>Recycled Water Total</b>	<b>10,672</b>	<b>5,078</b>	<b>15,751</b>	<b>10,672</b>	<b>484</b>	<b>11,156</b>	<b>0</b>	<b>0</b>	<b>331</b>		<b>331</b>	<b>80</b>
	<b>TOTAL</b>	<b>255,325</b>	<b>189,984</b>	<b>445,310</b>	<b>255,325</b>	<b>22,082</b>	<b>277,407</b>	<b>30,167</b>	<b>21,542</b>	<b>96,763</b>		<b>148,472</b>	<b>35,495</b>
		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 deliveries are assumed to use non-potable, untreated, 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 Desalination	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)	1.45	SWP-Bay Area	1,026			Flat Topography	proposed
Ocean Desalination	4,497	SWP-Central Coast	1,026			Moderate Topography	proposed
Brackish Water Desalination	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				

Source: CEC-500-2006-118

**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
Source: Metropolitan 2015 UWMP	



**Imported Water: Average Groundwater Depth in Ventura**

	Well Depth (ft)	Source
<b>County</b>		
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 Section Annual Report
UWCD	100.1	Appendix B of Ventura's 2013 Groundwater Section Annual Report
Private (unreported)	100	Assumed

## Wastewater

### Unincorporated 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

Source	MT CO2	MTCH4	MTN2O	MT CO2e
Septic Methane Emissions	0	202	0	5,043
WWTP Process Emissions	0	75	1	2,322
<b>Total</b>	0	277	1	7,365

#### Wastewater Emission Calculations

Wastewater Treatment Emissions					
Type of Treatment	WWTP Service by Percent of Unincorporated Population	Served Population	MT CH4*	MT N2O	Total CO <sub>2</sub> e Emissions (MT CO <sub>2</sub> e/yr)
Septic Tank Treatment	53%	51,613	202	0.00	5,043
Centralized Sewer Treatment	47%	46,120	75.08	1.50	2,322
<b>Total Septic</b>			202	0	5,043
<b>Total WWTP Process Emissions</b>			75	1	2,322
<b>Total</b>			277	1	7,365

\* 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 <sup>1</sup> )	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)
Camarillo Sanitary District	Camarillo WRP	7.25	40%	2.90	No	70,000 (population, city and unincorporated)
Ojai Valley Sanitary District	Ojai Valley WWTP	3	63%	1.88	No	20,000 (customers)
Saticoy Sanitary District	Jose Flores WWTP	0.25	100%	0.25	No	271
Triunfo Sanitation District	Tapia Water Reclamation Facility	16	21%	3.38	No	12,300
Camrosa Water District	Camrosa Water Reclamation Facility	1.5	100%	1.50	No	6,900
City of Oxnard	City of Oxnard WWTP	32.7	1%	0.48	Yes, with cogeneration	40,000
City of Simi Valley	Water Quality Control Plant	12.5	1%	0.16	No	40,000 (527 unincorporated)
City of Thousand Oaks	Hill Canyon Wastewater Treatment Plant	14	9%	1.22	Yes, with cogeneration	130,000 (population)
City of Ventura	Ventura Water reclamation facility	9	9%	0.80	No	N/A

Percent of Unincorporated Centralised WW treated aerobically 88%  
 Percent of Unincorporated Centralised WW treated anaerobically 12%

**Wastewater Calculation Methods**

*Emissions from Septic Systems* = A  
 =  $US_{\text{sew}} \times (\% \text{ onsite}) \times (EF_{\text{septic}}) \times 1/10^9 \times \text{Days}$

*Emissions from Centrally Treated Aerobic Systems* = B  
 =  $\{[(\% \text{ collected}) \times (\text{total BOD}_5 \text{ produced}) \times (\% \text{ aerobic}) \times (\% \text{ aerobic w/out primary}) + (\% \text{ collected}) \times (\text{total BOD}_5 \text{ produced}) \times (\% \text{ aerobic}) \times (\% \text{ aerobic w/primary}) \times (1 - \% \text{ BOD removed in prim. treat.})] \times (\% \text{ operations not well managed})\} \times (k_a) \times (\text{MCF-anaerobic\_not\_well\_man})$

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

*Emissions from Anaerobic Digesters* = D  
 =  $\{(\text{POTW\_flow\_AD}) \times (\text{digester gas}) / (\text{per capita flow})\} \times \text{conversion to m}^3 \times (\text{FRAC\_CH}_4) \times (365.25) \times (\text{density of CH}_4) \times (1 - \text{DE}) \times 1/10^9$

**Total CH<sub>4</sub> Emissions (kt) = A + B + C + D**

where,  
 US<sub>sew</sub> = 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<sub>septic</sub> = Methane emission factor (10.7 g CH<sub>4</sub>/capita/day) – septic systems  
 Days = days per year (365.25)  
 Total BOD<sub>5</sub> produced = kg BOD/capita/day × U.S. population × 365.25 days/yr  
 B<sub>a</sub> = Maximum CH<sub>4</sub>-producing capacity for domestic wastewater (0.60 kg CH<sub>4</sub>/kg BOD)  
 1/10<sup>9</sup> = Conversion factor, kg to kt  
 MCF-anaerobic\_not\_well\_man. = CH<sub>4</sub> correction factor for aerobic systems that are not well managed (0.3)  
 MCF-anaerobic = CH<sub>4</sub> correction factor for anaerobic systems (0.8)  
 DE = CH<sub>4</sub> 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 ft<sup>3</sup>/person/day)  
 per capita flow = Wastewater flow to POTW per person per day (100 gal/person/day)  
 conversion to m<sup>3</sup> = Conversion factor, ft<sup>3</sup> to m<sup>3</sup> (0.0283)  
 FRAC\_CH<sub>4</sub> = Proportion CH<sub>4</sub> in biogas (0.65)  
 density of CH<sub>4</sub> = 662 (g CH<sub>4</sub>/m<sup>3</sup> CH<sub>4</sub>)  
 1/10<sup>9</sup> = Conversion factor, g to kt

<b>Equation 10.2</b>	Stationary CH <sub>4</sub> from Incomplete Combustion of Digester Gas (default)
Annual CH <sub>4</sub> emissions (metric tons CO <sub>2</sub> e) =	
$(P \times \text{Digester Gas} \times F_{\text{CH}_4} \times \rho(\text{CH}_4) \times (1 - \text{DE}) \times 0.0283 \times 365.25 \times 10^{-5}) \times \text{GWP}$	

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	1.0
F <sub>CH<sub>4</sub></sub>	= fraction of CH <sub>4</sub> in biogas	0.65
ρ(CH <sub>4</sub> )	= density of methane [g/m <sup>3</sup> ]	662.00
DE	= CH <sub>4</sub> Destruction Efficiency	.99
0.0283	= conversion from ft <sup>3</sup> to m <sup>3</sup> [m <sup>3</sup> /ft <sup>3</sup> ]	0.0283
365.25	= conversion factor [day/year]	365.25
10 <sup>-5</sup>	= conversion from g to metric ton [metric ton/g]	10 <sup>-5</sup>
GWP	= Global Warming Potential	21

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

<b>Equation 10.4</b>	Process CH <sub>4</sub> from Wastewater Treatment Lagoons (default values)
Annual CH <sub>4</sub> emissions (metric tons CO <sub>2</sub> e) =	
$\{[(P \times F_{\text{ind-com}}) \times \text{BOD}_5 \text{ load} \times (1 - F_p) \times B_o \times \text{MCF}_{\text{anaerobic}} \times 365.25 \times 10^{-3}]\} \times \text{GWP}$	

Where:

Term	Description	Value
P	= population served by lagoons adjusted for industrial discharge, if applicable [person]	user input
F <sub>ind-com</sub>	= factor for industrial and commercial co-discharge waste into the sewer system	1.25
BOD <sub>5</sub> load	= amount of BOD <sub>5</sub> produced per person per day [kg BOD <sub>5</sub> /person/day]	0.090
F <sub>p</sub>	= fraction of BOD <sub>5</sub> removed in primary treatment, if present	0.325*
B <sub>o</sub>	= maximum CH <sub>4</sub> -producing capacity for domestic wastewater [kg CH <sub>4</sub> /kg BOD <sub>5</sub> removed]	0.6
MCF <sub>anaerobic</sub>	= CH <sub>4</sub> correction factor for anaerobic systems	0.8
365.25	= conversion factor [day/year]	365.25
10 <sup>-3</sup>	= conversion from kg to metric ton [metric ton/kg]	10 <sup>-3</sup>
GWP	= Global Warming Potential	21

Source: EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2007, Chapter 8, 8-9 (2009) except: \*F<sub>p</sub> Tchobanoglous, G., F.L. Burton, and H.D. Stensel, *Wastewater Engineering: Treatment and Reuse*, p. 396, 4th Edition (2003).

<b>Equation 10.7</b>	Process N <sub>2</sub> O Emissions from WWTP with Nitrification/Denitrification
Annual N <sub>2</sub> O emissions (metric tons CO <sub>2</sub> 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 <sub>total</sub>	= total population that is served by the centralized WWTP adjusted for industrial discharge, if applicable [person]	user input
F <sub>ind-com</sub>	= 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 <sub>2</sub> O/person/year]	7
10 <sup>-6</sup>	= conversion from g to metric ton [metric ton/g]	10 <sup>-6</sup>
GWP	= N <sub>2</sub> O Global Warming Potential	310

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

<b>Equation 10.10</b>	Process N <sub>2</sub> O Emissions from Effluent Discharge (default N load data)
Annual N <sub>2</sub> O emissions (metric tons CO <sub>2</sub> 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 <sub>total</sub>	= population served [person]	user input
F <sub>ind-com</sub>	= factor for industrial and commercial co-discharge waste into the sewer system	1.25
Total N Load <sup>27</sup>	= total nitrogen load [kg N/person/day]	0.026
N uptake <sup>28</sup>	= nitrogen uptake for cell growth in aerobic system (kg N/kg BOD <sub>5</sub> )	0.05 <sup>1</sup>
	= nitrogen uptake for cell growth in anaerobic system (e.g., lagoon) (kg N/kg BOD <sub>5</sub> )	0.005 <sup>1</sup>
BOD <sub>5</sub> load	= amount of BOD <sub>5</sub> produced per person per day [kg BOD <sub>5</sub> /person/day]	0.090
EF effluent	= emission factor [kg N <sub>2</sub> O-N/kg sewage-N produced]	0.005
44/28	= molecular weight ratio of N <sub>2</sub> O to N <sub>2</sub>	1.57
F plant nit/denit	= fraction of nitrogen removed for the centralized WWTP with nitrification/denitrification	0.7 <sup>1</sup>
	= fraction of nitrogen removed for the centralized WWTP w/o nitrification/denitrification	0.0 <sup>1</sup>
365.25	= conversion factor [day/year]	365.25
10 <sup>-3</sup>	= conversion from kg to metric ton [metric ton/kg]	10 <sup>-3</sup>
GWP	= Global Warming Potential	310

Source: EPA Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2007, Chapter 8, 8-13 (2009), except: <sup>1</sup> Grady, C. P. L., Jr., G. T. Daigger, and H. C. Lim, *Biological Wastewater Treatment*, p. 108-109, 644 2nd Edition (1999).

## Agriculture

### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

#### Agricultural Emissions in 2015

	MT CO2	MT CH4	MT N2O	MT CO2e	Scaled MTCO2e	% of total Ag
Residue Burn	7,928	8	1	8,514	8,514	3%
Enteric Fermentation	0	329	0	8,225	8,225	3%
Manure Management	0	16	2	869	869	0%
Farm Equipment	67,410	7	1	67,834	67,834	26%
Agricultural Irrigation Pumps - Diesel	22,257	0	0	22,257	21,625	9%
Pesticide	0	0	0	660	658	0%
Fertilizer	0	0	495	147,441	146,983	56%
Lime Application	294	0	0	294	291	0%
Urea Fertilization	4,941	0	0	4,941	4,894	2%
<b>Total</b>	<b>102,830</b>	<b>360</b>	<b>499</b>	<b>261,035</b>	<b>259,894</b>	<b>57%</b>

## Agricultural GHG Emissions - Summary

### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

Sector	MT CO <sub>2</sub>	MT CH <sub>4</sub>	MT N <sub>2</sub> O	MT CO <sub>2</sub> e/yr	Scaled MTCO <sub>2</sub> e/ % of total Ag
Residue Burn	7,928.13	7.70	1.32	8,514	8,514 3.3%
Enteric Fermentation	0.00	329.00	0.00	8,225	8,225 3.2%
Manure Management	0.00	15.73	1.60	869	869 0.3%
Farm Equipment	67,410.11	7.18	0.82	67,834	67,834 26.1%
Agricultural Irrigation Pumps - Diesel	22,257.17	0.00	0.00	22,257	21,625 8.3%
Pesticide	0.00	0.00	0.00	660	658 0.3%
Fertilizer	0.00	0.00	494.77	147,441	146,983 56.6%
Lime Application	293.98	0.00	0.00	294	291 0.1%
Urea Fertilization	4,940.87	0.00	0.00	4,941	4,894 1.9%
<b>Total</b>	<b>102830.27</b>	<b>359.61</b>	<b>498.51</b>	<b>261,035</b>	<b>259,894 100.0%</b>

### Notes

- 1) Pesticide and fertilizer data from 2014; scaled to 2015 by change in agriculture land use.
- 2) Lime and Urea data from 2012; scaled to 2015 by changes in agriculture land use.
- 3) Ag Pumps data from 2003; scaled to 2015 by changes in agriculture land use.

Greenhouse Gas	GWP
Methane (CH <sub>4</sub> )	25
Nitrous Oxide (N <sub>2</sub> O)	298

## Agricultural GHG Emissions - Residue Burning

### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

#### Summary Table from VCAPCD

Emission Source	Tons Material Burned	CO2 (tons/yr)	CH4 (tons/yr)	Total GHG (tons/yr)
Agricultural Burning	6,697.91	8,688.64	8.44	8,697.09
Prescribed Burning	31.19	50.54	0.04	50.58
Total Open Burning	6,729.10	8,739.18	8.48	8,747.66

#### Revised Summary Table Including GWP into Calculations

Emission Source	Tons Material Burned	CO2 (tons/yr)	CH4 (tons/yr)	N2O (tons/yr)	CO2 (MT/yr)	CH4 (MT/yr)	N2O (MT/yr)	Total GHG (MT/yr)
Agricultural Burning	6,697.91	8,688.64	8.44	1.45	7,882.29	7.66	1.32	8,465.77
Prescribed Burning	31.19	50.54	0.04	0.01	45.85	0.04	0.01	48.63
<b>Total</b>					<b>7,928.13</b>	<b>7.70</b>	<b>1.32</b>	<b>8,514.40</b>

#### Conversion Factor:

1 MT = 1.1023 ton (US)

Greenhouse Gas	GWP
Methane (CH <sub>4</sub> )	25
Nitrous Oxide (N <sub>2</sub> O)	298

#### Sources

IPCC 2007.

Email from VCAPCD (Chuck Thomas) to Ascent Environmental (Erik de Kok) on April 18, 2016.

### Agricultural GHG Emissions - Livestock

#### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

Livestock Type	2015	Enteric Fermentation			Manure Management						Emissions		
		Emission Factor (kg CH <sub>4</sub> /head-year)	MT CH <sub>4</sub> /year	MT CO <sub>2</sub> e/year	Emission Factor (kg CH <sub>4</sub> /head-year) <sup>2</sup>	MT CH <sub>4</sub> /year <sup>3</sup>	MT CO <sub>2</sub> e/year <sup>4</sup>	Emission Factor (kg N <sub>2</sub> O/head-year)	MT N <sub>2</sub> O/year	MT CO <sub>2</sub> e/year <sup>5</sup>	MT CH <sub>4</sub>	MT N <sub>2</sub> O	MT CO <sub>2</sub> e/year <sup>6</sup>
Beef Cattle	3,400	70.7	240	6,007	1.3	4	111	0.0	0.00	0	245	0	6,118
Dairy Cattle	0	93.0	0	0	156.7	0	0	1.5	0.00	0	0	0	0
Other Cattle	1,600	55.4	89	2,217	2.4	4	96	0.9	1.44	428	92	1	2,740
Lambs		8.00	0	0	0.8	0	0	0.0	0.00	0	0	0	0
Slaughter Sheep		8.00	0	0	0.8	0	0	0.01	0.00	0	0	0	0
Hogs	38	1.50	0	1	18.9	1	18	0.02	0.00	0	1	0	20
Chickens	50,871	0	0	0	0.133	7	169	0.003	0.16	48	7	0	216
<b>Total</b>			<b>329</b>	<b>8,225</b>		<b>16</b>	<b>393</b>		<b>1.60</b>	<b>476</b>	<b>345</b>	<b>2</b>	<b>9,094</b>

Greenhouse Gas	GWP
Methane (CH <sub>4</sub> )	25
Nitrous Oxide (N <sub>2</sub> O)	298

#### Cattle Population Calculation

Livestock Type	CASR 2015	2014 Crop Report Livestock	Adjusted Population Distribution
All Cattle (CWT only - From Crop Report)	21,030	21,030	
All Cattle (population - from CASR)	5,000	5,000	5,000
Beef Cattle	3,400	3,400	3,400
Dairy Cattle	-	-	-
Other Cattle	1,600		1,600

#### Enteric Fermentation Emission Factor Calculation

Livestock	State Total 2013	County Total 2013 (State categories calculated)	MMT CO <sub>2</sub> e from methane	kg CH <sub>4</sub> /head
<b>Dairy Cattle Total</b>	<b>3,533,836</b>	<b>0</b>	<b>0</b>	<b>93.05</b>
Dairy calves	920,353	-	0.2818	12.25
Dairy cows	1,780,000	-	6.6406	149.23
Dairy replacements 0-12 months	245,322	-	0.2810	45.82
Dairy replacements 12-24 months	588,161	-	1.0170	69.17
<b>Beef Cattle Total</b>	<b>1,020,156</b>	<b>3,400</b>	<b>3,400</b>	<b>70.67</b>
Beef calves	312,208	1,041	0.0882	11.30
Beef cows	620,000	2,066	1.5573	100.47
Beef replacements 0-12 months	26,135	87	0.0421	64.44
Beef replacements 12-24 months	61,813	206	0.1148	74.28
<b>Other Cattle Total</b>	<b>922,373</b>	<b>1,600</b>	<b>1,600</b>	<b>55.42</b>
Bulls	70,000	121	0.1818	103.89
Heifer feedlot	167,097	290	0.1803	43.16
Heifer stockers	104,021	180	0.1672	64.31
Steer feedlot	303,514	526	0.3187	42.00
Steer stockers	277,741	482	0.4298	61.90
Goats	141,000	245	0.0176	5.00
Horses	770,457	1,336	0.3467	18.00
Sheep	570,000	989	0.1140	8.00
Swine	105,000	182	0.0039	1.50



Sources:

[http://www.arb.ca.gov/cc/inventory/doc/methods\\_00-12/annex\\_3a\\_enteric\\_fermentation.pdf](http://www.arb.ca.gov/cc/inventory/doc/methods_00-12/annex_3a_enteric_fermentation.pdf)  
 2013 Query of ARB GHG Inventory ([http://www.arb.ca.gov/app/ghg/2000\\_2013/ghg\\_sector.php](http://www.arb.ca.gov/app/ghg/2000_2013/ghg_sector.php))

**Manure Management Emission Factor Calculation**

Sub Sector Level 2	Activity Subset	Sub Sector Level 3	State Total 2013	MMT CO2e from CH4	kg CH4/head	MMT CO2e from N2O	kg N2O/head
Cattle	Dairy cows	Anaerobic digester	21221	0.04	81.54	0.01	1.08
Cattle	Dairy cows	Anaerobic lagoon	1035710	8.71	336.42	0.33	1.08
Cattle	Dairy cows	Daily spread	187833	0.01	2.25	0.01	0.25
Cattle	Dairy cows	Deep pit	1843	0.01	149.42	0.00	1.09
Cattle	Dairy cows	Liquid/slurry	359444	1.34	149.42	0.20	1.90
Cattle	Dairy cows	Pasture	11948	0.00	6.75	0.00	0.00
Cattle	Dairy cows	Solid storage	162001	0.07	18.00	0.09	1.91
Cattle	Dairy heifers	Daily spread	90032	0.00	0.71	0.00	0.11
Cattle	Dairy heifers	Dry lot	728455	0.04	2.12	0.51	2.35
Cattle	Dairy heifers	Liquid/slurry	7285	0.01	46.87	0.00	0.83
Cattle	Dairy heifers	Pasture	7712	0.00	2.12	0.00	0.00
Cattle	Feedlot - heifers 500+ lbs	Dry lot	164953	0.01	2.21	0.09	1.91
Cattle	Feedlot - heifers 500+ lbs	Liquid/slurry	2144	0.00	60.04	0.00	0.64
Cattle	Feedlot - steers 500+ lbs	Dry lot	299619	0.02	2.15	0.17	1.96
Cattle	Feedlot - steers 500+ lbs	Liquid/slurry	2144	0.00	60.04	0.00	0.64
Cattle	Not on feed - beef cows	Pasture	620000	0.05	3.19	0.00	0.00
Cattle	Not on feed - bulls 500+ lbs	Pasture	70000	0.01	3.30	0.00	0.00
Cattle	Not on feed - calves <500 lbs	Pasture	1565936	0.02	0.56	0.00	0.00
Cattle	Not on feed - heifers 500+ lbs	Pasture	191969	0.01	2.05	0.00	0.00
Cattle	Not on feed - steers 500+ lbs	Pasture	277741	0.01	1.88	0.00	0.00
Other Livestock	Goats	Dry lot	10466	0.00	0.37	0.00	0.37
Other Livestock	Goats	Pasture	120357	0.00	0.37	0.00	0.00
Other Livestock	Horses	Dry lot	61637	0.01	3.29	0.02	1.34
Other Livestock	Horses	Pasture	708820	0.06	3.29	0.00	0.00
Other Livestock	Sheep	Dry lot	177270	0.00	0.70	0.02	0.40
Other Livestock	Sheep	Pasture	392730	0.01	0.70	0.00	0.00
Poultry	Broilers	Pasture	97055	0.00	0.02	0.00	0.00
Poultry	Broilers	Poultry with bedding	9608400	0.00	0.02	0.01	0.00
Poultry	Hens 1+ yr	Anaerobic lagoon	2411280	0.08	1.29	0.00	0.00
Poultry	Hens 1+ yr	Poultry without bedding	17682720	0.01	0.03	0.02	0.00
Poultry	Other chickens	Anaerobic lagoon	1200	0.00	1.39	0.00	0.01
Poultry	Other chickens	Poultry without bedding	8800	0.00	0.03	0.00	0.01
Poultry	Pullets	Anaerobic lagoon	529200	0.02	1.29	0.00	0.00
Poultry	Pullets	Poultry without bedding	3880800	0.00	0.03	0.00	0.00
Poultry	Turkeys	Pasture	51667	0.00	0.08	0.00	0.00
Poultry	Turkeys	Poultry with bedding	5115000	0.01	0.08	0.01	0.01
Swine	Swine - breeding	Anaerobic digester	0	0.00	#DIV/0!	0.00	#DIV/0!
Swine	Swine - breeding	Anaerobic lagoon	2506	0.00	46.08	0.00	0.13
Swine	Swine - breeding	Deep pit	1467	0.00	19.40	0.00	0.12
Swine	Swine - breeding	Liquid/slurry	350	0.00	19.41	0.00	0.18
Swine	Swine - breeding	Pasture	507	0.00	0.63	0.00	0.00
Swine	Swine - breeding	Solid storage	169	0.00	1.26	0.00	0.22
Swine	Swine - market < 50 lbs	Anaerobic digester	0	0.00	#DIV/0!	0.00	#DIV/0!
Swine	Swine - market < 50 lbs	Anaerobic lagoon	14034	0.00	9.72	0.00	0.04
Swine	Swine - market < 50 lbs	Deep pit	8215	0.00	4.09	0.00	0.04
Swine	Swine - market < 50 lbs	Liquid/slurry	1961	0.00	4.09	0.00	0.05
Swine	Swine - market < 50 lbs	Pasture	2841	0.00	0.13	0.00	0.00
Swine	Swine - market < 50 lbs	Solid storage	949	0.00	0.27	0.00	0.07
Swine	Swine - market 120-179 lbs	Anaerobic digester	0	0.00	#DIV/0!	0.00	#DIV/0!
Swine	Swine - market 120-179 lbs	Anaerobic lagoon	11528	0.01	31.12	0.00	0.12
Swine	Swine - market 120-179 lbs	Deep pit	6748	0.00	13.08	0.00	0.11
Swine	Swine - market 120-179 lbs	Liquid/slurry	1611	0.00	13.08	0.00	0.16
Swine	Swine - market 120-179 lbs	Pasture	2334	0.00	0.43	0.00	0.00

Swine	Swine - market 120-179 lbs	Solid storage	780	0.00	0.85	0.00	0.20
Swine	Swine - market 180+ lbs	Anaerobic digester	0	0.00	#DIV/0!	0.00	#DIV/0!
Swine	Swine - market 180+ lbs	Anaerobic lagoon	12029	0.01	41.65	0.00	0.16
Swine	Swine - market 180+ lbs	Deep pit	7041	0.00	17.50	0.00	0.15
Swine	Swine - market 180+ lbs	Liquid/slurry	1681	0.00	17.50	0.00	0.22
Swine	Swine - market 180+ lbs	Pasture	2435	0.00	0.57	0.00	0.00
Swine	Swine - market 180+ lbs	Solid storage	814	0.00	1.14	0.00	0.27
Swine	Swine - market 50-119 lbs	Anaerobic digester	0	0.00	#DIV/0!	0.00	#DIV/0!
Swine	Swine - market 50-119 lbs	Anaerobic lagoon	12531	0.01	17.90	0.00	0.07
Swine	Swine - market 50-119 lbs	Deep pit	7334	0.00	7.52	0.00	0.07
Swine	Swine - market 50-119 lbs	Liquid/slurry	1751	0.00	7.52	0.00	0.09
Swine	Swine - market 50-119 lbs	Pasture	2537	0.00	0.24	0.00	0.00
Swine	Swine - market 50-119 lbs	Solid storage	847	0.00	0.49	0.00	0.11

## Sources:

[http://www.arb.ca.gov/cc/inventory/doc/methods\\_00-12/annex\\_3b\\_manure\\_management.pdf](http://www.arb.ca.gov/cc/inventory/doc/methods_00-12/annex_3b_manure_management.pdf)

2013 Query of ARB GHG Inventory ([http://www.arb.ca.gov/app/ghg/2000\\_2013/ghg\\_sector.php](http://www.arb.ca.gov/app/ghg/2000_2013/ghg_sector.php))

## Sources

Ventura 2015.

Bureau of Labor Statistics 2016

CDFA 2015.

USDA 2012, 2015, 2016

IPCC 2007.

National Chicken Council 2015

### Agricultural GHG Emissions - Agricultural Equipment

#### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

Countywide Emissions	Carbon Dioxide (CO <sub>2</sub> )	Methane (CH <sub>4</sub> )	Nitrous Oxide (N <sub>2</sub> O)	CO <sub>2</sub> e
Emissions (tons/day)	204	0.02	0.00	205
Emissions (MT/yr)	67,410	7	1	<b>67,834</b>

**Notes**

- 1) OFFROAD2007 model outputs do not account for impacts from the recessions in 2007-2011. Newer models, however, are incomplete. ARB recommends using OFFROAD 2007 where data is not available in newer offroad models.
- 2) Assumes all agricultural equipment is operated in the unincorporated county.

**Sources**

ARB 2007.  
 IPCC 2007.

Greenhouse Gas	GWP
Methane (CH <sub>4</sub> )	25
Nitrous Oxide (N <sub>2</sub> O)	298

CY	Season	AvgDays	Code	Equipment	Fuel	MaxHP	Class	C/R	Pre	Hand	Port	County	CO2 Exhaust	N2O Exhaust	CH4 Exhaust
2015	Annual	Mon-Sun	2265005010	2-Wheel Tractors	G4	5	Agricultura U		P	NHH	NP	Ventura	1.46E-02	2.16E-05	2.00E-05
2015	Annual	Mon-Sun	2265005010	2-Wheel Tractors	G4	15	Agricultura U		P	NHH	NP	Ventura	7.04E-02	7.77E-05	6.17E-05
2015	Annual	Mon-Sun	2265005010	2-Wheel Tractors	G4	25	Agricultura U		P	NHH	NP	Ventura	3.78E-03	2.89E-06	3.50E-06
2015	Annual	Mon-Sun	2265005015	Agricultural Tractors	G4	120	Agricultura U		P	NHH	NP	Ventura	7.12E-01	1.45E-04	1.27E-04
2015	Annual	Mon-Sun	2265005015	Agricultural Tractors	G4	175	Agricultura U		P	NHH	NP	Ventura	1.45E-01	2.66E-05	1.25E-05
2015	Annual	Mon-Sun	2265005020	Combines	G4	120	Agricultura U		P	NHH	NP	Ventura	6.07E-02	4.70E-06	2.16E-06
2015	Annual	Mon-Sun	2265005020	Combines	G4	175	Agricultura U		P	NHH	NP	Ventura	5.23E-02	3.49E-06	1.25E-06
2015	Annual	Mon-Sun	2265005020	Combines	G4	250	Agricultura U		N	NHH	NP	Ventura	1.11E-02	1.03E-06	2.27E-07
2015	Annual	Mon-Sun	2265005025	Balers	G4	50	Agricultura U		P	NHH	NP	Ventura	1.23E-01	3.30E-05	1.98E-05
2015	Annual	Mon-Sun	2265005025	Balers	G4	120	Agricultura U		P	NHH	NP	Ventura	1.14E-01	2.51E-05	1.15E-05
2015	Annual	Mon-Sun	2265005030	Agricultural Mowers	G4	15	Agricultura U		P	NHH	NP	Ventura	2.64E-02	3.27E-05	2.35E-05
2015	Annual	Mon-Sun	2265005030	Agricultural Mowers	G4	25	Agricultura U		P	NHH	NP	Ventura	4.85E-02	3.94E-05	4.53E-05
2015	Annual	Mon-Sun	2265005035	Sprayers	G4	5	Agricultura U		P	NHH	NP	Ventura	2.84E-02	4.61E-05	3.83E-05
2015	Annual	Mon-Sun	2265005035	Sprayers	G4	15	Agricultura U		P	NHH	NP	Ventura	1.54E-02	1.89E-05	1.77E-05
2015	Annual	Mon-Sun	2265005035	Sprayers	G4	25	Agricultura U		P	NHH	NP	Ventura	9.70E-02	7.43E-05	1.08E-04
2015	Annual	Mon-Sun	2265005035	Sprayers	G4	50	Agricultura U		P	NHH	NP	Ventura	2.34E-02	6.76E-06	3.84E-06
2015	Annual	Mon-Sun	2265005035	Sprayers	G4	120	Agricultura U		P	NHH	NP	Ventura	8.02E-02	1.80E-05	8.25E-06
2015	Annual	Mon-Sun	2265005035	Sprayers	G4	175	Agricultura U		P	NHH	NP	Ventura	3.62E-02	6.29E-06	2.21E-06
2015	Annual	Mon-Sun	2265005040	Tillers	G4	15	Agricultura U		N	NHH	NP	Ventura	1.74E+00	1.63E-03	1.48E-03
2015	Annual	Mon-Sun	2265005045	Swathers	G4	120	Agricultura U		P	NHH	NP	Ventura	4.14E-01	8.14E-05	4.36E-05
2015	Annual	Mon-Sun	2265005045	Swathers	G4	175	Agricultura U		P	NHH	NP	Ventura	4.53E-01	8.05E-05	2.80E-05
2015	Annual	Mon-Sun	2265005050	Hydro Power Units	G4	5	Agricultura U		P	NHH	NP	Ventura	4.27E-03	6.02E-06	5.92E-06
2015	Annual	Mon-Sun	2265005050	Hydro Power Units	G4	15	Agricultura U		P	NHH	NP	Ventura	3.62E-02	4.26E-05	3.27E-05
2015	Annual	Mon-Sun	2265005050	Hydro Power Units	G4	25	Agricultura U		P	NHH	NP	Ventura	2.93E-02	2.33E-05	2.80E-05
2015	Annual	Mon-Sun	2265005050	Hydro Power Units	G4	50	Agricultura U		P	NHH	NP	Ventura	8.44E-03	1.36E-06	6.39E-07
2015	Annual	Mon-Sun	2265005050	Hydro Power Units	G4	120	Agricultura U		P	NHH	NP	Ventura	1.81E-03	1.68E-07	4.83E-08
2015	Annual	Mon-Sun	2265005055	Other Agricultural Equipr	G4	5	Agricultura U		P	NHH	NP	Ventura	1.94E-03	3.01E-06	2.61E-06
2015	Annual	Mon-Sun	2265005055	Other Agricultural Equipr	G4	15	Agricultura U		P	NHH	NP	Ventura	4.24E-03	4.40E-06	3.84E-06
2015	Annual	Mon-Sun	2265005055	Other Agricultural Equipr	G4	25	Agricultura U		P	NHH	NP	Ventura	2.70E-03	1.75E-06	2.55E-06
2015	Annual	Mon-Sun	2265005055	Other Agricultural Equipr	G4	50	Agricultura U		P	NHH	NP	Ventura	5.78E-03	1.44E-06	7.44E-07
2015	Annual	Mon-Sun	2265005055	Other Agricultural Equipr	G4	120	Agricultura U		P	NHH	NP	Ventura	7.64E-02	1.27E-05	5.68E-06
2015	Annual	Mon-Sun	2265005055	Other Agricultural Equipr	G4	175	Agricultura U		P	NHH	NP	Ventura	1.72E-02	2.23E-06	7.67E-07
2015	Annual	Mon-Sun	2265005055	Other Agricultural Equipr	G4	250	Agricultura U		N	NHH	NP	Ventura	1.12E-02	1.29E-06	4.13E-07
2015	Annual	Mon-Sun	2270005015	Agricultural Tractors	D	15	Agricultura U		P	NHH	NP	Ventura	2.53E+00	0.00E+00	2.65E-04
2015	Annual	Mon-Sun	2270005015	Agricultural Tractors	D	25	Agricultura U		P	NHH	NP	Ventura	5.97E+00	0.00E+00	6.50E-04

2015 Annual	Mon-Sun	2270005015	Agricultural Tractors	D	50	Agricultura U	P	NHH	NP	Ventura	2.11E+01	0.00E+00	5.15E-03
2015 Annual	Mon-Sun	2270005015	Agricultural Tractors	D	120	Agricultura U	P	NHH	NP	Ventura	5.19E+01	0.00E+00	5.91E-03
2015 Annual	Mon-Sun	2270005015	Agricultural Tractors	D	175	Agricultura U	P	NHH	NP	Ventura	5.00E+01	0.00E+00	3.90E-03
2015 Annual	Mon-Sun	2270005015	Agricultural Tractors	D	250	Agricultura U	N	NHH	NP	Ventura	4.62E+01	0.00E+00	2.42E-03
2015 Annual	Mon-Sun	2270005015	Agricultural Tractors	D	500	Agricultura U	N	NHH	NP	Ventura	1.50E+01	0.00E+00	7.17E-04
2015 Annual	Mon-Sun	2270005020	Combines	D	120	Agricultura U	P	NHH	NP	Ventura	4.50E-01	0.00E+00	4.10E-05
2015 Annual	Mon-Sun	2270005020	Combines	D	175	Agricultura U	P	NHH	NP	Ventura	8.78E-01	0.00E+00	5.35E-05
2015 Annual	Mon-Sun	2270005020	Combines	D	250	Agricultura U	N	NHH	NP	Ventura	1.32E+00	0.00E+00	5.27E-05
2015 Annual	Mon-Sun	2270005020	Combines	D	500	Agricultura U	N	NHH	NP	Ventura	7.26E-02	0.00E+00	2.59E-06
2015 Annual	Mon-Sun	2270005025	Balers	D	50	Agricultura U	P	NHH	NP	Ventura	2.07E-04	0.00E+00	3.01E-08
2015 Annual	Mon-Sun	2270005025	Balers	D	120	Agricultura U	P	NHH	NP	Ventura	2.18E-01	0.00E+00	1.90E-05
2015 Annual	Mon-Sun	2270005030	Agricultural Mowers	D	120	Agricultura U	P	NHH	NP	Ventura	2.51E-02	0.00E+00	2.67E-06
2015 Annual	Mon-Sun	2270005035	Sprayers	D	25	Agricultura U	P	NHH	NP	Ventura	1.22E-02	0.00E+00	1.78E-06
2015 Annual	Mon-Sun	2270005035	Sprayers	D	50	Agricultura U	P	NHH	NP	Ventura	4.26E-03	0.00E+00	6.13E-07
2015 Annual	Mon-Sun	2270005035	Sprayers	D	120	Agricultura U	P	NHH	NP	Ventura	1.03E-01	0.00E+00	8.94E-06
2015 Annual	Mon-Sun	2270005035	Sprayers	D	175	Agricultura U	P	NHH	NP	Ventura	7.19E-02	0.00E+00	4.15E-06
2015 Annual	Mon-Sun	2270005035	Sprayers	D	250	Agricultura U	N	NHH	NP	Ventura	7.37E-02	0.00E+00	2.77E-06
2015 Annual	Mon-Sun	2270005035	Sprayers	D	500	Agricultura U	N	NHH	NP	Ventura	1.37E-02	0.00E+00	4.58E-07
2015 Annual	Mon-Sun	2270005040	Tillers	D	15	Agricultura U	N	NHH	NP	Ventura	3.77E-04	0.00E+00	3.53E-08
2015 Annual	Mon-Sun	2270005040	Tillers	D	250	Agricultura U	N	NHH	NP	Ventura	1.23E-03	0.00E+00	5.03E-08
2015 Annual	Mon-Sun	2270005040	Tillers	D	500	Agricultura U	N	NHH	NP	Ventura	6.60E-03	0.00E+00	2.41E-07
2015 Annual	Mon-Sun	2270005045	Swathers	D	120	Agricultura U	P	NHH	NP	Ventura	1.35E+00	0.00E+00	1.19E-04
2015 Annual	Mon-Sun	2270005045	Swathers	D	175	Agricultura U	P	NHH	NP	Ventura	2.32E-02	0.00E+00	1.36E-06
2015 Annual	Mon-Sun	2270005050	Hydro Power Units	D	15	Agricultura U	P	NHH	NP	Ventura	8.51E-03	0.00E+00	8.93E-07
2015 Annual	Mon-Sun	2270005050	Hydro Power Units	D	25	Agricultura U	P	NHH	NP	Ventura	4.88E-02	0.00E+00	5.31E-06
2015 Annual	Mon-Sun	2270005050	Hydro Power Units	D	50	Agricultura U	P	NHH	NP	Ventura	9.76E-02	0.00E+00	2.92E-05
2015 Annual	Mon-Sun	2270005050	Hydro Power Units	D	120	Agricultura U	P	NHH	NP	Ventura	1.79E-02	0.00E+00	2.34E-06
2015 Annual	Mon-Sun	2270005055	Other Agricultural Equipr	D	15	Agricultura U	P	NHH	NP	Ventura	2.17E-02	0.00E+00	2.28E-06
2015 Annual	Mon-Sun	2270005055	Other Agricultural Equipr	D	25	Agricultura U	P	NHH	NP	Ventura	1.11E-01	0.00E+00	1.31E-05
2015 Annual	Mon-Sun	2270005055	Other Agricultural Equipr	D	50	Agricultura U	P	NHH	NP	Ventura	1.51E-01	0.00E+00	3.32E-05
2015 Annual	Mon-Sun	2270005055	Other Agricultural Equipr	D	120	Agricultura U	P	NHH	NP	Ventura	1.02E+00	0.00E+00	1.09E-04
2015 Annual	Mon-Sun	2270005055	Other Agricultural Equipr	D	175	Agricultura U	P	NHH	NP	Ventura	1.53E-01	0.00E+00	1.12E-05
2015 Annual	Mon-Sun	2270005055	Other Agricultural Equipr	D	250	Agricultura U	N	NHH	NP	Ventura	2.22E-01	0.00E+00	1.09E-05
2015 Annual	Mon-Sun	2270005055	Other Agricultural Equipr	D	500	Agricultura U	N	NHH	NP	Ventura	7.71E-02	0.00E+00	3.42E-06
<b>TOTAL</b>											<b>203.57853477</b>	<b>0.00247876</b>	<b>0.02168882</b>

## Agricultural GHG Emissions - Fertilizer Application

### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

Nitrogen Applied in Fertilizer (tons)	Nitrogen Applied (grams)	Nitrogen Emitted As				
		N <sub>2</sub> O (g/g)	MT CO <sub>2</sub>	MT CH <sub>4</sub>	MT N <sub>2</sub> O	MT CO <sub>2</sub> e/yr
<b>43,631.000</b>	39,581,377,391	494,767,217			494.767	<b>147,441</b>

Factor	Value
Nitrogen Volatilization (g/g)	<b>0.0125</b>
Nitrous Oxide (N <sub>2</sub> O) GWP	<b>298</b>

### Sources

CDFA 2015 Tonnage Report ([https://www.cdfa.ca.gov/is/ffldrs/Fertilizer\\_Tonnage.html](https://www.cdfa.ca.gov/is/ffldrs/Fertilizer_Tonnage.html)) (All Nitrogen)

IPCC 2007.

## Agricultural Pumps

### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

# Diesel Pumps in Ventura County	BAAQMI	MT CO2	MT CH4	MT N2O	Total Emissions (MT CO2e/yr)
335	0.2007	22257.17			22257.17012
<b>Total</b>		<b>22257.17</b>	<b>0</b>	<b>0</b>	<b>22257.1701</b>

#### Sources

ARB 2003.

ARB 2006.

## Agricultural GHG Emissions - Pesticide Application

### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

Year	Pesticide (Chemical Name)	Commodity Application lbs/yr	lbs/MT Conversion Factor	GWP	MT CO2e/yr	Agricultural Applications	Notes
2014	METHYL BROMIDE (CH3Br)	290,922.86	0.000454	5	660	87	
2014	Sulfuryl Fluoride (SO2F2)	95,086.34	0.000454	4,090	176,403	0	Non-Ag (household pesticide)
2014	Methylene Chloride	0.25	0.000454	9	0	0	Structural Pest Control
2014	Trifluorochloromethane (CCl3F) (CFC-11)	0.45	0.000454	4,660	1	0	Structural Pest Control

#### Sources

CDPR 2015.

IPCC 2013.

## Agricultural GHG Emissions - Liming

### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

Category	Value	Units	Source
mass of lime sold in Ventura County	737	tons/year	CDFA 2013. See Note 1.
mass conversion rate	1.1023	ton/MT	conversion calculation
mass of lime sold in Ventura County	669	MT/year	conversion calculation
emission factor	0.12	MT C/MT lime	IPCC 2006: p. 11.32, Equation 11.13
mass of carbon emitted	80	MT/year	Calculation based on IPCC 2006: p. 11.27, Equation 11.12
molecular mass of CO <sub>2</sub>	44.01	g/mol	IPCC 2006: p. 11.32, Equation 11.13
atomic mass of C	12.011	g/mol	periodic table
molecular mass ratio	3.664	unitless	ratio calculation
Emissions of CO <sub>2</sub>	293.98	MT/year	Calculation based on IPCC 2006: p. 11.27, Equation 11.12

#### Notes

1) It is assumed that the quantity of lime used in the County is equivalent to the quantity sold in the County.

#### Sources

CDFA 2013.

IPCC 2006.



## Agricultural GHG Emissions - Urea

### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

Category	Value	Units	Source
mass of urea sold in Ventura County	7,432	tons/year	CDFA 2013. See Note 1.
mass conversion rate	1.1023	ton/MT	conversion calculation
mass of urea sold in Ventura County	6,742	MT/year	conversion calculation
emission factor	0.20	MT C/MT urea	IPCC 2006: p. 11.32, Equation 11.13
mass of carbon emitted	1,348	MT/year	Calculation based on IPCC 2006: p. 11.32, Equation 11.13
molecular mass of CO <sub>2</sub>	44.01	g/mol	IPCC 2006: p. 11.32, Equation 11.13
atomic mass of C	12.011	g/mol	periodic table
molecular mass ratio	3.664	unitless	ratio calculation
Emissions of CO <sub>2</sub>	4,941	MT/year	Calculation based on IPCC 2006: p. 11.32, Equation 11.13

#### Notes

1) It is assumed that the quantity of urea used in the County is equivalent to the quantity sold in the County.

#### Sources

CDFA 2013.

IPCC 2006.

## Agriculture References

### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

Citation	Source
ARB 2003.	California Air Resources Board. 2003. Fuel Consumption Methodologies for Agricultural Irrigation Engines (category 052-042-1200-0000). Available: <a href="http://www.arb.ca.gov/ei/areasrc/FULLPDF/FULL1-1.pdf">http://www.arb.ca.gov/ei/areasrc/FULLPDF/FULL1-1.pdf</a> . Accessed April 13, 2016.
ARB 2006.	California Air Resources Board. 2006. Rulemaking to Consider Proposed Amendments to the Stationary Diesel Engine Control Measure - Appendix D: Emission Inventory Methodology Agricultural Irrigation Pumps - Diesel. Available:
ARB 2007.	California Air Resources Board. 2007. OffRoad Database. Annual Agriculture Equipment in Ventura County for 2014.
ARB 2014.	California Air Resources Board. 2014 (May). California's 2000-2012 Greenhouse Gas Emissions Inventory: Technical Support Document. Available: <a href="http://www.arb.ca.gov/cc/inventory/doc/methods_00-12/ghg_inventory_00-12_technical_support_document.pdf">http://www.arb.ca.gov/cc/inventory/doc/methods_00-12/ghg_inventory_00-12_technical_support_document.pdf</a> . Accessed April 12, 2016.
CDFA 2013.	California Department of Food and Agriculture. 2013. Fertilizing Materials Tonnage Report: January - June 2012. Sacramento, CA. Available: <a href="https://www.cdfa.ca.gov/is/ffldrs/pdfs/2012_Tonnage.pdf">https://www.cdfa.ca.gov/is/ffldrs/pdfs/2012_Tonnage.pdf</a> . Accessed April 12, 2016.
CDPR 2015.	California Department of Pesticide Regulation. 2014. Annual Pesticide Use Report Indexed by Chemical: Ventura County. Available: <a href="http://www.cdpr.ca.gov/docs/pur/purmain.htm">http://www.cdpr.ca.gov/docs/pur/purmain.htm</a> . Accessed April 12, 2016.
IPCC 2006.	Intergovernmental Panel on Climate Change. 2006. Chapter 11: N2O Emissions from Managed Soils, and CO2 Emissions from Lime and Urea Application. Volume 4: Agriculture, Forestry and Other Land Use. Guidelines for National Greenhouse Gas Inventories.
IPCC 2007.	Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. New York: Cambridge University Press. Available: <a href="http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml">http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml</a> . Accessed April 13, 2016.
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Ventura 2015.	Ventura County. 2015 (November). Crop & Livestock Report 2014: Resilience During Drought. Camarillo, CA: Office of the Agricultural Commissioner. Available: <a href="http://vcportal.ventura.org/AgComm/docs/crop-reports/Ag%20Crop%20Report%202014%20v11%2011%2009%2015.pdf">http://vcportal.ventura.org/AgComm/docs/crop-reports/Ag%20Crop%20Report%202014%20v11%2011%2009%2015.pdf</a> . Accessed April 12, 2016.
ARB 2008.	See Residue Burn. Find source and cite.

ARB 2015.	California Air Resources Board. 2015 (June). California's 2000-2013 Greenhouse Gas Emissions Inventory: Method Updates Since 2014 Edition of the Inventory. Available: <a href="http://www.arb.ca.gov/cc/inventory/doc/methods_00-13/2013_ei_method_update.pdf">http://www.arb.ca.gov/cc/inventory/doc/methods_00-13/2013_ei_method_update.pdf</a> . Accessed April 12, 2016.
USDA 2016.	United States Department of Agriculture. 2016 (April). Livestock Slaughter 2015 Summary. Washington, D.C.: National Agricultural Statistics Service. Available: <a href="http://usda.mannlib.cornell.edu/usda/current/LiveSlauSu/LiveSlauSu-04-20-2016.pdf">http://usda.mannlib.cornell.edu/usda/current/LiveSlauSu/LiveSlauSu-04-20-2016.pdf</a> . Accessed April 22, 2016.
CDFA 2015.	California Department of Food and Agriculture. 2015. <i>California Agricultural Statistics Review, 2014-2015</i> . Sacramento, CA. Available: <a href="https://www.cdfa.ca.gov/Statistics/PDFs/2015Report.pdf">https://www.cdfa.ca.gov/Statistics/PDFs/2015Report.pdf</a> . Accessed April 12, 2016.
Bureau of Labor Stat	<a href="http://data.bls.gov/timeseries/APU0000706111?data_tool=XGtable">http://data.bls.gov/timeseries/APU0000706111?data_tool=XGtable</a>
National Chicken Co	<a href="http://www.nationalchickencouncil.org/about-the-industry/statistics/u-s-broiler-performance/">http://www.nationalchickencouncil.org/about-the-industry/statistics/u-s-broiler-performance/</a>
USDA 2012	<a href="https://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/California/cp06111.pdf">https://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/California/cp06111.pdf</a>
USDA 2015	<a href="http://www.usda.gov/nass/PUBS/TODAYRPT/lSan0415.pdf">http://www.usda.gov/nass/PUBS/TODAYRPT/lSan0415.pdf</a>

## Agriculture Land Use Changes

### Unincorporated Ventura County Greenhouse Gas Emissions Inventory - 2015

Land Use	2003	2012	2014	2015	% Change 2003 to 2015	% Change 2012 to 2015	% Change 2014 to 2015	Scaling Factor 2003 to 2015	Scaling Factor 2012 to 2015	Scaling Factor 2014 to 2015
<b>Important Farmland St</b>	124,360	118,800	121,210	120,923	-2.84%	1.76%	-0.24%	0.9716	1.0176	0.9976
<b>Grazing Land</b>	200,982	197,866	193,428	192,742	-4.28%	-2.66%	-0.36%	0.9572	0.9734	0.9964
<b>All farmland (total)</b>	325,342	316,666	314,638	313,665	-3.72%	-0.96%	-0.31%	0.9628	0.9904	0.9969

#### Sources

FMMP\_Ventura\_LandUse.xls

**Stationary Sources**

Unincorporated 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
<b>Total</b>		<b>194,939</b>	<b>3,203</b>	<b>0</b>	<b>275,096</b>

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	77.85	0.0%	N2O
Fuel combustion	Associated gas	Associated Gas (Mcf)	5%	1.70E-01	170,161	170,161.45	61.9%	CO2
Fuel combustion	Associated gas	Associated Gas (Mcf)	5%	2.61E-06	2.61	65.31	0.0%	CH4
Fuel combustion	Distillate	Oil Produced (bbls)**	4%	1.85E-07	0	4.63	0.0%	CH4
Fuel combustion	Distillate	Oil Produced (bbls)**	4%	4.57E-03	4,567.58	4,567.58	1.7%	CO2
Fuel combustion	Distillate	Oil Produced (bbls)**	4%	3.71E-08	0.04	11.04	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	7,576.17	2.8%	CH4
Fugitive emissions	NA	Overall production	4%	6.93E-03	6,931	6,931.20	2.5%	CO2
Fugitive emissions	NA	Overall production	4%	2.59E-03	2,585	64,633.41	23.5%	CH4
Fugitive emissions	NA	Overall production	4%	1.33E-02	13,278	13,278.42	4.8%	CO2
Fugitive emissions	NA	Overall production	4%	3.11E-04	311	7,787.31	2.8%	CH4
Fugitive emissions	NA	Water Produced (bbls)	2%	2.00E-08	0	0.50	0.0%	CH4
				<b>TOTAL</b>	<b>198,142</b>	<b>275,095</b>	<b>100.0%</b>	

\* 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.

**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						2015 (Million Metric Tons)	2015 (Metric Tons CO2e)
Sub Sector Level 1	Sub Sector Level 2	Sub Sector Level 3	Main Activity	Activity Subset	GHG		
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Associated gas	N2O	5.1372E-06	1,531
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	1,284
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Distillate	CH4	4.4397E-06	111
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	265
Oil & Gas: Production & Processing	Not Specified	None	Fuel combustion	Natural gas	CH4	0.00025934	6,483
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	7,728
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	178,064
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	1,519,086
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	183,026
Oil & Gas: Production & Processing	Wastewater Treatment	Fugitives	Fugitive emissions	NA	CH4	1.1401E-06	29
					TOTAL	18	19,578,460

Source: CARB's California GHG Emission Inventory Summary [2000 - 2016] ([https://www.arb.ca.gov/app/ghg/2000\\_2016/ghg\\_sector.php](https://www.arb.ca.gov/app/ghg/2000_2016/ghg_sector.php))

**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*		Net Gas Production				Water Produced (bbbls)
	Active	Inactive	Oil Produced (bbbls)**	Associated Gas (Mcf)	Non Associated Gas (Mcf)	Total Net Gas (Mcf)	
Ventura	1,705	1,303	8,428,402	8,231,282	0	8,231,282	59,853,491
<b>TOTAL</b>	<b>56,653</b>	<b>24,684</b>	<b>201,972,233</b>	<b>161,867,377</b>	<b>27,948,252</b>	<b>189,815,629</b>	<b>3,408,359,291</b>
<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](ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2015/County_Production_2015.pdf)

Assumptions

Category				Source/Notes
<b>Conversions</b>				
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			
<b>GWP</b>				
Source	IPCC Fourth Assessment Report (Avg)			
CO2	1			
CH4	25			
N2O	298			
Source: IPCC Fourth Assessment Report Factors (Chapter 2. Table 2.14)				
<b>Electricity Emission Factors</b>				
<b>SCE</b>	<b>2015</b>	<b>2020</b>	<b>2030</b>	
RPS Status	25%	33%	50%	
<b>SCE Power Mix 2015</b>				
Natural Gas	26%			SCE 2015 Power Content Label ( <a href="https://www.energy.ca.gov/pcl/labels/2015_index.html">https://www.energy.ca.gov/pcl/labels/2015_index.html</a> )
Unspecified Sources	41%			
GHG Free Sources	33%			
<b>SCE 2015 Calculated EFs</b>				
<b>lb CO2/MWh</b>	<b>529</b>	<b>472.67</b>	<b>352.74</b>	2016 SCE Corporate Responsibility Report
<b>lb CH4/GWh</b>	<b>14.95</b>	<b>13.35</b>	<b>9.97</b>	Calculated from eGrid 2016 NG and Other Efs
<b>lb N2O/GWh</b>	<b>1.66</b>	<b>1.48</b>	<b>1.11</b>	Calculated from eGrid 2016 NG and Other Efs
<b>MT CO2e/MWh</b>	<b>0.240</b>	<b>0.215</b>	<b>0.160</b>	Calculated
<b>California Average</b>				
<b>RPS Status</b>	<b>25.0%</b>	<b>33.0%</b>	<b>50%</b>	
<b>CA Average Power Mix 2015</b>				
Natural Gas	44%			SCE 2015 Power Content Label ( <a href="https://www.energy.ca.gov/pcl/labels/2015_index.html">https://www.energy.ca.gov/pcl/labels/2015_index.html</a> )
Unspecified Sources	15%			
Coal	6%			
GHG Free Sources	41%			
<b>CA Average 2015 Calculated EFs</b>				
<b>lb CO2/MWh</b>	<b>519.21</b>	<b>463.8</b>	<b>346.1</b>	Calculated from eGrid 2016 NG and Other Efs
<b>lb CH4/GWh</b>	<b>11.96</b>	<b>10.7</b>	<b>8.0</b>	Calculated from eGrid 2016 NG and Other Efs
<b>lb N2O/GWh</b>	<b>2.32</b>	<b>2.1</b>	<b>1.5</b>	Calculated from eGrid 2016 NG and Other Efs
<b>MT CO2e/MWh</b>	<b>0.236</b>	<b>0.211</b>	<b>0.157</b>	Calculated
<b>eGrid 2016 Emission Factors (For Calculation of California Average EFs)</b>				Updated February 2017

Assumptions

<b>Natural Gas EFs: eGRID2016 Average of California Natural Gas Electricity Plant EFs</b>		<a href="https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid">https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid</a>
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
<b>MT CO2e/MWh</b>	<b>0.3941</b>	Calculated
<b>Coal EFs: eGRID2016 Average of California Coal Electricity Plant EFs</b>		<a href="https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid">https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid</a>
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
<b>MT CO2e/MWh</b>	<b>0.5279</b>	Calculated
<b>Unspecified EFs: eGRID2016 CAMX Emission Factors</b>		Assumed to represent 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

<b>Utility Natural Gas Emission Factors</b>			
kg CO <sub>2</sub> /MMBtu	53.06	Natural Gas - US Weighted Average	2017 Climate Registry Emission Factors. Table 12.1.
g CH4/MMBtu	4.7	Natural Gas - Residential/Commercial	2017 Climate Registry Emission Factors. Table 12.9.
g N2O/MMBtu	0.1	Natural Gas - Residential/Commercial	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
<b>MT CO2e/therm</b>	<b>0.0068</b>		Calculated

<b>The Climate Registry 2017 Default Emission Factors</b>		
Fuel Type	Carbon Content (Per Unit Energy)	CO2 Emission Factor (Per Unit Volume)
<b>Fuels Measured in Gallons</b>	<b>kg C / MMBtu</b>	<b>kg CO2 / gallon</b>
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
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
<b>Fuels Measured in Standard Cubic Feet</b>	<b>kg C / MMBtu</b>	<b>kg CO2 / Standard cubic foot</b>
Compressed Natural Gas (CNG)*	14.47	0.054
Propane (Gas)	16.76	0.1546



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, *Guidelines for National Greenhouse Gas Inventories* (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 x Conversion Factor. Heat content factors are based on higher heating values (HHV). NA = data not available.

Vehicle Type / Fuel Type	CH4 (g / gallon)	N2O (g / gallon)
<b>Ships and Boats</b>		
Residual Fuel Oil	0.11	0.60
Diesel Fuel	0.74	0.45
Gasoline	0.06	0.22
<b>Locomotives</b>		
Diesel Fuel	0.80	0.26
<b>Agricultural Equipment</b>		
Gasoline	1.26	0.22
Diesel Fuel	1.44	0.26
<b>Construction/Mining Equipment</b>		
Gasoline	0.50	0.22
Diesel Fuel	0.58	0.26
<b>Other Non-Highway</b>		
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
<b>Aircraft</b>		
Jet Fuel	0.00	0.31
Aviation Gasoline	7.05	0.11

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.

Vehicle Type / Fuel Type	CH4 (g / L)	N2O (g / L)
<b>Diesel Passenger Cars</b>		
Advanced	0.0005	0.0010
Moderate	0.0005	0.0010
Uncontrolled	0.0006	0.0012
<b>Diesel Light Trucks</b>		
Advanced	0.0010	0.0015
Moderate	0.0009	0.0014
Uncontrolled	0.0011	0.0017
<b>Diesel Medium and Heavy-Duty Vehicles (Trucks and Busses)</b>		
Aftertreatment	0.0051	0.0048
Advanced	0.0051	0.0048
Moderate	0.0051	0.0048
Uncontrolled	0.0051	0.0048
<b>CNG Medium and Heavy-Duty Vehicles (Trucks and Busses)</b>		
CNG	1.9660	0.1750

Fuel Type	Heat Content	CO2 Emission Factor (Per Unit Energy)	CO2 Emission Factor (Per Unit Mass or Volume)
Natural Gas	Btu / scf	kg CO2 / MMBtu	kg CO2 / scf

**Assumptions**

US Weighted Average	1026.00	53.06	0.05
Greater than 1,000 Btu*	>1000	53.06	varies
975 to 1,000 Btu*	975 – 1,000	54.01	varies

Fuel Type / End-Use Sector	CH4 (g / MMBtu)	N2O (g / MMBtu)
<b>Coal</b>		
Residential	300.7	1.5
Commercial	10.0	1.5
<b>Petroleum Products</b>		
Residential	10.0	0.6
Commercial	10.0	0.6
<b>Natural Gas</b>		
Residential	4.7	0.1
Commercial	4.7	0.1
<b>Wood</b>		
Residential	253.2	3.4
Commercial	253.2	3.4

<b>2013 - 2015 Population growth</b>				
Population	2013	2015	Growth from 2013	Source
Ventura County	836,154	NA	NA	County of Ventura. 2013 Water Supply and Demand.
Ventura County	840,867	850,491	1%	Department of Finance
Unincorporated County		97,733		Department of Finance
City of Ventura Population		108,037		Department of Finance
Population supplied by City of Ventura		112,412		City of Ventura 2015 UWMP

**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%
				18,918,239	
				43800	

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

Region	Calendar Y	Vehicle Cat	SCAG VEH CAT	Model Year	Speed	Fuel	Population	VMT	Trips	Weighted by VMT and SCAG Vehicle Category					
										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