

Greenhouse Gas Emissions Worksheet

Project Parameters	
	2010
Vehicles (trips/day)	14
Electricity used (MWh/year)	
(mscf/year)	
tons/year)	

MWh = Megawatt hour
mscf = million standard cubic feet

Emission Source	Total (metric tons/yr)				Percent of Total
	CO ₂	CH ₄	N ₂ O	CO ₂ e	
Vehicles (1)	0	0.0011	0.0018	0.56	100%
Electricity Production					
Natural Gas Combustion ⁽¹⁾	0				
Solid Waste	--	--	--		
Other Area Sources ⁽²⁾	0	--	--	0	0%
Total Annual Emissions		0.0011	0.0018	0.56	100.0%

tons/metric ton

1.1025

U.S. or Metric?

Tons Metric Tons

Note: Numbers in table may not appear to add up correctly due to rounding of all numbers to two significant digits.

(1) CO₂ emissions for Vehicles and Natural Gas from URBEMIS 2007 outputs, if available.

(2) Includes CO₂ emissions for hearth combustion and landscaping equipment from URBEMIS 2007 outputs.

Emission Source	Total CO ₂ e (Tg/yr)				
Vehicles	0.00000056	1,000,000 tonne/Tg			
Electricity Production					
Natural Gas Combustion					
Solid Waste					
Total (CO ₂ e)	0.00000056	Year of data	Comparison Area GHG Usage		
% of SCAG 2004 total	0.00000032	2004	SCAG	176.79	(Tg/yr)
% of State 2004 total	0.00000012	2004	State	480	(Tg/yr)

Global warming potentials (GWPs) are used to compare the abilities of different GHGs to trap heat in the atmosphere. GWPs are based on the radiative efficiency (heat-absorbing ability) of each gas relative to that of CO₂, as well as the decay rate of each gas (the amount removed from the atmosphere over a given number of years) relative to that of CO₂. The GWP provides a construct for converting emissions of various gases into a common measure, which allows climate analysts to aggregate the radiative impacts of various GHGs into a uniform measure denominated in carbon or CO₂ equivalents. The generally accepted authority on GWPs is the Intergovernmental Panel on Climate Change (IPCC). In 2007, the IPCC updated its estimates of GWPs for key GHGs. The table below lists the GWPs to calculate carbon dioxide equivalents (CO₂e)

Global Warming Potential

Gas	Atmospheric Lifetime (years)	Global Warming Potential (100 year time horizon)
Carbon Dioxide	50-200	1
Methane	12 ± 3	25
Nitrous Oxide	120	298
HFC-23	264	14800
HFC-134a	14.6	1430
HFC-152a	1.5	124
PFC: Tetrafluoromethane (CF ₄)	50000	7390
PFC: Hexafluoromethane (C ₂ F ₆)	10000	12200
Sulfur Hexafluoride (SF ₆)	3200	22800

Enter the project emissions from the URBEMIS modeling

Select the tons/year

appropriate units: lbs/day

Short-Term Construction Emissions

Source	CO ₂ Emissions
Demolition	0
Mass Grading	0
Fine Grading	0
Trenching	1829
Paving	2629
Building	2103
Coating	0

Long-Term Regional Operational Emissions

Source	CO ₂ Emissions
Natural Gas	0
Hearth	0
Landscape	0
Mobile Sources	0

Electricity Emissions Worksheet

Commercial Electricity Usage (2003 data):

Commercial Building Type	Electricity Consumption per Building by Building Type	Electricity Consumption per Square Foot by Building Type	Project Info (either # of bldgs or total sf, not both)		Annual Electricity Consumption
	thousand kWh	kWh	# of bldgs	total sf	MWh
All Buildings	226	14	0		0
Mercantile	327	17.8			0
Enclosed and Strip Malls	718	21.1			0
Retail (Other than Mall)	139	14.3			0
Education	283	10.7			0
Food Sales	276	49.4			0
Food Service	213	31.8			0
Health Care (All)	564	20.1			0
Inpatient Health	6,628	27.5			0
Outpatient Health	168	16.1			0
Lodging	483	11.9			0
Office	256	14.6			0
Other	510	22.5			0
Public Assembly	179	12.5			0
Public Order and Safety	237	15.3			0
Religious Worship	49	4.9			0
Service	73	8			0
Vacant	42	2.4			0
Warehouse and Storage	154	5.9			0

Note: Health Care (All) includes both "Inpatient Health" and "Outpatient Health".

Source: Energy Information Administration, www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/detailed_tables_2003.html, Table C14A - Bold valu

Residential Energy Usage (2001 data):

				Project Info	Annual Consumption
	Mountain	Pacific	Total US.	# of units	MWh
Single Family	9,926	7,622	10,656	0	0
Apartments (2-4 Units)			7,176	0	0
Apartments (5 or more Units)			6,204	0	0
Mobile Home			12,469	0	0
Total Residential (kWh)					0

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-G of the 2001 Residential Energy Consumption Survey.

	CO ₂			CH ₄	N ₂ O
Electricity production emission factors for CA	lb/kWh	short tons/MWh	tons/MWh	lb/MWh	lb/MWh
U.S. Average	0.61	0.303	0.275	0.0067	0.0037
	1.34	0.668	0.606	0.0111	0.0192

Source: Energy Information Administration, Updated State-and Regional-level Greenhouse Gas Emission Factors for Electricity (March 2002), <http://www.eia.doe.gov/pub/oiaf/1605/cdrom/pdf/e-supdoc.pdf>. (<http://www.eia.doe.gov/oiaf/1605/ee-factors.html> accessed 4/14/2008)

Water Usage Emissions Worksheet

kWh/MG

Select the appropriate location:

Project Location in California	
<input type="radio"/> Northern	<input checked="" type="radio"/> Southern

Water Supply and Conveyance	2,117	9,727	
Water Treatment	111	111	
Water Distribution	1,272	1,272	
Wastewater Treatment	1,911	1,911	
Totals	5,411	13,021	

Refining Estimates of Water-Related Energy Use In California, CEC, Dec. 2006

3.26E+05 gallons/acre-feet

Project total usage 0.0 acre-feet/year

Water Supply and Conveyance	0.00E+00	kWh/year	
Water Treatment	0.00E+00	kWh/year	
Water Distribution	0.00E+00	kWh/year	
Wastewater Treatment	0.00E+00	kWh/year	
Total	0.00E+00	kWh/year	

Water usage calculator

Number of Residences		Total Gallons Per Day	0
Estimated people per residence(1)	2.87	Gallons Per Year	0
Gallons/Resident/Day(2)	100	Total Acre-feet Per Year	0.00
Total Gallons Per Day	0		
Gallons Per Year	0		
Acre-feet Per Year	0		
<p>(1) United States Census. California County QuickFacts. Available at http://quickfacts.census.gov/qfd/states/06000.html. Accessed January 2009.</p> <p>(2) Pacific Institute. <i>Waste Not, Want Not: The Potential for Urban Water Conservation in California</i>. November 2003. Page 5 (http://www.pacinst.org/reports/urban_usage/)</p>			
Estimated Number of Employees(1)			
Gallons/Employee/Day(2)	136		
Total Gallons Per Day	0		
Gallons Per Year	0		
Acre-feet Per Year	0		

(1) Specific employee data was not available at the time of this analysis. Employee numbers by type (office, retail) were estimated based on percentage of building types within the project.

(2) Pacific Institute. 2003. *Waste Not, Want Not: The Potential for Urban Water Conservation in California*. November.

Solid Waste Emissions Worksheet

Total Square Footage - Office	0
Disposal Rate (dry short tons/sq. ft./year)	0.0108
Office Waste (Dry Short Tons/Year)	0

Total Square Footage - Retail	0
Disposal Rate (dry short tons/sq. ft./year)	0.0024
Retail Waste (Dry Short Tons/Year)	0

Total Residences	0
Disposal Rate (dry short tons/unit/year) ⁽²⁾	1.17
Residential Waste (Dry Short Tons/Year)	0

Total Square Footage - Industrial	0
Disposal Rate (lbs/1000 sq. ft./day) ⁽³⁾	62.5
Industrial Waste (Dry Short Tons/Year)	0

Total Square Footage - Institutional	0
Disposal Rate (lbs/sq. ft./day) ⁽⁴⁾	0.007
Institutional Waste (Dry Short Tons/Year)	0

Total Waste (Dry Short Tons/Year)
CO₂e Tonnes/Year

Dry Short Tons/Wet Short Tons of MSW	0.84	
MTCE/Wet Short Ton of MSW ⁽⁶⁾	0.272	1 metric ton
Tonnes of CO ₂ e/Wet Short Ton of MSW	1.007	0.27

(1) California Integrated Waste Management Board, 2009. Estimated Solid Waste Generation Rates for Commercial Establishments. Available at <http://www.ciwmb.ca.gov/wastechar/wastegenrates/Commercial.htm>.

(2) California Integrated Waste Management Board, 2009. Estimated Solid Waste Generation Rates for Residential Developments. Available at <http://www.ciwmb.ca.gov/wastechar/wastegenrates/Residential.htm>

(3) California Integrated Waste Management Board, 2009. Estimated Solid Waste Generation Rates for Industrial Establishments. Available at <http://www.ciwmb.ca.gov/wastechar/wastegenrates/Industrial.htm>.

(4) California Integrated Waste Management Board, 2009. Estimated Solid Waste Generation Rates for Commercial Establishments. Available at <http://www.ciwmb.ca.gov/wastechar/wastegenrates/Institution.htm>.

(5) U.S. Environmental Protection Agency. 2006. *Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks*, Exhibit 6-4. September.

(6) U.S. Environmental Protection Agency. 2006. *Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks*, Exhibit 6-6. September.

Natural Gas Emissions Worksheet

Commercial Natural Gas Usage (2003 data):

Commercial Building Type	Natural Gas Consumption per Building by Building Type	Natural Gas Consumption per Square Foot by Building Type	Project Info (enter values on Electricity worksheet)		Annual Natural Gas Consumption
	thousand cf	cf	# of bldgs	total sf	thousand cf
All Buildings	782	29.2	0	0	0
Mercantile	653	19.7	0	0	0
Enclosed and Strip Malls	1142	33.4	0	0	0
Retail (Other than Mall)	362	11.4	0	0	0
Education	1223	34.8	0	0	0
Food Sales	383	50.2	0	0	0
Food Service	870	141.2	0	0	0
Health Care (All)	3283	68.7	0	0	0
Inpatient Health	28,222	109.8	0	0	0
Outpatient Health	574	50.2	0	0	0
Lodging	2432	31.5	0	0	0
Office	535	14.2	0	0	0
Other	1885	67.6	0	0	0
Public Assembly	678	36.4	0	0	0
Public Order and Safety	771	43.7	0	0	0
Religious Worship	362	30.3	0	0	0
Service	481	54.1	0	0	0
Vacant	557	23	0	0	0
Warehouse and Storage	687	23.4	0	0	0

Note: Health Care (All) includes both "Inpatient Health" and "Outpatient Health".

Source: Energy Information Administration, www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/detailed_tables_2003.html, Table C24A - Bold value

Residential Energy Usage (2001 data):				Project Info	Annual Consumption
	Mountain	Pacific	Total US.	# of units	thousand cf
Single Family	67	48	70	0	0
Apartments (2-4 Units) ⁽¹⁾		48		0	0
Apartments (5 or more Units)			28	0	0
Mobile Home			58	0	0
Total Natural Gas Usage					0

(1) Single family natural gas consumption was used to represent 2-4 Unit Apartments, as the total U.S. number (70 thousand cf) would exceed the Pacific region single-family home consumption rates. Single-family and 2-4 Unit Apartments have consistent total U.S. consumption rates, so it is reasonable that regional rates would be consistent as well.

Source: Table CE1-12c. Total Energy Consumption in U.S. Households by West Census Region, 2001 (<http://www.eia.doe.gov/emeu/recs/recs>).

	CO ₂	CH ₄	N ₂ O
Natural gas combustion	lb/10 ⁶ scf	lb/10 ⁶ scf	lb/10 ⁶ scf
	120,000	2.3	2.2

Source: EPA AP-42 Vol I Chapter 1.4, Table 1.4-2

Vehicle Emissions Worksheet

avg. speed=		40	(mph)	avg trip length=		10	(miles)
2010		CO ₂	CH ₄	N ₂ O	Fleet %		
LDA	CAT	292.432	0.019	0.032	61.3%		
LDA	DSL	359.668	0.006	0.001	0.5%		
LDT	CAT	364.37	0.025	0.042	34.3%		
LDT	DSL	349.073	0.0035	0.002	0.4%		
HDT	CAT	468.081	0.0636	0.088	1.8%		
HDT	DSL	931.362	0.012	0.005	1.7%		
Composite		331.704	0.022	0.036	100.0%		

Notes:

CO₂ and CH₄ from EMFAC2007

N₂O from EPA *Update of Methane and Nitrous Oxide Emission Factors for On-Highway Vehicles*, November 2004, Table 28.

Fleet percentages from URBEMIS2007

From URBEMIS2007			
	Vehicle Categories	Fleet %	Diesel %
LDA	Light Auto	51.6	0.4
	Light Truck < 3750 lbs	7.4	4.1
LDT	Light Truck 3751-5750 lbs	22.9	0
	Med Truck 5751-8500 lbs	10.6	0
HDT	Lite-Heavy Truck 8501-10,000 lbs	1.6	18.8
	Lite-Heavy Truck 10,001-14,000 lbs	0.5	40
	Med-Heavy Truck 14,001-33,000 lbs	0.9	77.8
	Heavy-Heavy Truck 33,001-60,000 lbs	0.5	100
LDT	Other Bus	0.1	100
	Urban Bus	0.1	100
LDA	Motorcycle	2.8	0
LDT	School Bus	0.1	100
	Motor Home	0.9	11.1

100