

**APPENDIX A:
COMMUNITY 2006
GREENHOUSE GAS
EMISSIONS DETAILED
REPORT**

	Equiv CO ₂ (tonnes) ¹	Equiv CO ₂ (%)	Energy (MMBtu)
Residential			
San Luis Obispo County, CA			
<i>1 PG&E Residential Natural Gas</i>			
Natural Gas	798	0.1	14,993
<i>Subtotal 1 PG&E Residential Natural Gas</i>	798	0.1	14,993

Source(s):

- All PG&E data was received from Jeremy Howard, Account Executive with PG&E.
- Data file: PG&E_2006_UNINC.xls

Notes:

- The "California Coefficients for Natural Gas" coefficient set is based on a PG&E eCO₂ emissions factor of 53.05 kg/MMBtu of delivered natural gas, certified by the California Climate Action Registry and the CEC, and was reported to ICLEI in December 2007 by Jasmin Ansar. Criteria air pollutant emissions factors for natural gas are derived from the EPA's annual report of air pollution emission trends (EPA 2001c).

1 SoCal Gas Co. Residential Natural Gas

Natural Gas	70,055	7.6	1,249,665
<i>Subtotal 1 SoCal Gas Co. Residential Natural Gas</i>	70,055	7.6	1,249,665

Source(s):

- Southern California Gas Co data was provided by Colby Morrow, Air Quality Manager, Customer Programs Environmental Affairs.
- Data file: Gas Usage by Market (MCF).xls

Notes:

- Conversion of 1 MCF=10 therms was used.
- Default Fuel CO₂ Set
- CEC Emission Factor for Natural Gas – RCI Average Set

¹ Due to the rounding of decimals, the numbers provided in this appendix may not equal the totals.

	Equiv CO₂ (tonnes)¹	Equiv CO₂ (%)	Energy (MMBtu)
<i>2 PG&E Residential Electricity</i>			
Electricity	65,514	7.1	1,056,643
<i>Subtotal 2 PG&E Residential Electricity</i>	65,514	7.1	1,056,643

Source(s):

- All PG&E data was received from Jeremy Howard, Account Executive with PG&E.
- Data file: PG&E_2006_UNINC.xls

Notes:

- The "PG&E California" electricity coefficient set is based on the 2005 PG&E eCO₂ emission factor of 0.492859 lbs/kWh of delivered electricity. This emissions factor is certified by the California Climate Action Registry and was reported to ICLEI in January 2007 by Greg San Martin. Criteria air pollutant emission factors for electricity are derived from the NERC Region 13 - Western Systems Coordinating Council/CNV Average Grid Electricity Set.

Subtotal Residential	136,367	14.9	2,321,301
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Commercial**San Luis Obispo County, CA***1 PG&E Commercial + Industrial Natural Gas*

Natural Gas	1,144	0.1	21,506
<i>Subtotal 1 PG&E Commercial + Industrial Natural Gas</i>	1,144	0.1	21,506

Source(s):

- All PG&E data was received from Jeremy Howard, Account Executive with PG&E.
- Data file: PG&E_2006_UNINC.xls

Notes:

- PG&E supplies natural gas to Shandon and portions of Creston, while SoCal Gas Co. serves the rest of SLO County. Conversion of 1 MCF=10 therms was used.
- PG&E data for commercial and industrial was combined and included under commercial, due to 15/15 Rule.
- Notation: The "California Coefficients for Natural Gas" coefficient set is based on a

**Equiv CO₂
(tonnes)¹** **Equiv CO₂
(%)** **Energy
(MMBtu)**

PG&E eCO₂ emissions factor of 53.05 kg/MMBtu of delivered natural gas, certified by the California Climate Action Registry and the CEC, and was reported to ICLEI in December 2007 by Jasmin Ansar. Criteria air pollutant emissions factors for natural gas are derived from the EPA's annual report of air pollution emission trends (EPA 2001c).

1 SoCal Gas Co. Commercial Natural Gas

Natural Gas	72,214	7.9	1,288,177
<i>Subtotal 1 SoCal Gas Co. Commercial Natural Gas</i>	72,214	7.9	1,288,177

Source(s):

- Southern California Gas Co data was provided by Colby Morrow, Air Quality Manager, Customer Programs Environmental Affairs .
- Data file: Gas Usage by Market (MCF).xls
- Conversion of 1 MCF=10 therms was used.
- CEC Emission Factor for Natural Gas – RCI Average Set
- Default Fuel CO₂ Set

1 SoCal Gas Co. Industrial Natural Gas

Natural Gas	74,135	8.1	1,322,431
<i>Subtotal 1 SoCal Gas Co. Industrial Natural Gas</i>	74,135	8.1	1,322,431

Source(s):

- Southern California Gas Co data was provided by Colby Morrow, Air Quality Manager, Customer Programs Environmental Affairs .
- Data file: Gas Usage by Market (MCF).xls

Notes:

- Conversion of 1 MCF=10 therms was used.
- Default Fuel CO₂ Set
- CEC Emission Factor for Natural Gas – RCI Average Set

	Equiv CO₂ (tonnes)¹	Equiv CO₂ (%)	Energy (MMBtu)
<i>2 PG&E Commercial + Industrial Electricity</i>			
Electricity	68,483	7.5	1,104,531
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<i>Subtotal 2 PG&E Commercial + Industrial Electricity</i>	68,483	7.5	1,104,531
Source(s):			
<ul style="list-style-type: none"> All PG&E data was received from Jeremy Howard, Account Executive with PG&E. Data file: PG&E_2006_UNINC.xls 			
Notes:			
<ul style="list-style-type: none"> PG&E data for commercial and industrial was combined and included under commercial, due to 15/15 Rule adopted by the CPUC to protect customer confidentiality. The 15/15 rule requires that any aggregated information provided by the utilities must be made up of at least 15 customers. A single customer's load must be less than 15% of an assigned category. If the number of customers in the complied data is below 15, or if a single customer's load is more than 15% of the total data, categories must be combined before the information is released. The rule further requires that if the 15/15 Rule is triggered for a second time after the data has been screened already using the 15/15 Rule, the customer must be dropped from the information provided. This information was provided by Corie Cheeseman, Program Manager with Pacific Gas and Electric Company - Customer Energy Efficiency . 			
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Subtotal Commercial	215,976	23.5	3,736,644

	Equiv CO ₂ (tonnes) ¹	Equiv CO ₂ (%)	Energy (MMBtu)
Transportation			
<i>1 On-Road VMT – Unincorporated SLO County</i>			
Carbon Dioxide	365,263	39.8	
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<i>Subtotal 1 On-Road VMT – Unincorporated SLO County</i>	365,263	39.8	
Source(s):			
<ul style="list-style-type: none"> • All vehicle miles traveled (VMT) and transportation-related GHG emissions were provided by Fehr & Peers, January 2011. • Individual GHGs such as carbon dioxide, methane, and nitrous oxide are converted to CO₂e by multiplying the CO₂ emissions by a conversion factor provided by the U.S. Environmental Protection Agency of 100/95. 			
Notes:			
<ul style="list-style-type: none"> • Using select link analysis, three types of vehicle trips were tracked separately for AM and PM peak periods in unincorporated San Luis Obispo County: • Internal-Internal: Vehicle trips with both a beginning and end in unincorporated areas of the county. • Internal-External and External-Internal: Vehicle trips that have an ending or a beginning in unincorporated San Luis Obispo County and another outside of unincorporated San Luis Obispo County. • External-External: Vehicle trips that pass through unincorporated San Luis Obispo County. • Using the recommendation of the Regional Target Advisory Committee (RTAC), the body responsible for Senate Bill 375 target setting, vehicle miles traveled (VMT) from trips of type 1, 2, and 3 were counted 100%, 50%, and 0% respectively toward jurisdiction-generated VMT. • Transportation-related greenhouse gas emissions were calculated using the California Air Resources Board (CARB) Emissions Factor (EMFAC) 2007 software. EMFAC2007 provides carbon dioxide emissions according to the unique vehicle composition of each county in California. 			
Subtotal Transportation	365,263	39.8	3,736,644

	Equiv CO₂ (tonnes)¹	Equiv CO₂ (%)	Energy (MMBtu)
Waste			
Chicago Grade			
<i>3 Unincorp. SLOco Solid Waste – Chicago Grade</i>			<i>Disposal Method – Managed Landfill</i>
Paper Products	4,401	0.5	
Food Waste	1,458	0.2	
Plant Debris	640	0.1	
Wood/Textiles	1,166	0.1	
<i>Subtotal 3 Unincorp. SLOco Solid Waste – Chicago Grade</i>			
	7,666	0.8	

Source(s):

- Total waste tonnage for unincorporated SLO County in 2006 provided by the 2006 Disposal Report prepared by San Luis Obispo County Integrated Waste Management Authority on 3/6/07, provided by Tom Martin (.).
- Percentages of waste share by type for landfill tonnage provided by CIWMB 2004 Statewide Waste Characterization Study (<http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097>).
- Chicago Grade landfill reports a methane recovery factor of 60%. Chicago Grade total gas generated = 170.21 million cubic feet (mmcf/yr). Total gas transferred = 102.13 mmcf/yr.

Notes:

- Waste type data not collected by landfill. State average waste characterization data is used for residential, commercial, and self-haul waste.
- A weighted average methane recovery factor of 58% is used for this calculation to account for the different recovery factor of Paso Robles.

	Equiv CO₂ (tonnes)¹	Equiv CO₂ (%)	Energy (MMBtu)
Cold Canyon			
<i>3 Unincorp. SLOco Solid Waste – Cold Canyon</i>		<i>Disposal Method – Managed Landfill</i>	
Paper Products	10,712	1.2	
Food Waste	3,549	0.4	
Plant Debris	1,559	0.2	
Wood/Textiles	2,839	0.3	
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<i>Subtotal 3 Unincorp. SLOco Solid Waste – Cold Canyon</i>	18,660	2.0	

Source(s):

- Total waste tonnage for unincorporated SLO County in 2006 provided by the 2006 Disposal Report prepared by San Luis Obispo County Integrated Waste Management Authority on 3/6/07, provided by Tom Martin.
- Percentages of waste share by type for landfill tonnage provided by CIWMB 2004 Statewide Waste Characterization Study (<http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097>).
- Cold Canyon landfill reports a methane recovery factor of 60%. Cold Canyon total gas generated = 763.1 mmcf/yr. Total gas transferred = 457.84 mmcf/yr.

Notes:

- Waste type data not collected by landfill. State average waste characterization data is used for residential, commercial, and self-haul waste.
- A weighted average methane recovery factor of 58% is used for this calculation to account for the different recovery factor of Paso Robles.

	Equiv CO₂ (tonnes)¹	Equiv CO₂ (%)	Energy (MMBtu)
Paso Robles			
<i>3 Unincorp. SLOco Solid Waste – Paso Robles</i>			<i>Disposal Method – Managed Landfill</i>
Paper Products	2,420	0.3	
Food Waste	802	0.1	
Plant Debris	352	0	
Wood/Textiles	641	0.1	
<i>Subtotal 3 Unincorp. SLOco Solid Waste – Paso Robles</i>	4,215	0.5	
Source(s):			
<ul style="list-style-type: none"> • Total waste tonnage for unincorporated SLO County in 2006 provided by the 2006 Disposal Report prepared by San Luis Obispo County Integrated Waste Management Authority on 3/6/07, provided by Tom Martin. • Percentages of waste share by type for landfill tonnage provided by CIWMB 2004 Statewide Waste Characterization Study (http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1097). • Paso Robles landfill reports a methane recovery factor of 50%. Paso Robles total gas generated = 144.48 mmcf/yr. Total gas transferred = 72.24 mmcf/yr. 			
Notes:			
<ul style="list-style-type: none"> • Waste type data not collected by landfill. State average waste characterization data is used for residential, commercial, and self-haul waste. • A weighted average methane recovery factor of 58% is used for this calculation to account for the different recovery factor of Paso Robles. 			
Subtotal Waste	30,540	3.3	
Other			

	Equip CO₂ (tonnes)¹	Equip CO₂ (%)	Energy (MMBtu)
San Luis Obispo County, CA			
<i>1 Off-Road Agricultural Equipment</i>			
Carbon Dioxide	62,784	6.8	
Nitrous Oxide	236	0	
Methane	258	0	
<i>Subtotal 1 Off-Road Agricultural Equipment</i>	63,278	6.9	

Source(s):

- CO₂, CH₄, and N₂O emissions calculated using the California Air Resources Board OFFROAD2007 modeling tool.
- The portion of agricultural land per jurisdiction in SLO County calculated by John Demartino, PMC using County GIS shape files.

Notes:

- OFFROAD aggregates off-road agricultural equipment emissions for the entire county. Emissions were separated by jurisdiction based on the proportion of agricultural land per jurisdiction. This analysis was completed using GIS shapefiles of land use patterns in the county.
- OFFROAD includes the following agricultural equipment: 2-wheel tractors, agricultural mowers, agricultural tractors, balers, combines, hydro power units, other agricultural equipment, sprayers, swathers, tillers.

3 – Aircraft – Oceano Airport

Carbon Dioxide	0	0.0	
Nitrous Oxide	1	0.0	
Methane	5	0.0	
<i>Subtotal 3 – Aircraft – Oceano Airport</i>	6	0.0	

Source(s):

- The Airport Cooperative Research Program (ACRP) Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories, 2009.

Notes:

- Make and model of aircraft, engine type, and number of annual landing and takeoff

	Equiv CO₂ (tonnes)¹	Equiv CO₂ (%)	Energy (MMBtu)
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operations (LTO) were provided by an engineering report prepared by the SLO Air Pollution Control District (2008). This was a special report documenting airport activity in 2007. It was assumed that no significant changes in airport operations activity levels occurred during this time interval.

- The Federal Aviation Administration's (FAA) Emissions and Dispersion Modeling System (EDMS 5.1.2) was used to calculate CO₂ emissions and fuel consumed with the LTO. CH₄ and N₂O were calculated using fuel coefficients provided by the ACRP Guidebook.
- A total of 247.323.547 lbs of aviation gas (AvGas) was reported.
- A total of 0 lbs of jet fuel was reported.

3 Agriculture Nitrogen Fertilizers

Nitrous Oxide	22,632	2.5
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<i>Subtotal 3 Agriculture Nitrogen Fertilizer</i>	22,632	2.5

Sources:

- California Air Resources Board.(2010). International Local Government GHG Emissions Analysis Protocol. Version 1.1. <http://www.arb.ca.gov/cc/protocols/localgov/localgov.htm>
- Mary Bianchi. University of California Cooperative Extension. Email and phone correspondence.
- UC Davis Agricultural & Resource Economics (2010). Outreach & Extension: Current Cost Return Studies. Retrieved <http://coststudies.ucdavis.edu/current.php>.
- San Luis Obispo County Department of Agriculture Weights & Measures. 2007. 2006 Annual Report. <http://www.slocounty.ca.gov/Assets/AG/croprep/2006+Crop+Report.pdf>

Notes:

- County-wide crop emissions. Crop data was gathered from the 2006 County Crop Report. For each crop category (i.e. Fruit and Nut, Vegetables, and Field Crops) the top three crops in acreage were identified and confirmed as appropriate with the San Luis Obispo County University of California Cooperative Extension. An average nitrogen fertilizer use for each crop was identified using University of California Cooperative Extension cost reports and the local Farm Advisor's office. A weighted average of nitrogen fertilizer was calculated for each crop category and assumed to apply to all other crop land not within the top three crops for each category. Relies on the California Air Resources Board equation for soil management emissions that was used in the statewide greenhouse inventory to calculate direct and indirect grams of N₂O. Fertilizer

Equiv CO ₂ (tonnes) ¹	Equiv CO ₂ (%)	Energy (MMBtu)
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applications grams of N₂O was converted into metric tons of CO₂e using factors provided in the Local Government Operations Protocol Version 1.1(2010).

- Distinctions were not made for organic farming practices per communication with Mary Bianchi and agricultural stakeholders; there is not adequate local data to make distinctions between use of fertilizer for organic and non-organic crops.
- The following crop acreages and fertilizer characteristics were used to calculate emissions in 2006. All crop acreages are from the 2006 Annual Report (San Luis Obispo County Department of Agriculture Weights & Measures 2007). Except where otherwise noted, fertilizer application rates are taken from Current Cost Return Studies produced by UC Davis Agricultural & Resource Economics.

Fruit and Nut Crops:

- Grapes: 36,493 acres, average of 25 pounds of nitrogen applied per acre.
- Avocadoes (Has): 4,526 acres, average of 120 pounds of nitrogen applied per acre. Assumption was made using data on crop practices provided by Mary Bianchi of the Cooperative Extension.
- English Walnuts: 3,107 acres, de minimis impact. Per Mary Bianchi, walnuts in the County are dry farmed and very little fertilizer is used. Therefore, no fertilizer emissions were calculated for English walnuts.
- All other fruit and nut crops: 6,623 acres, average of 35.5 pounds of nitrogen applied per acre.

Vegetables:

- Broccoli: 11,308 acres, average of 220 pounds of fertilizer applied per acre.
- Lettuce: 6,171 acres, average of 172 pounds of fertilizer applied per acre.
- Cauliflower: 2,556 acres, average of 240 pounds of fertilizer applied per acre.
- All other vegetable crops: 14,540 acres, average of 207.8 pounds of nitrogen applied per acre.

Field Crops:

- Barley: 12,500 acres, average of 50 pounds of nitrogen applied per acre. Assumption based on local crop practices.
- Grain hay: 10,300 acres, average of 41 pounds of nitrogen per acre. Assumption based on local crop practices.
- All other field crops: 7,030 acres, average of 45.9 pounds of nitrogen applied per acre.

	Equiv CO₂ (tonnes)¹	Equiv CO₂ (%)	Energy (MMBtu)
<i>3 Aircraft – San Luis Obispo Regional Airport</i>			
Carbon Dioxide	5	0.0	
Nitrous Oxide	54	0.0	
Methane	173	0.0	
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<i>Subtotal 3 Aircraft – San Luis Obispo Regional Airport</i>	231	0.0	

Source(s):

- All data from 2007, APCD Airport Source Emissions Engineering Report by Courtney Ward.

Notes:

- This emission category accounts for all aircraft exhaust emissions (excluding agricultural crop dusting). The operating emissions considered were those that occur in San Luis Obispo County below 3,000 feet, the average mixing depth in the U.S., which is also the assumed inversion altitude. Data for report obtained from San Luis County Airport and Oceano Municipal Airport. Other emissions reported by APCD but not quantified here are HC (67.223) and PM_{2.5} (1.094).
- Make and model of aircraft, engine type, and number of annual landing and takeoff operations (LTO) were provided by an engineering report prepared by the SLO Air Pollution Control District (2008). This was a special report documenting airport activity in 2007. It was assumed that no significant changes in airport operations activity levels occurred during this time interval.
- The Federal Aviation Administration's (FAA) emission Dispersion Modeling System (EDMS 5.1.2) was used to calculate CO₂ emissions and fuel consumed with the LTO. CH₄ and N₂O were calculated using fuel coefficients provided by the ACRP Guidebook.
- A total of 3,297,074.50600 lbs of aviation gas (AvGas) was reported.
- A total of 3,714,067.182 lbs of jet fuel was reported.

3 Heads of Cattle and Sheep

Methane	83,417	9.1	
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<i>Subtotal 3 Heads of Cattle and Sheep</i>	83,417	9.1	

Source(s):

- | | Equiv CO ₂
(tonnes) ¹ | Equiv CO ₂
(%) | Energy
(MMBtu) |
|--|--|------------------------------|-------------------|
| <ul style="list-style-type: none"> Livestock data obtained from the Department of Agriculture and reported in the Farming Operations engineering report by Courtney Ward, July 22, 2008. Cattle heads estimated to be 95,000. Methane emissions from enteric fermentation and manure were calculated using Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines for National Greenhouse Gas Inventories (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_10_Ch10_Livestock.pdf). | | | |

Notes:

- CH₄ is attributed to the 95,000 cattle and 6,210 sheep in SLO County (2006). Since half of the sheep and half of the cattle are in-county year-round and half are here only half of the year, we will model (95,000 * 75%) = 71,250 cattle and (6,210 * 75%) = 6,457.5 sheep.
- All cows were assumed to be in the Other/Meat category of IPCC cattle categories, as SLO county does not raise cattle or calves for dairy uses. The only dairy is on the Cal Poly campus, which is not included in this Inventory. Assumption confirmed by Robert Lilley (rlilley@co.slo.ca.us), Agricultural Commissioner for the County on 3/2/09.
- Tier 1 Enteric fermentation methane emissions factor (kg CH₄ per head per year) for Other cattle = 53. For Sheep = 8.
- Tier 1 Manure management methane emission factor (kg per head per year) for Other cattle = 2. For sheep in temperate average temperatures (15–25 Degrees C) = 0.28
- CATTLE: (71,250 heads * 53 kg/head) + (71,250 * 2 kg/head) = 3,776,250 + 142,500 = 3,918,750 kg/year
- SHEEP: (6,457.5 * 8) + (6,457.5 * .28) = 51,660 + 1,801.1 = 53,468.1 kg/year
- TOTAL= 3,918,750 + 53,468.1= 3,972,248.1 kg/year

Subtotal Other	169,564	18.5	
Total	917,710	100	6,057,945

