Appendix E
Greenhouse Gas Inventory

ESA

APPENDIX E
Greenhouse Gas Emission Inventory

Appendix E provides an inventory of the estimated greenhouse gas (GHG) emissions generated in the unincorporated areas of Tulare County for calendar year 2007, as well as the projected emissions for calendar year 2030 that would be generated in Tulare County assuming adoption of the 2030 General Plan Update.

APPENDIX E
Greenhouse Gas Inventory

Summary of Findings

Introduction

This assessment presents the estimated greenhouse gas (GHG) emissions generated in the unincorporated areas of Tulare County (Tulare County) for calendar year 2007, as well as the projected emissions for calendar year 2030 that would be generated in Tulare County assuming adoption of the Tulare County General Plan 2030 Update.

Summary of Emissions

GHG emissions produced within Tulare County in 2007 were estimated to be 5.2 million metric tons of CO_2 equivalent (tonnes of CO_2e).[1] Projected emissions for 2030 are 6.1 million tonnes of CO_2e. In both 2007 and 2030, dairies/feedlots accounted for the largest portion of total emissions, making up 63 percent and 59 percent of total emissions, respectively. Mobile sources (on and off-road) accounted for the second largest portion of emissions, contributing 16 percent in 2007 and 20 percent in 2030. When normalized by population, total annual emissions equate to 36 tonnes of CO_2e per resident in 2007, and 27 tonnes of CO_2e per resident in 2030.

Methods

This assessment includes emissions attributable to all unincorporated land within Tulare County. It does not include emissions associated with incorporated cities within Tulare County. Therefore, unincorporated Tulare County is considered to be the organizational boundary for the assessment. The assessment includes emission inventories for five main sectors of emission sources, including: electricity; natural gas; solid waste; mobile sources; and dairy/feedlot. Therefore, these sectors are considered to be the operational boundary for the assessment.

2007 emissions were calculated using data from calendar year 2007, when available. When data from 2007 was unavailable, data from 2006 were used as a proxy. 2030 projections assume that overall build-out outlined in the Tulare County General Plan 2030 Update would occur. 2030 projections also assume a 'business-as-usual' trajectory for generation and emission of greenhouse gases in the County.

[1] For the purposes of this assessment, carbon dioxide equivalent (CO2e) includes emissions of carbon dioxide, methane and nitrous oxide.

Setting

Climate Change

The scientific community has reached a consensus that climate change is occurring. According to the International Panel on Climate Change (IPCC), "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level" (IPCC, 2007a). Regional climate changes, particularly temperature increases and changing precipitation patterns, will affect natural systems world wide, with impacts on food production, ecosystem biodiversity, and human health.

According to the IPCC, it is very likely that human-generated greenhouse gas (GHG) emissions, which have increased considerably since the mid-20th century, are a primary cause of climate change. Human activities have created marked increases in atmospheric concentrations of CO_2, methane, and nitrous oxide since 1750, levels of which now far exceed atmospheric concentrations from the past several thousand years. Land use changes, burning of fossil fuels, and agricultural practices all contribute to these increasing concentrations.

Public Policy

Policies to address climate change have been implemented at global and local levels. On December 11, 1997, the Kyoto Protocol was adopted at the third Conference of the Parties to the United Nations Framework Convention on Climate Change. In recognition of the looming dangers of climate change, the protocol represents a binding commitment by signatory countries to reduce their GHG emissions below specified levels between 2008 and 2012 (UNFCCC, 2008a). To accomplish such targets, countries would need to spur businesses, communities, and individuals to action. As of October 23, 2007, 181 countries have ratified, approved, accepted, or accessed the protocol, representing 63.7 percent of global GHG emitters (UNFCCC, 2008b).

In California, Governor Schwarzenegger signed Executive Order S-3005 in 2005, establishing the following timeline for GHG emissions reductions:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020, reduce GHG emissions to 1990 levels; and
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

To support the proposed GHG reductions timeline, the California State Legislature passed AB 32, the California Global Warming Solutions Act, in 2006. This Act requires the California Air Resources Board (CARB) to design and implement GHG emission limits, regulations, and other measures to achieve a statewide goal of reducing emissions to 1990 levels by 2020 (a 25 percent reduction of emissions). Consequently, in anticipation of regulations, local governments across the State have begun taking steps to determine their own GHG emissions and develop strategies to reduce them.

The inclusion of a GHG inventory as part of a general plan update has been a recent issue with the California Attorney General's office. In 2007, Attorney General Brown sued San Bernardino County for failing to consider the impact of GHG emissions in its general plan update. A settlement was reached in August of 2007 by the Superior Court of the State of California for the County of San Bernardino, in which San Bernardino County agreed to add a policy to its general plan "that describes the County's goal of reducing those greenhouse gas emissions reasonably attributable to the County's discretionary land use decisions and the County's internal government operations, and calls for adoption of a Greenhouse Gas Reduction Plan" (State of California, 2007). According to the settlement, the GHG Emission Reduction Plan must include an inventory of all known, or reasonably discoverable, sources of GHGs that currently exist in the County. The settlement also requires that GHG estimates be supported by substantial evidence (State of California, 2007).

More recently, Senate Bill 375 was signed by Governor Schwarzenegger in September of 2008. The bill attempts to reduce GHG emissions by preventing urban sprawl. It provides emissions-reducing goals so that regions can integrate disjointed planning activities, and it provides incentives for local governments and developers to follow new conscientiously-planned growth patterns. SB 375 also enhances CARB's ability to reach AB 32 goals (State of California, 2008).

Tulare County

Tulare County contains more than 4,840 square miles (3,097,600 acres) and can be divided into the following three general topographical zones: a valley region; a foothill region east of the valley area; and a mountain region just east of the foothills. Geographically, nearly 4,790 square miles of this area is unincorporated (97 percent) (TCAG, 2007b).

In 2007, the population in unincorporated areas of Tulare County was estimated to be 144,090 (TCAG, 2008a). This represents 34 percent of the total population within Tulare County. The General Plan Update assumes that a majority of the future population growth in the County will occur within the incorporated cities (established Urban Development Boundaries). To a lesser degree, there will also be projected population growth in the unincorporated communities and hamlets. Using population projections provided by the Tulare County Association of Governments (TCAG) and the State Department of Finance, the County estimates that by 2030, the population in unincorporated areas of Tulare County is expected to reach 222,580 (30 percent of the total county population). The proposed 2030 population split is based on demographic research conducted as part of the alternatives phase of the proposed project and direction provided by the Tulare County Board of Supervisors. Table 1 outlines the expected population growth in Tulare County and the percentages of population growth expected to occur between the incorporated and unincorporated areas of the county.

TABLE 1
POPULATION IN TULARE COUNTY, 2007 AND 2030

Tulare County	2007	% of total--2007	2030	% of total--2030
Unincorporated	144,090	34%	222,580	30%
Incorporated	284,910	66%	520,390	70%
County Total	429,000	100%	742,970	100%

Source: TCAG, 2008a and County of Tulare

TCAG also predicts that jobs in unincorporated Tulare County will grow from 48,807 in 2005, to 49,529 in 2010, and to 54,351 in 2030 (TCAG, 2008b).

Methods

General Procedure

This GHG inventory has been performed using protocols established by the California Climate Action Registry (CCAR, 2008), and by the GHG Protocol Initiative (GHG Protocol, 2008). In keeping with protocol guidelines, the process used to perform this GHG inventory is as follows:

1. Set organizational boundaries.
2. Set operational boundaries.
3. Identify sources of emissions.
4. Collect data on emissions for a representative period of time.
5. Calculate GHG emissions from data using data-specific emission factors.
6. Create an inventory of CO_2e emissions that is complete and transparent.

Greenhouse Gases

The Kyoto Protocol covers six GHGs, including: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_20), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). Table 2 shows the Kyoto GHGs, their chemical formulas, the lifetime of the compounds, and their global warming potential (GWP). GWP is a measure of a GHG's capacity to trap heat in the atmosphere, relative to CO_2; consequently, gases with a high GWP can have a very large impact, even when only a small amount is generated.

TABLE 2
GREENHOUSE GASES COVERED BY THE KYOTO PROTOCOL

GHG	Chemical Formula	Lifetime (years)	Global Warming Potential for 100-year horizon
Carbon Dioxide	CO_2		1
Methane	CH_4	12	25
Nitrous Oxide	N_20	114	298
Sulfur Hexafluoride	SF_6	3,200	22,800
Hydrofluorocarbons	HFCs	1.4–270	77–14,400
Perfluorocarbons	PFCs	1,000 - 50,000	7,390-22,800

Source: IPCC, 2007b

Typical sources of the six GHGs listed above include (CCAR, 2008):

- CO_2: fossil fuel combustion, including that associated with energy production, use of natural gas, and fuel for vehicles;
- CH_4: anaerobic decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production, distribution, and use of natural gas and petroleum, coal production and use, and incomplete fossil fuel combustion;

- N_20: soil cultivation practices, particularly the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning;
- SF_6: leaks from electrical transmission and distribution systems;
- HFCs: refrigerant leaks; and
- PFCs: by-products of industrial and manufacturing processes.

This assessment includes: CO_2 from production of electricity, use of natural gas, and operation of mobile sources; CH_4 from production of electricity, use of natural gas, decomposition of solid waste, operation of mobile sources, and operation of dairy/feedlots; and N_20 from production of electricity, use of natural gas, and operation of mobile sources. This assessment does not include emissions of SF_6, HFCs, or PFCs, which were not expected to be significant contributors to the total GHG inventory in Tulare County.[2]

Organizational Boundaries

The organizational boundary for this assessment was established using the GHG Protocol's *control approach*. Under this approach, an entity (in this case, Tulare County) accounts for all of the GHG emissions generated by operations over which it has control. For Tulare County, this includes the emissions generated from activities occurring in unincorporated county land. Incorporated cities that are not a part of this inventory include: Dinuba; Exeter; Farmersville; Lindsay; Porterville; Tulare; Visalia and Woodlake.

This approach is consistent with the ruling in *The People of the State of California, ex rel. Attorney General Edmund G. Brown Jr. v. County of San Bernardino, San Bernardino County Board of Supervisors*, filed August 28, 2007. As described above, that settlement agreement set a precedent requiring that county general plan GHG inventories must include "greenhouse gas emissions reasonably attributable to the County's discretionary land use decisions and the County's internal government operations." Because Tulare County has the authority to make discretionary land use decisions in unincorporated areas, this inventory includes all reasonably discoverable emissions generated within that geographic boundary, generated by both public and private sources.

Operational Boundaries

Operational boundaries are defined as "[t]he boundaries that determine the direct and indirect emissions associated with operations owned or controlled by the reporting company. This assessment allows a company to establish which operations and sources cause direct and indirect emissions, and to decide which indirect emissions to include that are a consequence of its operations" (GHG Protocol, 2008).

This inventory includes direct and indirect emissions resulting from the energy (electricity and natural gas), mobile source (on- and off-road), agriculture (dairy/feedlots), and solid waste (landfills) sectors in Tulare County. Table 3 identifies all sources of emissions included in the inventory, as well as information on where data for each source were obtained.

[2] The 1990 GHG Inventory for the State of California found that less than 2 percent of gross CO_2e emissions were in the form of SF_6 and halogenated gas.

TABLE 3
OPERATIONAL BOUNDARIES OF GREENHOUSE GAS INVENTORY

Sector	Source of Emissions	Data Source
Mobile Sources	On-Road	Tulare County Association of Governments (TCAG), EMFAC Model
	Off-Road	OFFROAD2007 Model, CARB
Solid Waste	Trash	LandGEM Model, Tulare County Resource Management Agency
Natural Gas	Residential	The Gas Company
	Commercial	The Gas Company
	Industrial	The Gas Company
Dairy/Feedlot	Dairy/Feedlot	Jones and Stokes, 2006; EPA
Electricity	Residential	PG&E, Southern California Edison (SCE)
	Commercial	PG&E, SCE
	Industrial	PG&E, SCE

Data

Data Sources and Quality

Data collection for the electricity and natural gas inventory was conducted by Tulare County staff and ESA analysts. Data collection for solid waste, mobile sources, and dairy/feedlot was conducted by ESA analysts. Appendix A (of this report) contains the data, sources of information, calculations, and assumptions used to estimate the GHG emissions for all sectors. Underlying all calculations is the basic assumption that the data provided by utility service providers, TCAG, and Jones and Stokes are accurate and complete. Specific assumptions for each source are located in Appendix A (of this report).

Electricity

2007 Emissions

PG&E provided data for 2007 electricity consumption in unincorporated Tulare County in kilowatt-hours (kWh), separated by residential, commercial, and industrial usage. PG&E also provided PG&E-specific CO_2 emission rates (emission factors) for electricity for 2007. (See Appendix A for a list of emission factors used). Of note, PG&E provided its ClimateSmart[3] emission rate, which is a multi-year average, as a proxy for its 2007 emission rate. The actual 2007 emission rate has not yet been verified at the time that this report was prepared.

SCE provided data for electricity consumption in unincorporated Tulare County in kWh, separated by residential, commercial/industrial, agricultural, and street lighting usage. Data was provided for December 1, 2005 to November 30, 2006. This analysis assumes that electricity use during this period is similar to electricity use in 2007. SCE did not provide an SCE-specific emission

[3] PG&E's ClimateSmart™ program provides a voluntary option for PG&E customers to calculate their monthly GHG emissions from electricity use, and to offset those emissions by funding GHG emissions reduction projects.

factor; therefore, this analysis uses a regional emission factor from the California Climate Action Registry (CCAR).

Neither utility provide utility-specific emission factors for N_20 or CH_4. Therefore, this analysis uses a regional emission factor from CCAR for N_20 and CH_4 estimates.

2030 Emissions

Residential and street light electricity consumption in 2030 was estimated using the predicted population growth rate. This analysis assumes that, under a business-as-usual trajectory, residential electricity consumption will grow at the same rate as the population—approximately 54 percent from 2007 to 2030.

Commercial, industrial, and agricultural electricity consumption was assumed to increase commensurate with job growth. The Tulare County Association of Governments predicts that the number of jobs in unincorporated Tulare County will increase by approximately 11 percent between 2007 and 2030.

Natural Gas

2007 Emissions

The Gas Company (formerly Southern California Gas) provided data for calendar year 2007 in million cubic feet (Mcf), for residential, commercial, and industrial usage. The Gas Company also provided a company-specific emission factor for CO_2, but not for N_20 or CH_4. Therefore, this analysis uses a U.S. average emission factor from CCAR for N_20 and CH_4 estimates.

2030 Emissions

Residential natural gas consumption in 2030 was estimated using the predicted population growth rate. Commercial and industrial consumption were assumed to increase commensurate with job growth. See Appendix A (of this report) for all calculations.

Solid Waste

2007 Emissions

Annual generation of methane emissions were calculated using the USEPA's LandGEM model (USEPA, 2008). The model uses as inputs the amount of waste placed in the landfill annually; a factor (Lo) for the *potential methane generation capacity*, which depends on the type and composition of waste placed in the landfill; and a factor (k) for the *methane generation rate*, which determines the rate of methane generation for the mass of waste in the landfill, and which is related to environmental conditions within the landfill – primarily the amount of moisture.

Tulare County Resource Management Agency (RMA) provided data for the three active landfills in Tulare County: Visalia Disposal Site, Woodville Disposal Site and Teapot Dome Disposal Site. Because the landfills are owned, operated and managed by the County, landfill emissions are included as direct emissions by the County. RMA provided data for total tonnage of the waste in place as of 2007 and the annual tonnage reports for 1996-2007, as well as information about which landfills

flare methane emissions and which use generators. ESA ran the LandGem model using the default values for the potential methane generation capacity (Lo) and methane generation rate (k). See Appendix A (of this report) for calculations, additional assumptions and emission factors.

2030 Emissions

Total production of solid waste in 2030 was projected using the predicted population growth rate. Also, according to RMA, Teapot Dome Disposal Site will reach its permitted capacity within the next calendar year if the current disposal rate continues. Consequently, emission calculations assume that future waste generation for Teapot Dome Disposal Site will be redirected to Woodville Disposal Site.

Mobile Sources

2007 Emissions

Off-road emissions were calculated using CARB's OFFROAD2007 Model (CARB, 2008a), and represent 2007 emissions. The off-road model captures emissions from various types of off-road equipment, including agricultural, construction, lawn and garden and off-road recreation, which includes equipment from hedge trimmers to cranes. Using the off-road model, ESA analysts generated a tons-per-day average for all off-road equipment, using a "Monday-Sunday" averaging period and "Annual" as the month or season. To obtain an annual estimate for 2007, this number was multiplied by 365. The model estimates emissions for all off-road mobile sources in Tulare County, including unincorporated and incorporated areas. Because the scope of this analysis includes unincorporated areas only, total county emissions were allocated to unincorporated Tulare County based on the percent of the population that lived in unincorporated Tulare County in 2007 (34 percent).

On-road emissions were derived using vehicle miles traveled (VMT) data from the Tulare County Association of Governments (TCAG, 2007), and emission factors from CARB's EMFAC2007 model. This model is used to calculate emission rates from all motor vehicle classifications, from passenger cars to heavy-duty trucks, operating on highways, freeways, and local roads in California (CARB, 2008b). Because VMT data was for all of Tulare County, including incorporated cities, total County emissions were allocated to unincorporated Tulare County based on the percent of the population that lived in unincorporated Tulare County in 2007 (i.e., 34 percent) and 2030 (i.e., 30 percent).

2030 Emissions

Year 2030 off-road emissions were calculated using TCAG's predicted job growth rate. This analysis assumes that, under a business-as-usual trajectory, off-road equipment usage will grow at the same rate as employment, approximately 11 percent from 2007 to 2030. See Appendix A (of this report) for calculations.

Year 2030 on-road emissions were calculated using TCAG's VMT estimates for 2030. See Appendix A (of this report) for calculations.

Dairy/Feedlot

2007 and 2030 Emissions

Dairy and feedlot operational emissions were estimated in the *Tulare County Draft Phase I Animal Confinement Facilities Plan Supplemental Program EIR* (Jones and Stokes, 2006). Total dairy and feedlot emissions of methane are derived using emission rates associated with manure decomposition and enteric digestion. The analysis calculates methane emissions under existing conditions (2006), and complete build-out conditions (2020). This analysis assumes that emissions in 2006 emissions are similar to emissions in 2007, and that emissions in 2030 will be similar to those in 2020.

Results

In 2007, Tulare County generated approximately 5.2 million tonnes of CO_2e. The largest portion of these emissions (63 percent) is attributed to dairies/feedlots, while the second largest portion (16 percent) is from mobile sources. See Table 4 and Figure 1 for annual emissions per sector.

TABLE 4
EMISSIONS BY SECTOR IN 2007

Sector	CO2e (tonnes/year)	% of Total
Electricity	542,690	11%
Natural Gas	321,020	6%
Mobile Sources	822,230	16%
Dairy/Feedlots	3,294,870	63%
Solid Waste	227,250	4%
Total	**5,208,060**	**100%**
Per Capita	**36.1**	

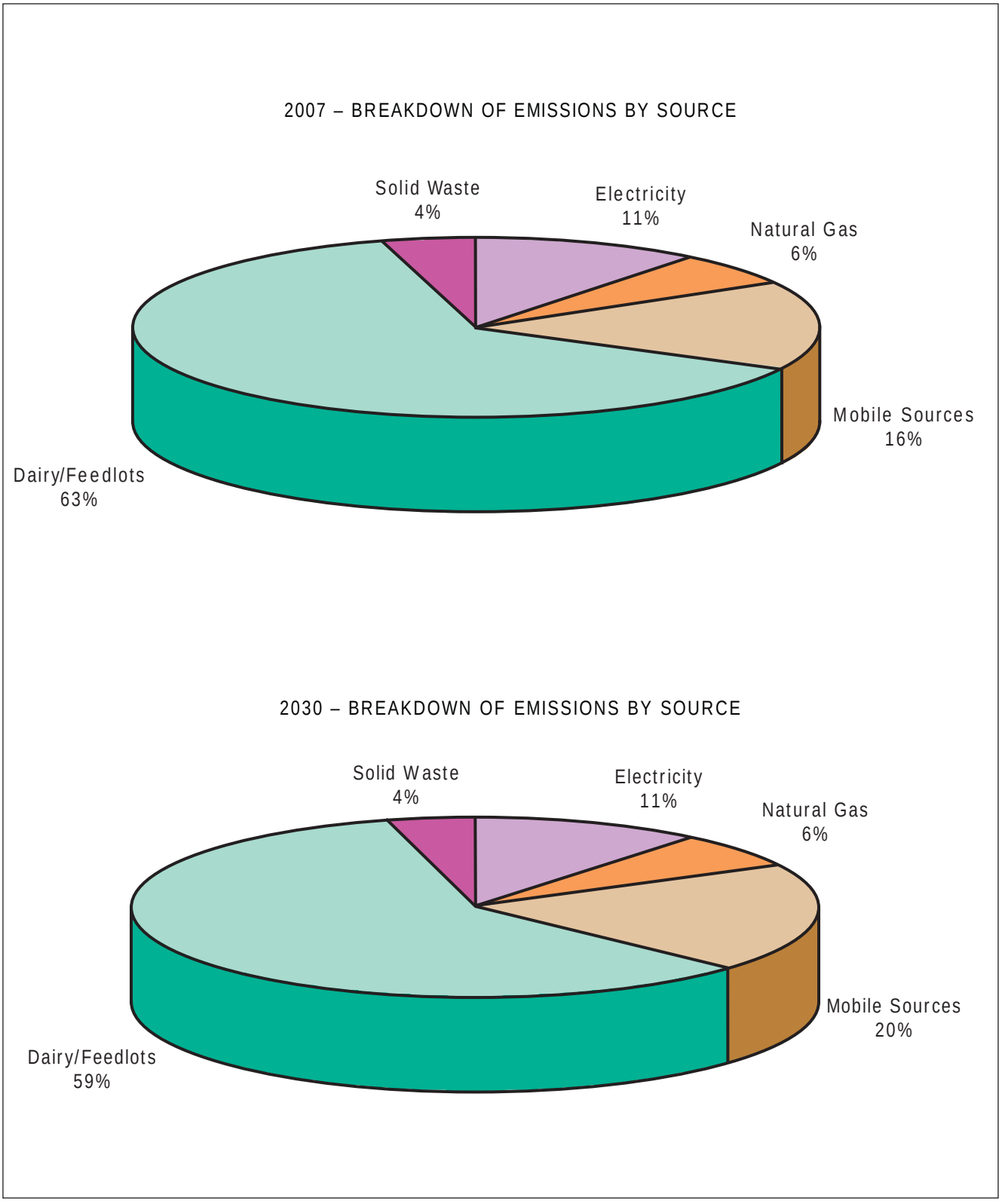
Per capita emissions in 2007 were approximately 36 tonnes of CO_2e per resident.

In 2030, Tulare County is forecast to generate approximately 6.1 million tonnes of CO_2e. The largest portion of these emissions (59 percent) is attributed to dairies/feedlots, while the second largest portion (20 percent) is from mobile sources. See Table 5 and Figure 1 for annual emissions per sector.

TABLE 5
EMISSIONS BY SECTOR IN 2030

Sector	CO2e (tonnes/year)	% of Total
Electricity	660,560	11%
Natural Gas	384,410	6%
Mobile Sources	1,212,370	20%
Dairy/Feedlots	3,601,390	59%
Solid Waste	246,750	4%
Total	**6,105,480**	**100%**
Per capita	**27.4**	

Per capita emissions in 2030 are projected to be approximately 27 tonnes of CO_2e per resident.



SOURCE: ESA, 2010

Figure 1
Breakdown of Emissions by Source – 2007 and 2030

Future Inventories

By including emissions associated with mobile sources, use of natural gas, production of electricity, decay of solid waste, and dairy/feedlot operations, this inventory was designed to capture the major sources of emissions in Tulare County in 2007 and 2030. However, if Tulare County wishes to expand upon this inventory in future years, it may consider including the following sources of emissions:

- Aircraft
- Sewage
- Rail
- Wildfires
- Fertilizer

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Appendix A: Calculations and Assumptions

ELECTRICITY

2007		Total Usage (kWh)	CO2 emissions (tonnes/yr)	CH4 emissions (tonnes/yr)	N20 emissions (tonnes/yr)	CO2e emissions (tonnes/year)
PG&E	Residential	*73,395,636*	17,445	0.22	0.12	17,487
	Commercial	*275,430,673*	65,466	0.84	0.46	65,624
	Industrial	*0*	0	0	0	0
SCE	Residential	*295,063,091*	117,645	0.90	0.50	117,815
	Commercial/Industrial	*452,885,586*	180,571	1.38	0.76	180,832
	Street Lighting	*6,982,029*	2,784	0.02	0.01	2,788
	Agricultural	*396,066,698*	157,916	1.20	0.66	158,145
Total		1,499,823,713	541,827	4.56	2.52	**542,691**

2030		Total Usage (kWh)	CO2 emissions (tonnes/yr)	CH4 emissions (tonnes/yr)	N20 emissions (tonnes/yr)	CO2e emissions (tonnes/year)
PG&E	Residential	113,376,367	26,948	0.34	0.19	27,013
	Commercial	304,464,947	72,367	0.93	0.51	72,542
	Industrial	0	0	0	0	0
SCE	Residential	455,792,510	181,730	1.39	0.76	181,992
	Commercial/Industrial	500,626,108	199,606	1.52	0.84	199,894
	Street Lighting	10,785,343	4,300	0.03	0.02	4,306
	Agricultural	437,817,709	174,563	1.33	0.73	174,815
Total		1,822,862,983	659,513	5.54	3.06	**660,563**

Data collection period *PG&E--2007 Calendar Year*
SCE--December 1, 2005-November 30, 2006

Figures in italics provided by utility

Assumptions

- 2030 Residential and Street Lighting total usage will increase proportionate to population growth (~54.5%)
- 2030 Commercial, Industrial, and Agricultural total usage will increase proportionate to job growth (~10.5%)

• Baseline Population and job growth projections provided by the Tulare County Association of Governments

Emission Factors		Used For	Source
0.879	CO2 (lb/kWh)	SCE	California Climate Action Registry General Reporting Protocol, Version 3.0, April 2008; CAMX eGRID subregion
0.524	CO2 (lb/kWh)	PG&E	PG&E (http://www.pge.com/mybusiness/environment/calculator/assumptions.shtml)
6.7E-06	CH4 (lbs/kWh)	SCE and PG&E	California Climate Action Registry General Reporting Protocol, Version 3.0, April 2008; CA average
3.7E-06	N20 (lbs/kWh)	SCE and PG&E	California Climate Action Registry General Reporting Protocol, Version 3.0, April 2008; CA average

NATURAL GAS

		Total Usage (Mcf/yr)	CO2 emissions (tonnes/yr)	CH4 emissions (tonnes/yr)	N20 emissions (tonnes/yr)	CO2e emissions (tonnes/year)
2007	Residential	*1,239,323*	67,087	7.46	0.01	67,276
	Commercial	*2,059,449*	111,483	12.39	0.01	111,796
	Industrial	*2,614,877*	141,549	15.74	0.01	141,947
	Total	*5,913,648*	320,119	35.59	0.03	**321,019**
2030	Residential	1,914,418	103,632	11.52	0.01	103,923
	Commercial	2,276,543	123,234	13.70	0.01	123,581
	Industrial	2,890,521	156,470	17.40	0.02	156,910
	Total	7,081,483	383,337	42.62	0.04	**384,414**

Data collection period: *2007 Calendar Year*

Figures in italics provided by utility

Assumptions

- 2030 Residential will increase proportionate to population growth (~54.5%)
- 2030 Commercial and Industrial will increase proportionate to job growth (~10.5%)
- Population and job growth projections provided by the Tulare County Association of Governments

Emission Factors		**Source**
11.7	CO2 (lbs/therm)	The Gas Company: Gail Henry, Tulare County Utility Coordinator
0.0059	CH4 (kg/MMBtu)	California Climate Action Registry General Reporting Protocol, Version 3.0, April 2008; weighted U.S. average
0.0001	N20 (kg/MMBtu)	California Climate Action Registry General Reporting Protocol, Version 3.0, April 2008; weighted U.S. average

Natural Gas Conversion Factors

1	cubic foot	1050	Btu
1	therm	100,000	Btu
1	Mcf	10.2	therms

1	MMBtu	10	therms

Source: The Gas Company. http://www.socalgas.com/residential/billing/meter.html

MOBILE SOURCES

OFF-ROAD EMISSIONS			CO2 emissions	CH4 emissions	N20 emissions	CO2 equivalent (Total emissions)
2007	Total County	tonnes/day	1,047	0.32	0.05	1,070
	Total County	tonnes/year	381,981	116.25	18.66	390,449
	Unincorporated County	**tonnes/year**	**128,298**	**39.05**	**6.27**	**131,142**
2030	**Unincorporated County**	**tonnes/year**	**141,822**	**43.16**	**6.93**	**144,966**

Data Source	OFFROAD2007 Model, California Environmental Protection Agency, Air Resources Board (CARB)
Data Collection Period	*Calendar Year 2007*

Assumptions

- Total County emissions are allocated to unincorporated areas on a per capita basis (using % population residing in unincorporated areas).
- 2030 emissions will increase proportionate to job growth (~10.5%)
- Population and job growth projections provided by the Tulare County Association of Governments (TCAG, 2008)

ON-ROAD EMISSIONS			CO2 emissions	CH4 emissions	N20 emissions	CO2 equivalent (Total emissions)
2007	Total County	lbs/day	12,062,280	1,058	1,138	12,427,774
	Total County	tonnes/year	1,997,046	175	188	2,057,558
	Unincorporated County	**tonnes/year**	**670,756**	**59**	**63**	**691,081**
2030	Total County	lbs/day	20,819,696	1,810	1,946	21,444,823
	Total County	tonnes/year	3,446,934	300	322	3,550,432

	Unincorporated County	**tonnes/year**	**1,032,637**	**101**	**108**	**1,067,400**	

Data Source	CO2 Emission Factors: EMFAC2007 Vehicle Miles Traveled: Tulare County Association of Governments (TCAG)
Data Collection Period	Calendary Year 2007

Assumptions

- Total County emissions are allocated to unincorporated areas on a per capita basis (using % population residing in unincorporated areas).
- VMT: Assuming 20% @ 35mph, 60% @ 55mph, 20% @ 65mph
- Population projections provided by the Tulare County Association of Governments (TCAG, 2008)

2030 Trip Percentages by Category (from URBEMIS defaults)

Type	Percent	# VMT
LDA	49.90%	8,808,893
LDT	33.60%	5,931,439
MDT	7.80%	1,376,941
HDT	2.70%	476,633
BUS	4.00%	706,124
MCY	2.00%	353,062
Total	100.00%	17,653,092

2007 Trip Percentages by Category (from URBEMIS defaults)

Type	Percent	# VMT
LDA	49.90%	5,150,316
LDT	33.60%	3,467,948
MDT	7.80%	805,059
HDT	2.70%	278,674
BUS	4.00%	412,851
MCY	2.00%	206,425
Total	100.00%	10,321,274

		LDA	**LDT**	**MDT**	**HDT**	**BUS**	**MCY**
CO2 Emission Factors		(g CO2/mi)	(g CO2/mi)	(g CO2/mi)	(g CO2/mi)	(g CO2/mi)	(g CO2/mi)
2007	35mph	390.436	466.381	619.381	1669.4	1530.9	112.7

	55mph	397.093	473.709	629.43	1547.7	1536.0	99.2
	65 mph	485.447	577.422	771.999	1599.4	1638.5	104.3
2030	35mph	385.552	482.063	621.818	1659.5	1527.2	139.9
	55mph	392.544	490.472	632.365	1541.0	1531.8	171.4
	65 mph	479.469	599.307	781.252	1592.6	1626.3	235.8

Source: EMFAC 2007

CH4 emission factor	0.0465	grams/mile
N20 emission factor	0.05	grams/mile

Source: Calif. Climate Action Registry (CCAR) Protocol ver 3.0; rate in grams/mile; asumes 60% cars, 35% light trucks, 5% heavy diesel trucks & older vehicles.

DAIRY / FEEDLOT

	Methane	Methane	CO2 equivalent
	(tons/yr)	(tonnes/year)	(tonnes/year)
Existing (2006)	145,279	131,795	3,294,872
Future (2020)	158,794	144,055	3,601,387

Data Source	*Jones and Stokes, 2006: Tulare County Draft Phase I Animal Confinement Facilities Plan Supplemental Program EIR*
Data Collection Period	*2006*

Assumptions

- 2006 emissions are similar to 2007 emissions
- 2020 emissions are similar to 2030 emissions

Emission Factors		**Used For**
112.56	CH4 (lbs/head/yr)	Manure Decomposition -Dairy and Feed Lot
320.56	CH4 (lbs/head/yr)	Enteric Digestion -Dairy
215.65	CH4 (lbs/head/yr)	Enteric Digestion -Feed Lots

Sources

Jones and Stokes, 2006, *Tulare County Draft Phase I Animal Confinement Facilities Plan Supplemental Program EIR*

WASTE

2007	**Waste in Landfill** (tons)	**Annual Fugitive Emissions** (tonnes CH4/yr)	**Total equiv. CO2** (tonnes/yr)
Teapot Disposal Site	*2,421,480*	2,256	56,395
Woodville Disposal Site	*2,396,736*	2,441	61,015
Visalia Disposal Site	*4,612,704*	4,393	109,837
Total	**9,430,920**	**9,090**	**227,247**

2030	**Waste in Landfill** (tons)	**Annual Fugitive Emissions** (tonnes CH4/yr)	**Total equiv. CO2** (tonnes/yr)
Teapot Disposal Site	2,496,245	467	11,679
Woodville Disposal Site	4,775,118	3,863	96,573
Visalia Disposal Site	7,805,844	5,540	138,497
Total	**15,077,207**	**9,870**	**246,749**

Data Source *LandGem Model, United States Environmental Protection Agency (USEPA)*
Tulare County Resource Management Agency (RMA)

Data Collection Period *Calendar Year 2007*

Figures in italics provided by RMA

Assumptions

• 2030 total solid waste generation will increase proportionate to population growth

• LandGem default values for potential methane generation capacity and methane generation rate are comparable to actual values for the three disposal sites

• Annual disposal rates at each landfill did not change from 1971 to 1996

• Because the landfills are owned, operated, and managed by the County, land fill emissions are included as direct emissions by the County. As a result, emissions are for the entire County, not just for unincorporated areas.

Visalia Disposal Site Data

37	years of operation
4,612,704	tons of waste in place
124,668	annual average
106,913	average of last three years (05 - 07)
1,448,953	sum of 96-07 - 12 years

3,163,751	waste in place as of 1996
126,550	annual average (1971 - 1996)
114,111	average from 2001 to 2007
1.0241649	county-wide annual % Increase in Population
60%	percent of total methane produced captured by thel landfill gas collection system
98%	efficiency rate of internal combustion engine generator

• Visalia Disposal Sites uses a internal combustion engine generator to convert methane emissions to electricity

Woodville Disposal Site Data

37	years of operation
2,396,736	tons of waste in place
64,777	annual average
73,622	average of last three years (05 - 07)
998,407	sum of 96-07 - 12 years
1,398,329	waste in place as of 1996
55,933	annual average (1971 - 1996)
67,465	average from 2001 to 2007
1.0241649	county-wide annual % Increase in Population
60%	percent of total methane produced captured by the landfill gas collection system
98%	efficiency rate of internal combustion engine generator

• Woodville Disposal Sites uses a internal combustion engine generator to convert methane emissions to electricity

Teapot Disposal Site Data

37	years of operation
2,421,480	tons of waste in place
65,445	annual average
72,190	average of last three years (05 - 07)
739,341	sum of 96-07 - 12 years
1,682,139	waste in place as of 1996
67,286	annual average (1971 - 1996)
63,244	average from 2001 to 2007
1.0241649	county-wide annual % Increase in Population
60%	percent of total methane produced captured by the landfill gas collection system (2007)
75%	percent of total methane produced captured by the landfill gas collection system (2030)
10%	percent of methane that is oxided as it passes through earthen landfill cover material (of methane not captured by the landfill gas collection system) (2030)

99% efficiency rate of disposal site flares

- The Teapot Dome Disposal Site will reach its permitted capacity in 2009 and will cease accepting new waste.
- After 2009, waste that would have gone to Teapot Dome will be diverted to Woodville Disposal Site
- Teapot Dome Disposal Sites flares captured landfill gas