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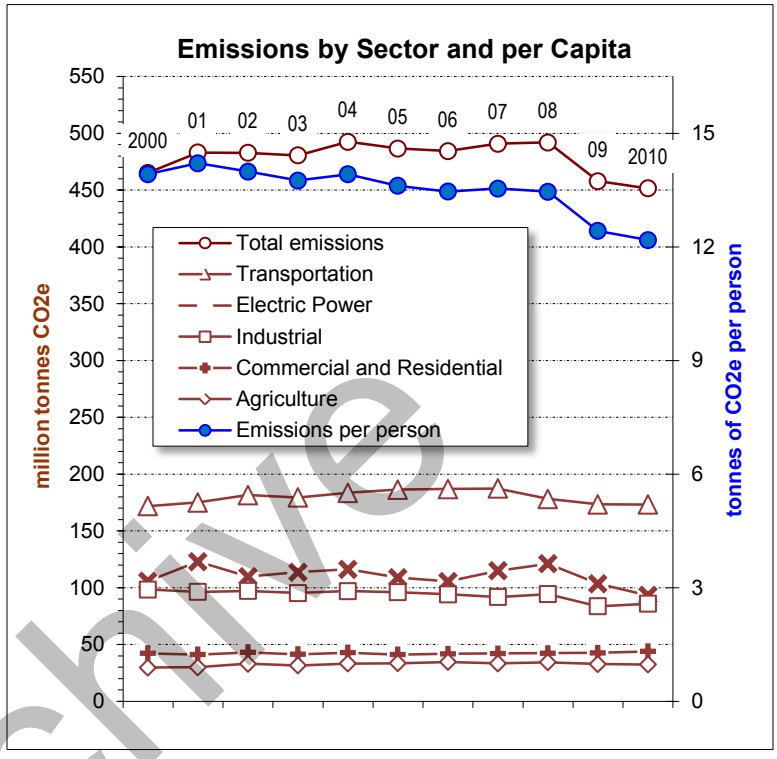
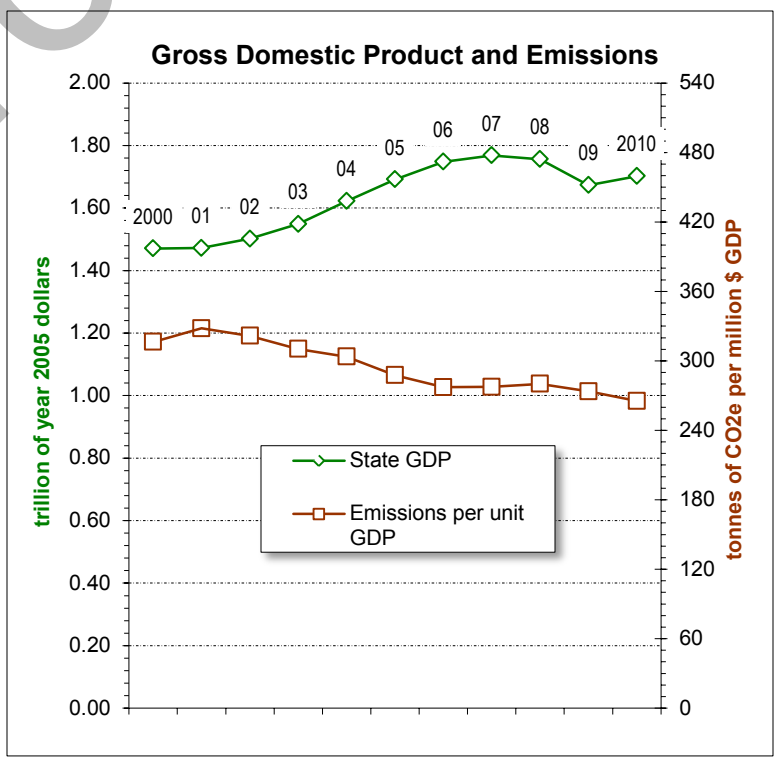
California Greenhouse Gas Emissions for 2000 to 2010 – Trends by Emissions and Other Indicators

Overview

Annual emission inventories provide the basis for establishing historical emission trends. Trends are useful in tracking progress towards a specific target or goal. There are many factors affecting year-to-year changes in greenhouse gas (GHG) emissions, including the level of economic activity, demography, improved efficiency, and changes in environmental conditions such as drought. Evaluating emission trends requires recognizing these influences across the overall inventory as well as by sector and sub-sector within the inventory.





In 2010, California's real Gross Domestic Product (GDP) —adjusted for inflation— began to grow again after falling for two years due to the economic recession. Statewide GHG emissions decreased slightly in 2010 following a marked drop in 2009. The 2009 drop in emissions included a decrease in on-road transportation, electricity generation and industrial emissions. The further decrease in emissions in 2010 also reflects an increase in the availability of water for use in hydroelectric power generation relative to 2009.

Over the last decade, California's gross emissions of greenhouse gases decreased 2.9 percent from 465.2 million tonnes of CO_2e in 2000 to 451.6 million in 2010, with a maximum of 492.6 million in 2004.

During the same period, California's population grew by 10.9 percent from 33.4 to 37.1 million people[1] and GHG emissions per person decreased from 13.9 to 12.2 tonnes of CO_2e per

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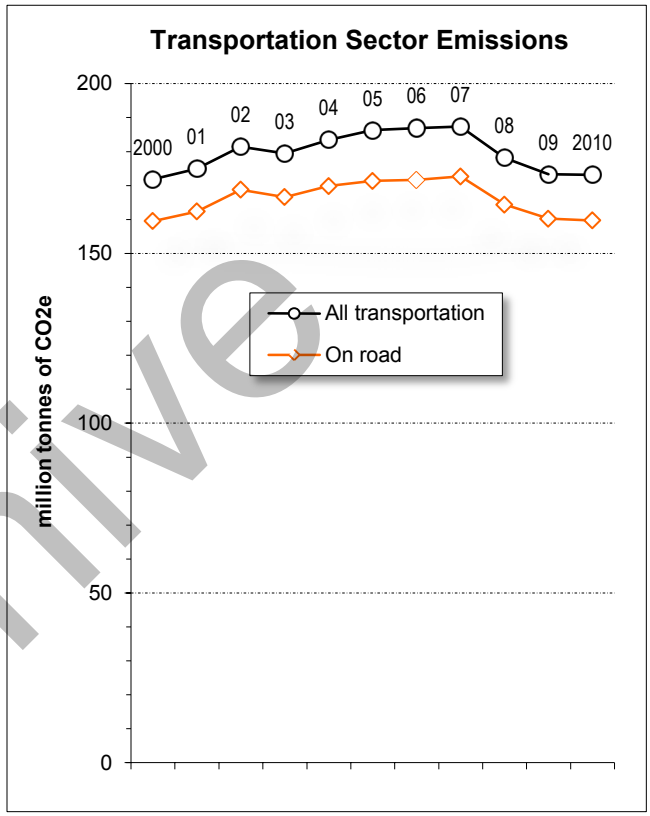
person. During that period, California's Gross Domestic Product (GDP) increased from $1.47 trillion in 2000 to $1.7 trillion in 2010 (in 2005 dollars)[2]. The GHG intensity of California's economy decreased from 316.4 tonnes CO_2e per million dollars of GDP in 2000 to 265.3 tonnes per million dollars in 2010.

For each major sector of the statewide greenhouse gas inventory, a trend summary is provided below along with a time-series graph.

Transportation

In 2010, GHG emissions from the transportation sector leveled after declining noticeably two years in a row. The transportation sector remained the largest source of emissions with 38.3 percent of California's gross inventory.



The largest category within the transportation sector is on-road, which includes passenger vehicles and heavy duty trucks. On road emissions from passenger vehicles and heavy duty trucks constitute 92.2 percent of the transportation sector total. On road emissions grew to a maximum of 172.7 million tonnes of CO_2e in 2007, and decreased to 159.7 million in 2010. The amount of gasoline and diesel fuel consumed by on-road vehicles followed a similar trend.

Over this inventory period, the average retail price of gasoline and diesel fuel in California first decreased, reaching a minimum in 2002 before steadily increasing to twice the 2002 price in 2010. In the summer of 2008, fuel prices spiked, reaching a historic maximum ($4.48 per gallon for gasoline and $4.97 for diesel)[3]. The consumption of gasoline and diesel fuel decreased dramatically in 2008, and continued to decline in 2009 and 2010.

Electric Power

GHG emissions from electric power generation varied from 105.8 million tonnes of CO_2e in 2000 to 93.3 million in 2010, without exhibiting a clear trend over the period. California electricity consumption[4] grew from 265.8 TWh in 2000 to 287.8 TWh in 2008 and fell to 275 in 2010. During the same time the electricity consumed per million dollars of GDP —adjusted for inflation— decreased from 181 to 162 MWh.

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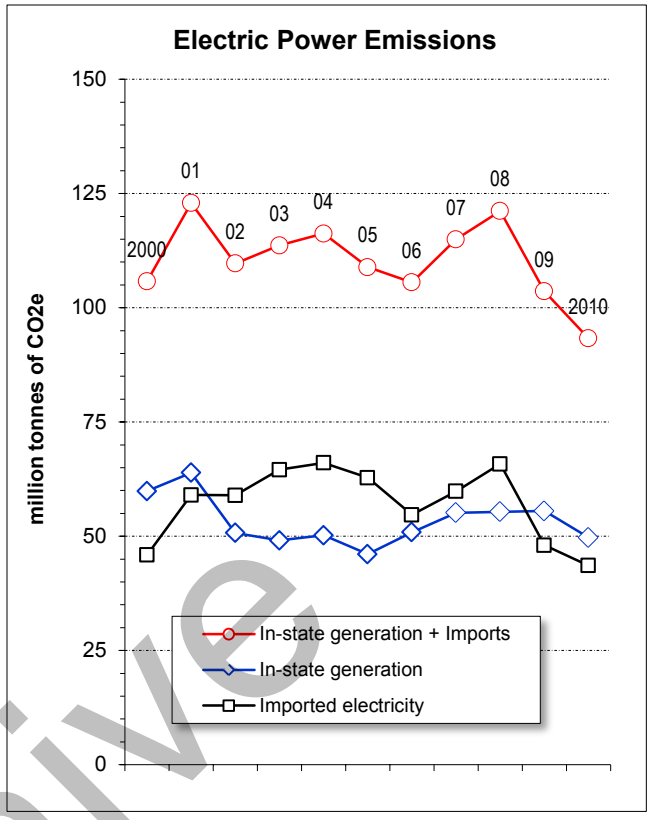
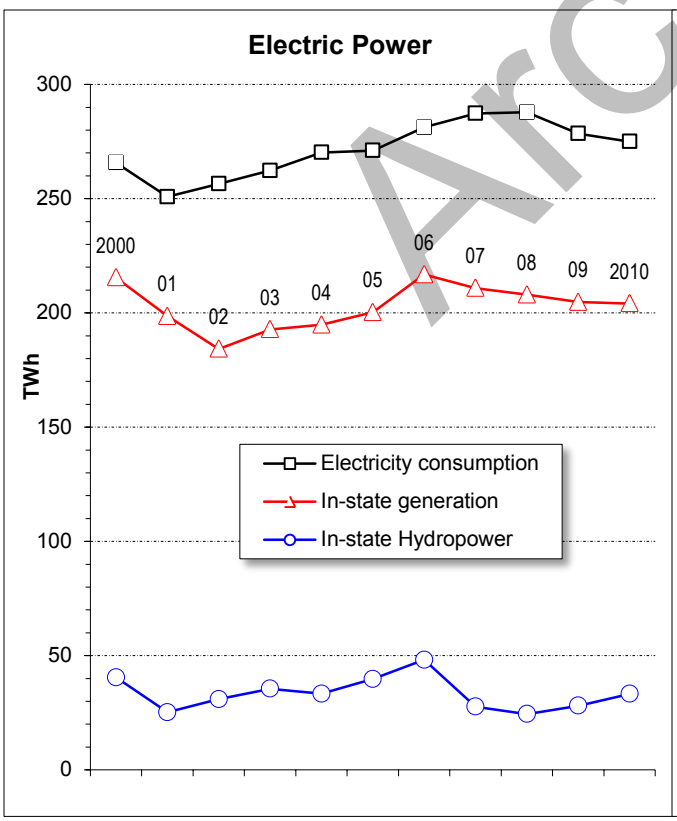
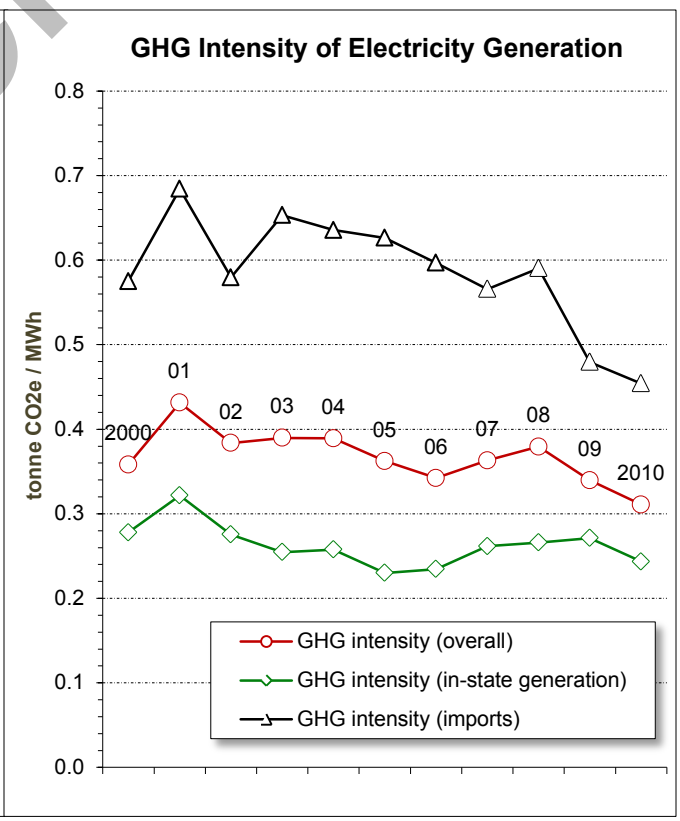
California produces roughly 70 percent of its electricity consumption from power plants located within the state[5]; the rest is imported from other western states. In-state hydropower production is one of the determinants of how much electricity needs to be imported. In-state hydropower generation varied with hydrologic conditions: it reached minima of 25.2 TWh in 2001 and 24.4 TWh in 2008 (drought years) and a maximum of 48.1 TWh in 2006 (a wet year). Hydropower production, and other non-emitting sources of energy, also condition the GHG intensity of electricity generation (i.e., the quantity of CO2e emitted per MWh produced). The GHG intensity of California electricity peaked in 2001, a year marked by drought and electricity market manipulation, and reached a low point in 2006, a year of record water flow. The GHG intensity of electricity imports fell in 2009 and 2010 with a marked increase in the share of non-emitting sources (hydropower, nuclear, wind, solar) which went from 10.1 percent in 2008 to 20.9 percent in 2010.







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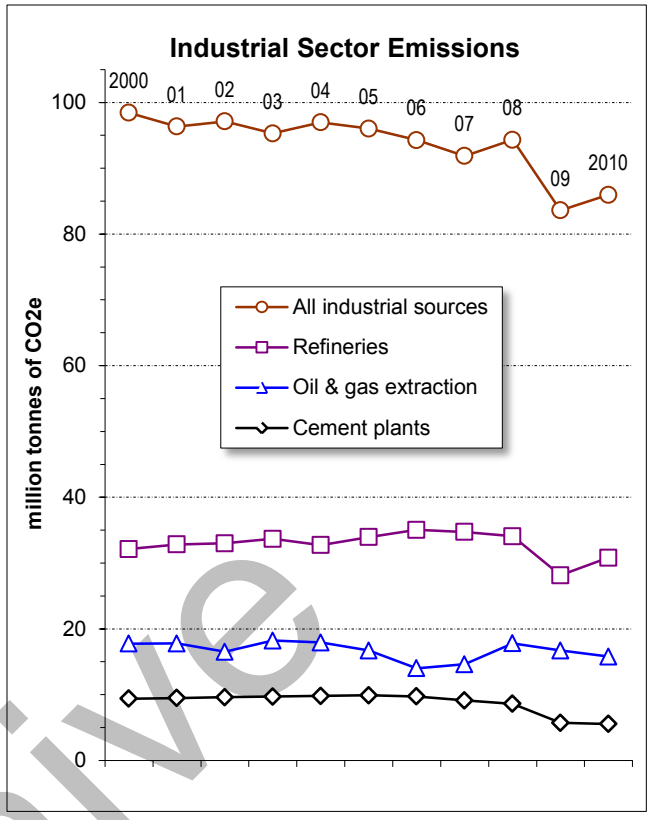
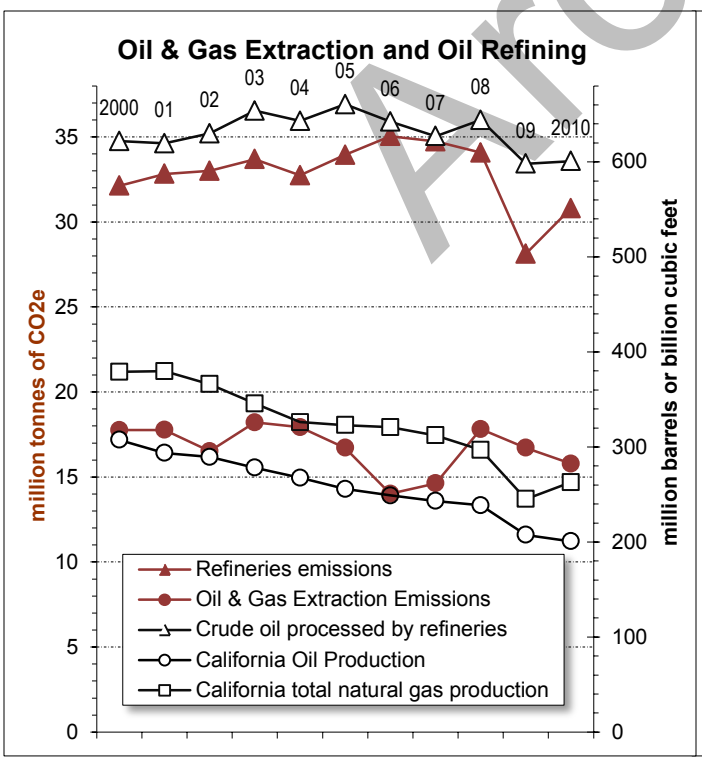
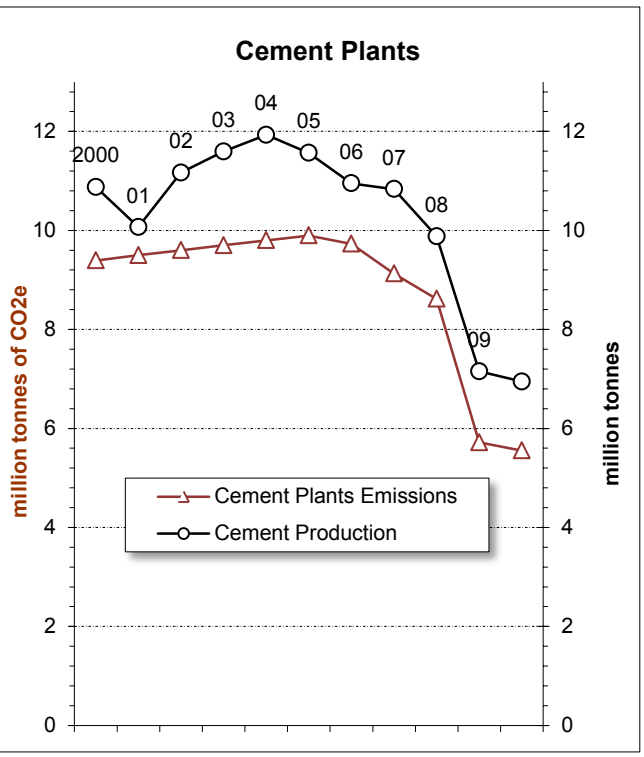
Industrial

Industrial emissions varied from 98.4 million tonnes of CO_2e in 2000 to 86.0 in 2010. Emissions from refineries represent more than a third of the category's total and have been growing from 32.1 million tonnes of CO_2e in 2000 to a maximum of 35 million in 2006. Refineries emissions declined to 28.1 million in 2009, but grew back to 30.8 million in 2010. The total net crude oil processed by refineries[6] was 622 million barrels in 2000 and peaked at 661 million in 2005; it dipped to 598 million in 2009 and was 601 million barrels in 2010.



Overall, emissions from oil and gas extraction, the second largest industrial source, have declined slightly: from 17.7 million tonnes of CO_2e in 2000 to 15.8 million in 2010. Oil and gas production in California[7] declined substantially during the period: from 307 to 201 million barrels of oil and from 379 billion cubic feet of natural gas to 263 billion. Cement plants' emissions decreased 34 percent in 2009, reflecting a large decrease in demand for cement. Nationally, demand for cement fell by 26.5 percent in 2009 to the lowest level since 1983[8]. This decline continued in 2010 with California cement plants operating at 51 percent capacity[9].





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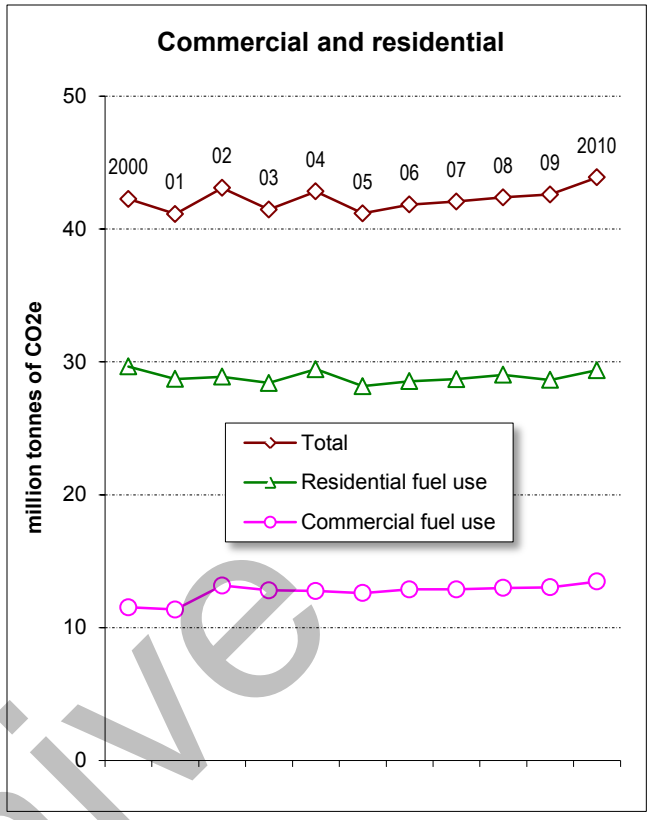
Commercial and Residential

Together, emissions from the commercial and residential sectors have remained about the same over the period, with limited year-to-year ups and downs. Individually, they exhibit different overall trends.

Emissions from residential fuel remained the same: 29.7 million tonnes of CO_2e in 2000 and 29.4 million in 2010, mostly from natural gas combustion. At the same time, the number of housing units[10] grew steadily from 12.2 million units in 2000 to 13.7 million in 2010. This suggests that the fuel consumption per housing unit has steadily declined.

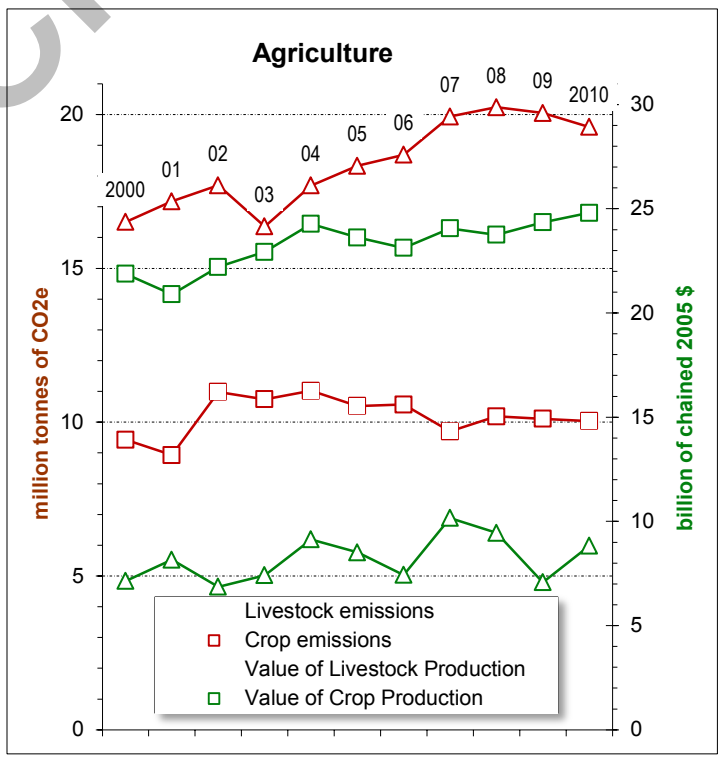
Emissions from commercial fuel use grew from 11.5 million tonnes of CO_2e in 2000 to 13.5 million in 2010. Commercial and institutional floor space grew steadily in California[11] from 6.28 billion square feet to 7.54 billion over the period. This sub-category does not exhibit an apparent change in fuel use per unit of space.



Agriculture

Emissions from agriculture grew from 29.7 million tonnes of CO2e in 2000 to 32.4 million in 2010. Over the period, emissions from livestock enteric fermentation and manure management increased form 16.5 million tonnes of CO2e to 19.6 million. The value of livestock production includes meat, poultry, eggs and dairy products. California dairies increased their herds from 1.49 million cows in 2000 to 1.76 million in 2010, and their total milk production from 14.6 to 18.3 million metric tons[12].

Emissions from crop growing and harvesting went from 9.4 million tonnes of CO2e in 2000, to 11 million in 2004, and returned to 10 million in 2010. The value of crop production includes field crops, fruits, nuts and vegetables.



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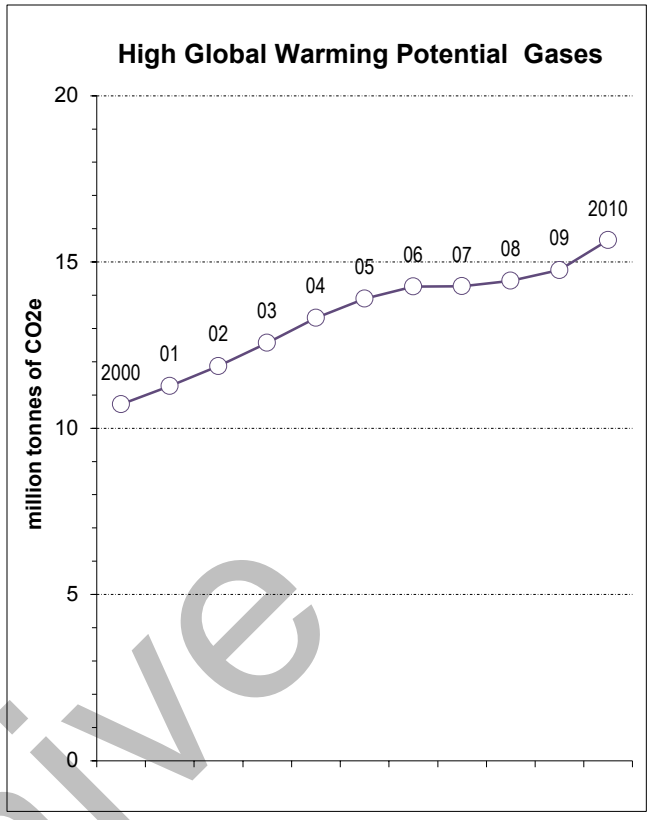
High Global Warming Potential Gases

Since the 1990's, use of ozone depleting substances (ODS) substitutes such as HFCs and PFCs has grown progressively as they are phased in as replacements for now banned CFCs and HCFCs. These gases are used in a variety of applications including refrigeration and air conditioning, solvent cleaning, foam production, sterilization, fire extinguishing, and as aerosol propellants.

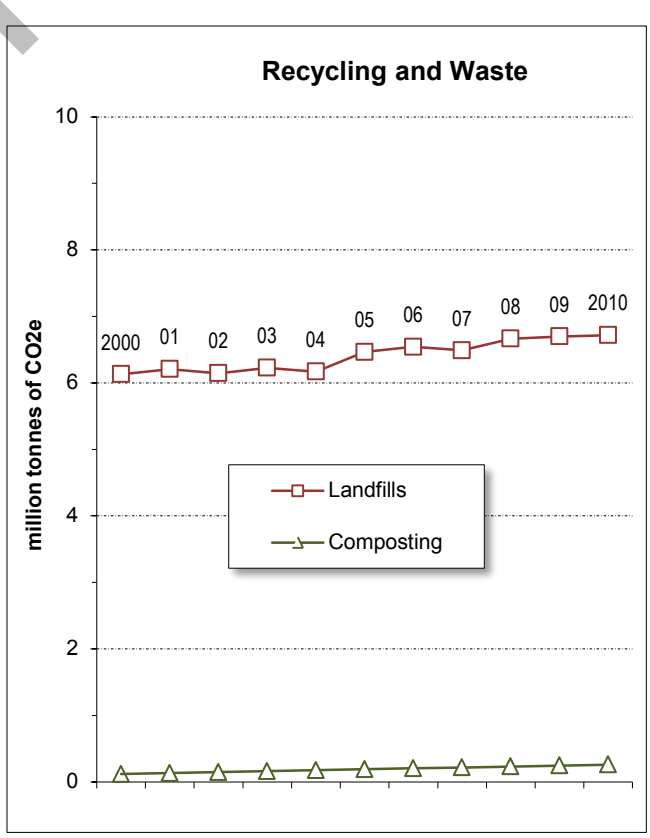
As a result, emissions of high global warming potential (HGWP) gases grew steadily from 10.7 million tonnes of CO2e in 2000 to 15.7 million in 2010, driven by the 61 percent increase in emissions of ODS substitutes.

Fugitive emissions of both SF_6 from electricity grid equipment and HGWP gases from semiconductor manufacturing are estimated to have decreased over the time period. However, emissions of HGWP gases that are used as ODS substitutes more than offset these reductions.



Recycling and Waste

Emissions from recycling and waste grew from 6.13 million tonnes of CO2e in 2000 to 6.72 million in 2010. Emissions from landfills constitute more than 95 percent of the total. In California, municipal solid waste landfills are the second largest anthropogenic source of methane. 37 million tons of solid waste were deposited in California's landfills in 2000; this amount grew to 42 million tons in 2005 and then declined to 30 million in 2010[13]. This decrease in annual landfill deposits is not reflected in landfill emissions however, because it is the overall amount of waste-in-place accumulated over the years that drives the amount of landfill gas produced. ARB's Regulation to Reduce Methane Emissions from Municipal Solid Waste Landfills is expected to reduce landfills emissions by 1.5 million tonnes of CO2e by 2020. GHG emissions from composting have remained relatively small since 2000.



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[4] California Energy Commission – California Energy Consumption Database
[5] Based on California Energy Commission and U.S. Energy Information Administration data
[6] California Energy Commission – Weekly Fuels Watch Reports
[7] California Department of Conservation – Annual Reports of the State Oil & Gas Supervisor
[8] U.S. Geological Survey – 2009 Mineral Yearbook
[9] U.S. Geological Survey – 2010 Mineral Yearbook
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[12] U.S. Department of Agriculture – National Agricultural Statistics Service
[13] CalRecycle - Solid Waste Disposal Tonnage Summary Data

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