

A Community-Wide
Greenhouse Gas Emissions Inventory
for Pacifica, California
for 2005

Prepared by

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June 2009



Introduction	3
Methods	3
Inventory Results.....	4
Key Findings.....	5
Goals	6
Details of findings, methods, and data sources	6
Residential Natural Gas and Electricity Use	6
Passenger Vehicle Use	8
Air Travel	8
Solid Waste	9
Commercial Natural Gas and Electricity Use.....	9
County and Special Districts Natural Gas and Electricity.....	9
Conclusions.....	10
Acknowledgements	10
References.....	11
Appendix A: Biography for Carlos Davidson	12
Appendix B: Membership of the Pacifica Climate Committee.....	12

Introduction

The Pacifica Climate Committee is a citizens group in Pacifica, California working to address climate change issues in our community. In 2008 the committee successfully urged the City Council and mayor to sign the U.S. Mayors Climate Protection Agreement ^[1]. The Climate Committee then began working in conjunction with City government on a community-wide greenhouse gas (GHG) emissions inventory to complement the City's inventory for government operations. The community-wide inventory can help guide Pacifica's efforts to reduce emissions from the community as a whole. A community-wide focus is necessary for emissions reductions efforts because city operations account for less than three percent of total Pacifica emissions. Greenhouse gas inventories indicate the major sources of emissions and their relative size, and therefore help identify opportunities for emissions reductions. With the completion of the inventory the Pacifica Climate Committee is now working on a set of recommendations to submit to the city for its Climate Action Plan.

Methods

A greenhouse gas inventory is an accounting of emissions sources that can be tracked over time to help an entity achieve its emissions reduction goals. An inventory thus covers fewer emissions sources than a "carbon footprint" analysis, which aims to include all sources of emissions. For example the current inventory does not include emissions associated with all the goods purchased by Pacificans, and it does not include the life-cycle emissions associated with electricity generation.

The World Business Council for Sustainable Development and the World Resources Institute define three 'scopes' of reporting for greenhouse gas inventories. The first scope covers direct sources of GHG emissions that are owned or controlled by an entity, including the release of refrigerants and natural gas used in residences and city buildings. The second scope covers imported sources of energy, such as electricity. The third scope refers to transportation and solid waste. This inventory covers all three scopes for the year 2005. We chose the year 2005 to match the city operations inventory conducted by the city. Due to lack of data we were not able to calculate a 1990 base-year inventory.

To complete the inventory we used the Clean Air and Climate Protection greenhouse gas inventory calculator developed by the International Council for Local Environmental Initiatives (ICLEI). For air travel and solid waste calculations we also made use of a second inventory calculator developed by the organization Clean Air Cool Planet ^[2].

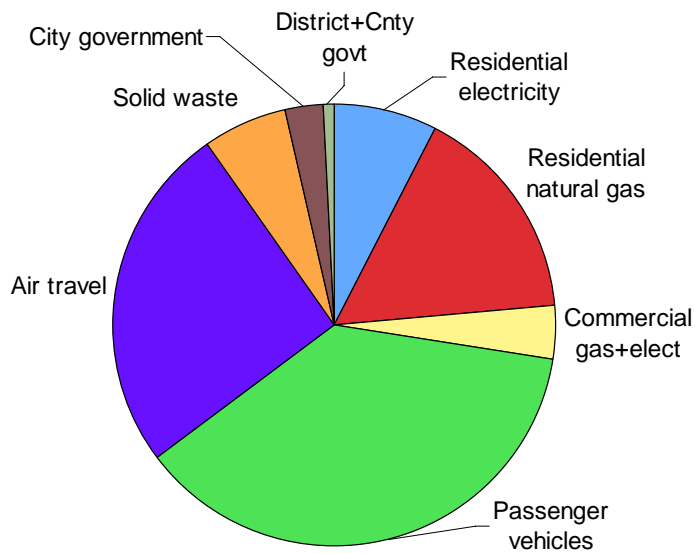
Our inventory calculations include emissions of three greenhouse gases: carbon dioxide, methane and nitrous oxide. Rather than reporting emissions of each gas separately, greenhouse gas inventories typically report emissions in metric tonnes of carbon dioxide equivalents in which the amount of methane and nitrous oxide are converted to carbon dioxide equivalents based on how much they contribute to climate warming. Following State of California and international convention our inventory reporting is in metric tonnes. One metric tonne is 1000 kilograms or 2,205 pounds.

Inventory Results

Pacifica Community-wide Greenhouse Gas Emissions 2005

Source	1000 metric tonnes eCO ₂	Share
Residential electricity	17.1	7.4%
Residential natural gas	37.8	16.3%
Passenger vehicles	86.2	37.2%
Community air travel	58.8	25.4%
Solid waste	14.3	6.2%
Commercial electricity	4.5	1.9%
Commercial natural gas	4.5	1.9%
City government operations	6.6	2.8%
County + District govt Gas+Elect	1.9	0.8%
Total	231.7	

Note: eCO₂ is carbon dioxide equivalents



Key Findings

Including city government operations, Pacifica's community-wide greenhouse gas emissions in 2005 were 231,695 metric tonnes of carbon dioxide equivalents (tonnes eCO₂). City government operations accounted for less than three percent of total emissions. Reducing greenhouse emissions from Pacifica will therefore require the city government and the community to work together to reduce emissions from city operations, and more importantly, from the community as a whole.

The single largest source of emissions was from passenger vehicles, at 86,204 tonnes eCO₂, accounting for 37 percent of total emissions. This highlights that significant emissions reductions will require addressing transportation – both encouraging use of public transit and ride sharing, and encouraging use of high fuel efficiency and alternate fuel vehicles.

Air travel by Pacificans was the second largest source of emissions, at 58,830 tonnes eCO₂, accounting for 25 percent of total emissions. Many community level inventories do not include air travel, in part because it is not clear how city government can effect changes in air travel. The Pacifica Climate Committee felt it was important to include air travel because it is a large share of total emissions. Our hope is that including air travel will help educate the public and encourage Pacificans to fly less.

Residential natural gas use accounted for 16 percent of total emissions, and residential electricity was seven percent of total emissions (37,782 and 17,109 tonnes eCO₂ respectively). From 2003 to 2007 Pacifica residential electricity use grew 7.7 percent and natural gas use increased 1.9 percent, while Pacifica's population was roughly unchanged. Reducing residential energy use will require programs such as encouraging and incentivizing home energy audits for existing buildings, city help with financing for home insulation, and solar water thermal, or photovoltaic systems. The development of Green building codes for new buildings and remodels will be key. Pacifica city government can play a leadership role by setting high energy and environmental standards for all new city buildings and retrofits.

Solid waste generated 14,267 tonnes eCO₂, accounting for six percent of total emissions. In landfills food and other organic waste generate methane, a potent greenhouse gas. Pacifica has the opportunity to easily reduce emissions from solid waste. The best approach is to prevent organic material from going to the landfill. If Pacifica had curbside pickup of compostables, and organic waste was taken to a large-scale composting facility, emissions from solid waste could be greatly reduced. San Francisco, Oakland, and Hayward have been using such a system successfully.

Commercial natural gas and electricity use together accounted for four percent of total emissions. Commercial gas and electric is a relatively small share of total emissions so it is not a potential source of large emissions reductions. However commercial business' commitment to energy use reductions can in some cases be a model for patrons and therefore can contribute to overall community commitment to reduce emissions.

Goals

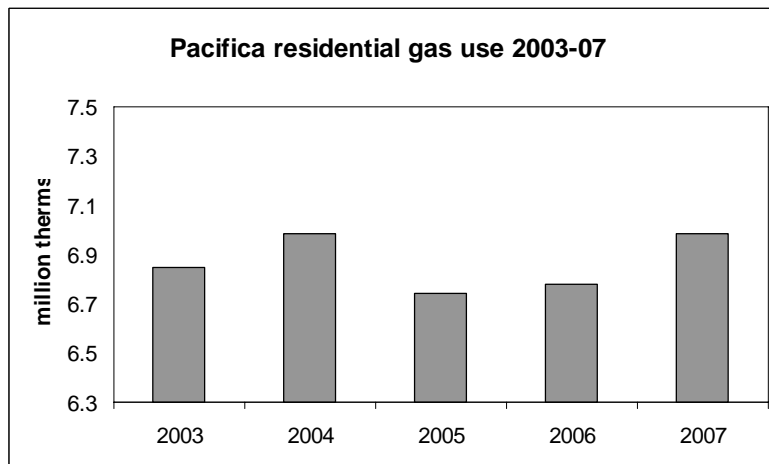
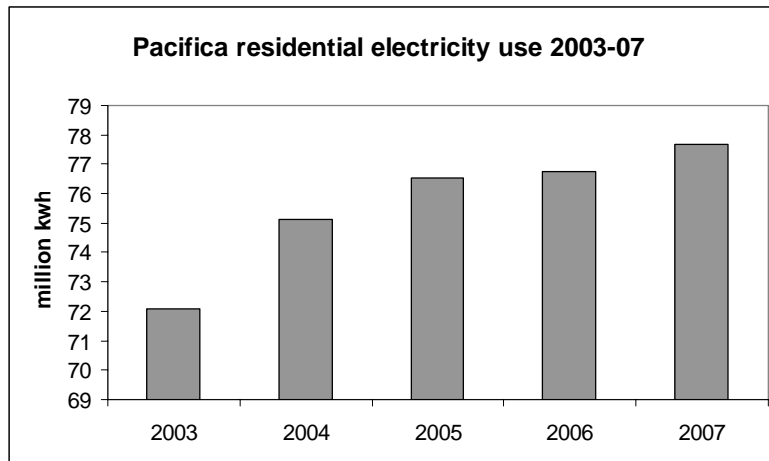
The city of Pacifica signed on to the U.S. Conference of Mayors Climate Protection Agreement ^[1], which committed the city to “strive to meet or beat the Kyoto Protocol targets.” The Kyoto Protocol targets call for seven percent emissions reductions from 1990 levels by 2012. Due to lack of data we have not been able to calculate 1990 baseline emissions for Pacifica. However if we assume that Pacifica’s emissions have increased since 1990 at the same rate as for the state of California as a whole, then our levels in 2005 would be approximately 15 percent above 1990 levels. Thus Kyoto Protocol goals imply a 22 percent reduction below 1990 levels by 2012. The state of California has set a greenhouse gas emissions reduction target of returning to 1990 emissions levels by the year 2020 (equivalent to a 15% reduction from 2005 levels), and 80% below 1990 levels by 2050 ^[3]. The Kyoto Protocol and very likely the successor treaty to be negotiated in Copenhagen at the end of 2009, call for much steeper and earlier reductions. We believe Pacifica should take a leadership role and commit to reducing total community-wide emissions by 20 percent below 2005 levels by 2020, and 80% below 1990 levels by 2050.

Details of findings, methods, and data sources

Residential Natural Gas and Electricity Use

Pacific Gas and Electric Company (PG&E) provided us with total meter readings for residential electricity and natural gas use for the years 2003-2007. For 2005, total residential electricity use was 75.6 million kWh and total natural gas use was 6.7 million therms. When natural gas is burned in residential stoves, furnaces, clothes dryers and other appliances it releases greenhouse gases. Electricity use in residences does not result in GHG emissions at the site. Greenhouse gas emissions from electricity result from electricity generation and are determined by how the electricity is generated (e.g., coal or wind power). For our inventory calculations we used an electricity emissions factor of 0.492859 lbs eCO₂ per kWh, supplied by ICLEI. This is the California Climate Action Registry verified emissions per kWh for PG&E supplied electricity in 2005.

While Pacifica’s population was little changed from 2003 to 2007, residential electricity use increased 7.7 percent. This is a disturbing trend. We would have hoped that with the recent increase in public awareness of the need for energy conservation, and the now easy availability of compact florescent light bulbs and energy efficient appliances that residential energy use per capita would be declining. Instead Pacificans are using more and more electricity each year in their homes.



It should be noted that there was some use of electricity in Pacifica that we have not accounted for because it was purchased through Direct Access agreements between the user and the provider, rather than purchased from PG&E. Although PG&E distributes and measures Direct Access electricity, the identity of the purchaser and the quantity are suppressed from the public information provided by PG&E.

Passenger Vehicle Use

Estimating GHG emissions from vehicles was the most challenging part of the inventory. Ideally we would want to know how far Pacificans drive and what type of vehicles they use, but this information is not available. We followed the methods of the Palo Alto Cool Cities Team and estimated emissions based on Pacifica's share of San Mateo county population and total gasoline sales in the county in 2005. The Palo Alto committee found that this method produced similar figures to a more complicated analysis based on Census Bureau commuting data. In 2005 Pacifica's population according to the U.S Census Bureau ^[4] was 37,010, and the population of San Mateo County was 722,012 ^[5], so Pacifica's share of county population was 5.13 percent. There was a total of 172,398,000 gallons of gasoline and 730,500 gallons of diesel sold to passenger vehicles in the county in 2005 according to data from California Air Resources Board ^[5]. Pacifica's share of the county fuel sales comes to 8,837,041 gallon of gasoline and 37,445 gallons of diesel. These quantities were then entered into the ICLEI carbon calculator to produce the emissions estimates.

Our emissions estimates cover only gasoline sales to passenger vehicles. We decided not to include emissions from light trucks to focus the emissions information on personal commuting which is more under people's personal control than light truck use, a major share of which is use for business. Light truck fuel sales accounted for another 44,560,500 gallons of gasoline and 730,500 gallons of diesel sales in the county.

A downside of our estimation method is that it does not allow us to track changes in Pacificans' commuting behavior as it is basically a county wide average applied to Pacifica. In the future it would be helpful to explore use of census data or other more direct methods of estimating vehicle use by Pacificans that could be tracked over time to measure progress in reducing emissions.

Air Travel

We estimated Pacifica air travel emissions based on Pacifica's share of U.S. population and total passenger air travel miles in the U.S. in 2005. In 2005 Pacifica's population according to the Census Bureau ^[4] was 37,010, and the U.S. population was 285,107,923 ^[6], so Pacifica's share of national population was 0.013 percent. There were a total of 583,689,304,000 passenger miles flown in 2005 ^[7]. Pacifica's share of the national total is 75,768,996 passenger air miles. Passenger air miles for Pacifica were entered into the Clean Air Cool Planet calculator to determine total emissions from air travel.

This is likely an underestimate of Pacificans' air travel and associated greenhouse gas emissions. First, Pacificans have easy access to a major airport making air travel more convenient than for most Americans, and Pacifica's average income is much higher than the national average so we can afford more air travel. In 1999 median family income in Pacifica was \$78,361 a year, while the U.S. median was \$50,046 ^[8].

Scientists have noted that greenhouse gases emitted at higher altitudes from airplanes have a greater warming effect than would the same emissions at ground level. The extent of this effect is still unclear. It is estimated that emissions from airplanes have between 2 and 4 times the warming effect of ground level emissions. Accordingly, the Clean Air Cool Planet calculator we used includes a 2.8 multiplier for estimating emissions from air travel.

Solid Waste

In 2005 Pacifica sent 15,784 tons of solid waste to the landfill at Ox Mountain, Half Moon Bay^[9]. The ICLEI carbon calculator required breakdowns on the percentage of waste by category (food, paper, etc) which was not available from Coastside Scavenger. We therefore calculated emissions from solid waste using the Clean Air – Cool Planet calculator which does not require waste category data (and therefore implicitly assumes some average waste composition). The Clean Air – Cool Planet calculator estimates 15,784 tons of solid waste in a landfill without methane capture would produce 14,267 metric tonnes eCO₂ emissions.

Commercial Natural Gas and Electricity Use

Pacific Gas and Electric Company provided us with total meter readings for commercial electricity and natural gas use for the years 2003-2007. For 2005 total commercial electricity use was a 20.1 million kWh and total natural gas use was 802,038 therms. Emissions were calculated using the methods described in the residential natural gas and electricity section above. Like residential electricity use, commercial electricity use increased 8.5 percent from 2003 to 2007. Commercial natural gas used increased 8.8 percent over the same time period. We did not have the necessary information to allow us to determine if increased commercial energy use was due to an expansion of commercial business activity, or increased energy intensity (greater energy use for a given level of activity).

County and Special Districts Natural Gas and Electricity

Pacific Gas and Electric Company provided us with total meter readings for electricity and natural gas use for the years 2003-2007 for county government and special districts in Pacifica. Special districts include the two school districts and the North Coast County Water District. For 2005 total electricity use by county government was 120,024 kWh and total natural gas use was 3,032 therms. For 2005 total electricity use by special districts in Pacifica was 4,048,866 kWh and total natural gas use was 171,520 therms. Emissions were calculated using the methods described in the residential natural gas and electricity section above.

Conclusions

The next step is for Pacifica to develop a climate action plan stating its emissions reductions targets and actions to achieve those targets. This inventory identifies the major sources of GHG emissions and can be used to estimate the possible emissions reductions achievable by specific actions. Developing an action plan requires identifying a set of actions that together can meet Pacifica's emissions reduction targets.

Reducing greenhouse gas emissions is an enormous challenge. Pacifica has already made the commitment to reduce greenhouse gas emissions by signing on to the U.S. Mayors Climate Protection Agreement, and by completing this inventory as well as an inventory for city operations. And the city has already begun to reduce emissions from city operations by installing solar panels on the wastewater treatment plant and at City Council Chambers/Sharp Park Pump Station. With a concerted effort from the entire community, Pacifica can reach its goals of significantly reducing its GHG emissions. A number of analyses indicate that in the long run there are very little net-costs to taking the actions required to reduce emissions ^[10]. Actions to reduce emissions can have tremendous economic benefits by reducing energy costs, and can improve public health by reducing emissions of particulates and other pollutants that are co-emitted along with greenhouse gases.

Acknowledgements

This first greenhouse gas inventory for Pacifica was a large undertaking and would not have been possible without the support and help of many people. We wish to thank the Pacifica City Council for signing the Mayor's Climate Protection Agreement and City Manager Steve Rhodes for his strong support for the inventory process, and help obtaining PG&E and solid waste data. Chris Porter of Coastside Scavenger provided solid waste data. Bruce Hodge of the Palo Alto Cool Cities Team generously shared their vehicle emissions methods and spreadsheets. Xico Manarolla of ICLEI arranged access to their carbon calculator software. Caitlin Steele of San Francisco State University, and Charlotte Ely of the U.S. Environmental Protection Agency provided helpful information on emissions from solid waste.

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Appendix A: Biography for Carlos Davidson

Carlos Davidson is an associate Professor and Director of the Environmental Studies Program at San Francisco State University where he teaches courses on a variety of environmental topics including sustainability and climate change. He is co-author of a greenhouse gas inventory report for the San Francisco State University campus and is a member of the university's sustainability committee. He has a Ph.D. in ecology from the University of California, Davis, and a masters degree in economics from U.C. Berkeley.

Appendix B: Membership of the Pacifica Climate Committee

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Pete Shoemaker, Solar Energy Instructor, Vallemar

Mike Vasey, Professor, Pedro Point

Celeste Langille, Lawyer, Linda Mar

Hal Bohner, Home Energy Consultant, Vallemar

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