

# **Greenhouse Gas Emissions Inventory 1990-2006**

## **San Francisco State University**

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## **Executive Summary**

### **Background**

In May of 2007 San Francisco State University President Robert A. Corrigan became a charter signatory of the American College & University Presidents' Climate Commitment (ACUPCC)<sup>1</sup>, committing SF State to create an inventory of greenhouse gas (GHG) emissions from 1990 to 2006. Over the next year SF State will engage the campus in developing a strategic action plan to reduce greenhouse gas emissions.

### **Methodology**

The World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI) defined three 'scopes' of reporting that are required for carbon inventories<sup>2</sup>. The California Climate Action Registry requires reporting of the first and second scope. The first scope covers direct sources of GHG emissions that are owned or controlled by the campus, these include the natural gas used in the central plant and the cogeneration plant, university fleet, and refrigerants. The second scope covers imported sources of energy, such as electricity. And the third scope, which is required by the Presidents' Climate Commitment, refers to transportation and solid waste.

SF State started the inventory process by working with the California State University (CSU) Chancellor's Office's inventory. They completed a 2006 Greenhouse Gas Emissions Inventory for the entire CSU system after joining the California Climate Action Registry<sup>3</sup>. The Chancellor's Office's report included emissions from natural gas use, electricity purchases, and university fleet gasoline and diesel consumption. SF State incorporated the Chancellor's Office results and expanded the inventory to cover emissions from commuting to campus, faculty and staff air travel, and solid waste as required by the President's Climate Commitment.

SF State completed the three scopes for this inventory using the campus greenhouse gas inventory calculator developed by Clean Air Cool Planet (CA-CP)<sup>4</sup>. CA-CP is a science based non-profit whose GHG inventory methodology has become the standard for higher education.

Data reported here is comprised of both estimated and actual data and represent the primary sources of GHG emissions. More detailed data collection and analysis will be needed in the future to refine our next inventory.

The geographic area used in this inventory included SF State's main campus and the Romberg Tiburon Center. Recently acquired housing complexes were not included in this report. University Park North and South were not included due to the number of single meters. Further investigations are needed to find a way to gather this information and include it in future inventories.

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<sup>1</sup> [www.presidentsclimatecommitment.org](http://www.presidentsclimatecommitment.org)

<sup>2</sup> [www.wbcsd.org](http://www.wbcsd.org)

<sup>3</sup> [www.climateregistry.org](http://www.climateregistry.org)

<sup>4</sup> [www.cleanair-coolplanet.org](http://www.cleanair-coolplanet.org)

## Key Findings

### Emissions by Sector

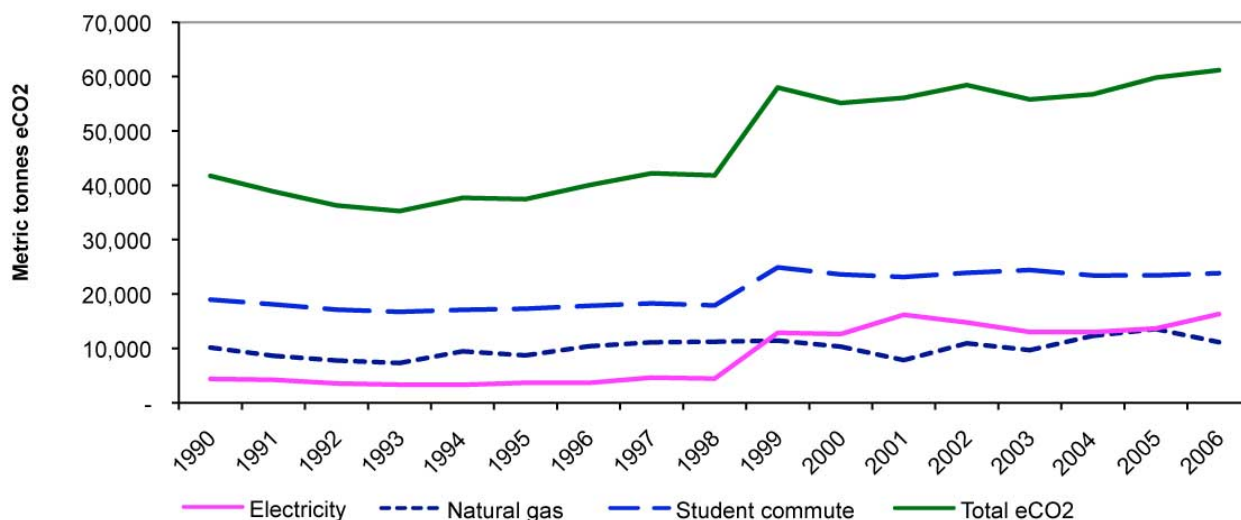
- SF State's overall greenhouse gas emissions have risen by 47% since 1990, from 41,730 to 61,184 metric tonnes of carbon dioxide equivalents (MTCDE).

In 2006, the major sources of SF State's 61,184 MTCDE were:

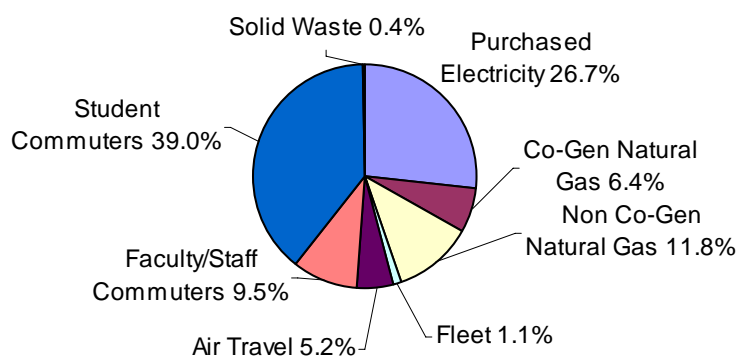
- 44.9% Purchased Utilities, comprised of Electricity (26.7%) and Natural Gas (18.2%)
- 48.5% Commuting, comprised of Student Commuting (39%) and Staff/Faculty (9.5%)
- 5.2% Air Travel
- 1.1% University Fleet
- <1% Solid Waste

### Contributions by Sector to Total Campus GHG Emissions:

Total and major sector GHG emissions 1990-2006



### Total Emissions (Metric Tonnes eCO2) - 2006

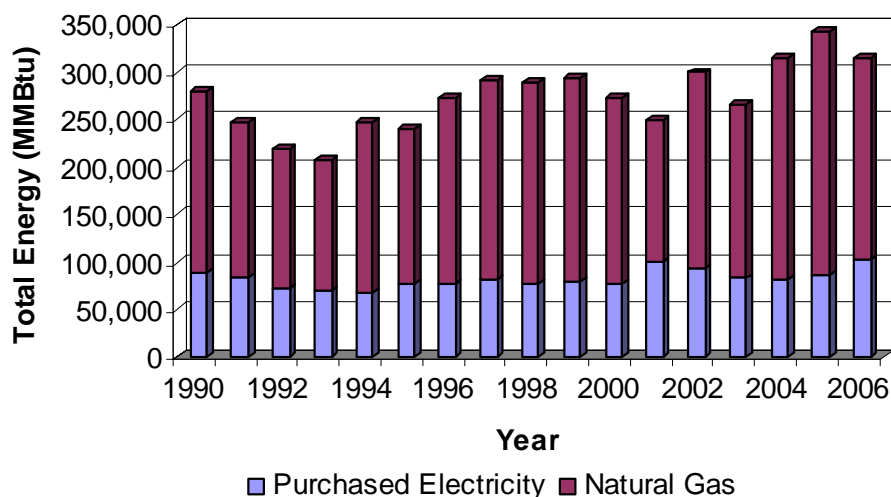


## Emissions from Energy Use

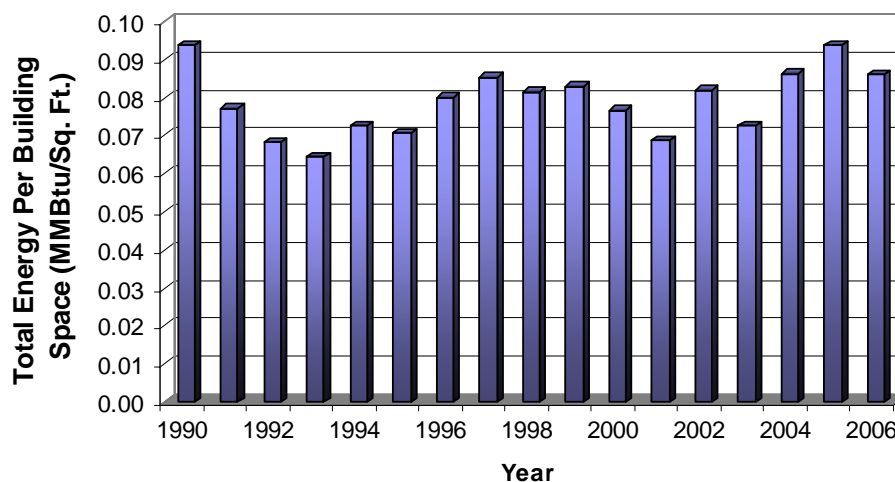
- Utilities, made up of purchased electricity, natural gas for the hot water boilers and co-generation plant, and natural gas used directly by the campus in kitchens and laboratories, accounted for 45% of the total emissions of the campus.
- From 1990 to 2006 SF State's overall energy use (MMBtu's) has increased by 12.5%, going from 279,305 to 314,139 MMBtu's. Electricity use on campus increased by 18 percent and natural gas use increased by 9.8 percent due to campus growth.
- On a total campus building square footage basis electricity use from 1990 to 2006 declined by 3.4% and natural gas use by 10.3% likely in part due to energy efficiency efforts on campus, such as improved co-generation efficiency, and more efficient lighting.
- The single largest share of the 1990 to 2006 increase in overall MTCDE emissions (71%) occurred in 1998 when the University changed to Direct Access for purchasing electricity. This changed the University's electrical source from Pacific Gas & Electric (PG&E) to Arizona Public Service (APS). PGE has a large percentage of hydro and nuclear generation, which has an average emissions factor of 0.16 kg CO<sub>2</sub>/kWh vs. APS which generates a large share of its electricity from coal and natural gas which has an emissions factor of 0.55 kg CO<sub>2</sub>/kWh.

The following two charts normalize electricity and gas use to MMBtus to show overall energy consumption since 1990.

**Total Energy by Sector**



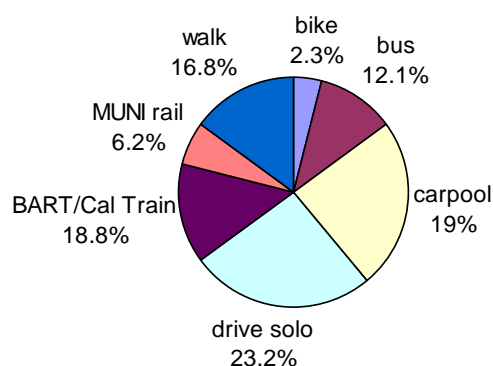
### Total Energy Use (Electricity & Natural Gas) By Building Space



### Emissions from Commuting

- Commuting accounts for almost 49% of the total emissions for the campus. Since 1990, emissions from student commuting increased by 26 percent and faculty/staff emissions increased by 36 percent mainly due to the increase in numbers of each group.

### Transportation Mode - Students, Faculty, & Staff (2006)



### Accomplishments

Research for this inventory revealed the many efforts the university has made in the past two decades to increasing energy efficiency and environmental awareness. Some of those projects included are: building and maintaining the cogeneration plant, modernization of building energy management systems, installation of motion sensors and energy efficient lighting, installation of LED exit signs, Compact Fluorescent Lights (CFL) give-away programs, purchasing electric fleet vehicles, providing Flex Zip cars on-campus, xeriscaping, developing a highly efficient (75% waste diversion) recycling program, yard waste composting, organic food waste composting, providing in Housing a Sustainable Move Out, three ECO themed housing options, a 'Green' Apartment, and supporting educational efforts such as Focus the Nation, annual Earth Day celebrations, and Bike to School Day.

## **Goals**

A growing campus area and population makes reducing greenhouse gas emissions at SF State even more challenging. Within a year, SF State will develop a climate action plan with reduction targets. Since purchased utilities and commuting are the largest emissions sources there are multiple opportunities to formulate and implement solutions. Sustainable behaviors, practices, curriculum, research projects, and campus-wide policies will all be needed to reduce emissions to 1990 levels and to ultimately achieve climate neutrality.

## **Methodology, Key Findings, & Recommendations**

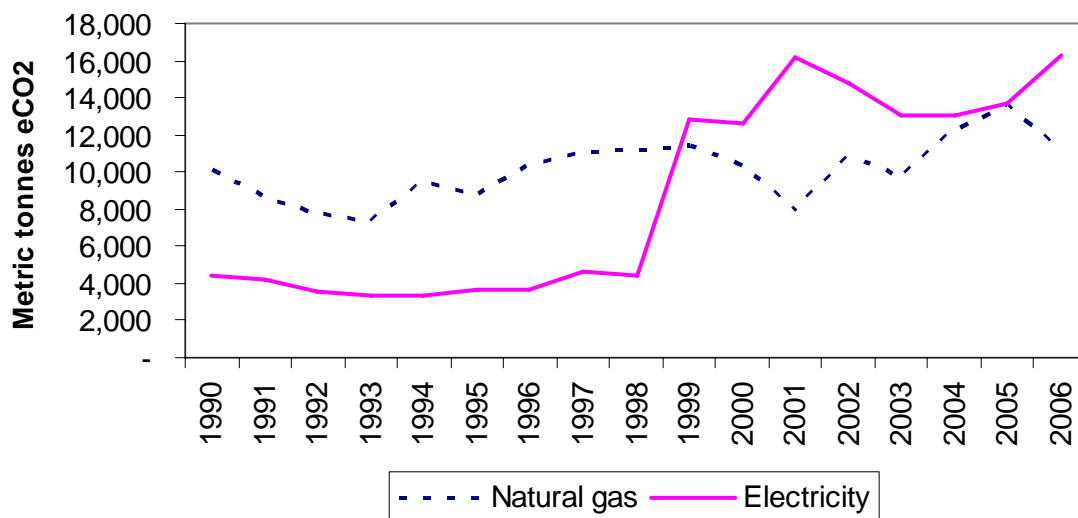
### **Purchased Utilities**

#### **Electricity**

While purchased utilities (including natural gas) account for 45% of campus overall emissions, electricity usage alone accounts for 26.7% of the campus' total emissions. In 2006, SF State used over 30 million kilowatt hours (kWh), emitting 16,307 MTCDE.

Greenhouse gas emissions from electrical use are determined by how the electricity was generated. The mix of fuel sources for electricity identifies the percentage generated using coal, large hydro-electric, nuclear, and renewable energy sources. Pacific Gas & Electric (PG&E) supplied electricity from 1990 to 1998 when the UC/CSU system switched to direct access. The Chancellor's Office inventory supplied the total kWhs purchased from PG&E (1990 to 1998) and Arizona Public Service (APS) (1998 to 2006). California wide average power mix values were utilized by the Chancellor's Office, but in the SF State inventory the specific power mix data for PG&E and APS were used. SF State researched PG&E's custom fuel mix in the Environmental Protection Agency's (EPA) eGRID database and APS supplied SF State with its fuel mix for 2006.

#### **GHG Emissions for Electricity and Natural Gas 1990-2006**



#### **Key Findings**

Purchased electricity use increased 18 percent from 1990 to 2006. However, due to the switch in utility providers from PGE to APS in 1998, emissions from purchased electricity increased by 272 percent. The large increase in the emissions reflects this change in providers and, in turn, the change in fuel sources. PG&E uses less than 1% coal compared to the almost 40% coal in the APS power mix. Since SF State received electricity after 1998 from sources high in coal generation, its emission levels increased significantly.

#### **Recommendations**

1. The CSU currently has a Request for Proposals for a new utility provider and is factoring in GHG emissions into the selection criteria by requiring providers to submit fuel mix reports. The campus should carefully evaluate the overall cost of electricity and emission factors for direct access vs. returning to bundled service with PG&E.



2. Incorporate the recently purchased housing complexes, UPN and UPS into the existing campus wide metering system to begin to monitor consumption patterns and for inclusion in the future GHG inventories.
3. Continue to explore, and where feasible, install solar installations on campus to reduce overall emissions.
4. Implement an “Energy Star” purchasing policy to help reduce energy consumption through the purchase of more efficient appliances, computers and peripherals.
5. Develop and implement a high profile “Energy Awareness and Education Program” for the campus community to promote energy saving behavior changes.
6. Continue development and implementation of energy efficiency projects for lighting, fan and pump controls, and campus computer and peripheral uses.

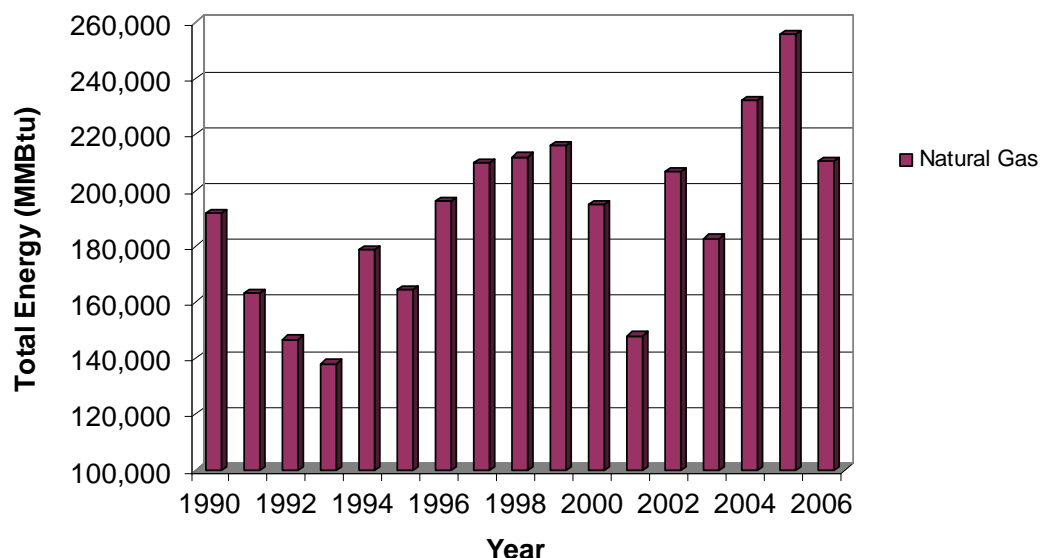
## Natural Gas Use

The campus uses natural gas in two ways. Natural gas is utilized in campus kitchen ovens and laboratory burners. The campus central plant also burns natural gas, in engines which generate electricity and in boilers which make the hot water used to heat campus buildings and provide hot water for sinks and showers. Data on natural gas for both these uses came from the Chancellor’s Office inventory. Data for 1998 and 1999 appeared inconsistent and was estimated based on prior and subsequent year usage.

### Key findings

Natural gas use was the third largest emissions source accounting for 18.2 percent of total campus emissions in 2006. As reflected in the chart below natural gas usage is highly variable due to the number of hours the co generation plant operates. From 1990 to 2006 natural gas use increased 9.8 percent.

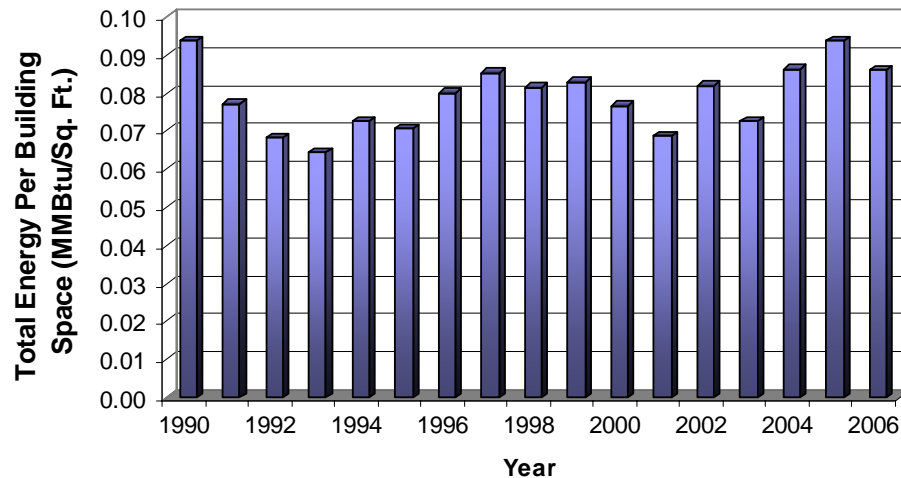
**Total Natural Gas Use 1990 - 2006**



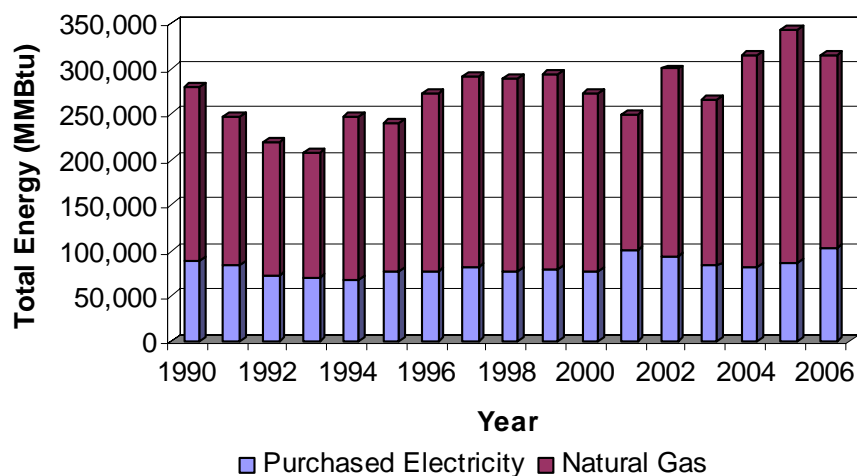
## Recommendations

1. The campus should research ways to expand the cogeneration plant. The cogeneration plant captures the waste heat produced from the central plant. This system emits less GHG emissions than purchasing electricity from an outside power provider.
2. Continue the current program of renovating building heating systems to reduce the use of natural gas for heating. The campus should continue to install improved heating and ventilation controls and programmable thermostats in campus buildings.

**Total Energy Use (Electricity & Natural Gas) By Building Space**

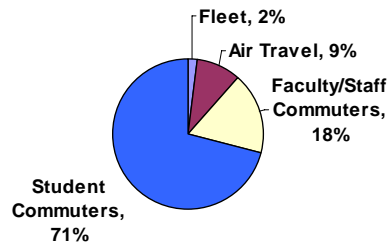


**Total Energy by Sector**



## Transportation

### Transportation Emissions by Sector (2006)

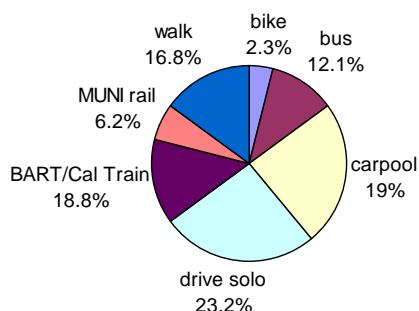


## Commuting

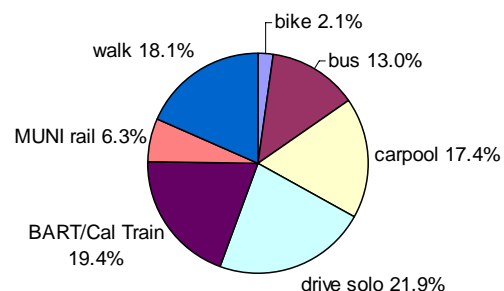
SF State emissions originating from commuting were derived from a transportation survey conducted in 2005 by the campus and Nelson Nygaard, a local consulting firm. This transit survey provided detailed data on commuting patterns of student, faculty and staff by mode of transit. We assigned commuters to a transit mode based on the longest leg of their trip to campus. The transit survey also collected home zip codes which enabled the campus to estimate travel distances for the inventory. To develop the commuter emission quantities, SF State calculated as follows: multiply the estimated number of people taking a particular mode of transit (bus, cars, MUNI, BART, etc), by the average number of miles traveled, the commute frequency, and by an emissions factor for that mode of transit. The CA-CP calculator provides the emissions factors per passenger mile traveled for each mode of transit<sup>5</sup>.

SF State commuters were broken into five groups: staff, full and part-time faculty, full and part-time students for the regular semesters and summer session. The numbers for each of these groups for 1990-2006 were obtained from the Human Resources, University Budget and Planning, and CEL Departments. The number of days full-time faculty, and full and part-time students commute to campus was based on a small scale survey we conducted. The survey indicated faculty come to campus 3.5 days a week, full-time students 4 times a week and part-time students 3 times a week. Staff were assumed to come to campus five days a week for 49 weeks of the year. Part-time faculty were assumed to come to campus on average 3 times a week, for the 34 weeks of fall and spring semesters. Lacking commute data for years other than 2005, we assumed that the choice of transit mode, travel distances, and commute frequency were the same for all years. Our analysis did not include winter intersession or faculty for summer sessions.

### Transportation Mode - Students, Faculty, & Staff (2006)



### Transportation Mode - Students (2006)



<sup>5</sup> [www.cleanair-coolplanet.org](http://www.cleanair-coolplanet.org)

### **Key findings**

Commuting to campus by students, staff and faculty was the single largest source of emissions, accounting for just under half (49%) of total campus emissions. Commuting by students, because they are more numerous, accounted for the largest share (71%) of commute emissions. Students commute in cars, buses, and trains 98.9 million miles a year coming and going from campus. Likewise, staff and faculty commute 18.2 million miles a year.

### **Recommendations**

1. Continue initiatives to shift commuter patterns to public transportation. The campus is currently conducting a more in-depth transportation study that will serve as the basis for a Transportation Demand Management (TDM) plan. This study will serve as an update to the next GHG inventory and identify strategies to move more of the University's commuters to public transportation.
2. Increase the carpooling percentage. For commuters not served by public transport carpooling provides the next best option to driving solo. The university should explore various programs to promote and stimulate carpooling.
3. Increase percentage of bike commuters. The campus is currently working with the SF Bike Coalition to promote biking to SF State. The University has received a grant for additional bike racks and funding for creating additional bikeways into the campus.

### **University Fleet**

The campus has 130 vehicles including cars, trucks, forklifts, and small utility vehicles. The Chancellor's Office provided data for 1990 to 2006 on the amount of gasoline and diesel the campus purchased off campus using Voyager credit cards, as well as on-campus diesel and gasoline use only for 2006. SF State estimated pre-2006 on-campus gasoline and diesel use based on the 2006 proportions between on and off campus use.

### **Key Findings**

Fleet use of gasoline and diesel is not a large source of campus greenhouse gas emissions, accounting for only 1.1 percent to total emissions in 2006. Currently most of the university's fleet still runs on gasoline and diesel. It should be noted that SF State has a large number of small electric vehicles and their emissions are not reflected in the fleet total but rather are accounted for as part of electricity use.

### **Recommendations**

1. The campus should invest in more fuel efficient, electric and alternative fuel vehicles.
2. The campus currently recycles used kitchen grease from campus food services in a city wide biodiesel program. This used kitchen grease could be a major fuel source for the university fleet if the vehicles that run on diesel are converted to biodiesel.

### **Air Travel**

Air travel by faculty and staff has likely increased over time, as it has for the general U.S. population. However for this inventory we were only able to obtain campus travel data for 2006. The University's archived travel claim documents for 2006 were analyzed to determine the total number of air travel trips taken by faculty, and staff. Data from the off-campus travel agency, Fell Travel, was used to determine an average trip mileage of 1,000 miles for flights taken during 2006 by the SF State community. With the help of the Fiscal Affairs Department, queries were pulled to find a percentage of the travel claim forms that included air travel. The total average distance of air travel trips was multiplied by the total number of air travel trips taken to get total miles of air travel for 2006. To calculate air travel miles for years before 2006 we used the total number of air miles

traveled per total number of faculty and staff from 2006 and multiplied by the number of staff and faculty on campus each year. While this assumption that travel behavior has not changed over time is unlikely, this was the only methodology available, given the lack of actual travel data for the years 1990 to 2005.

### **Key findings**

In 2006, Faculty and staff took two thousand trips involving air travel for a total of four million air miles traveled. Emissions from air travel were 5.2 percent of the overall campus emissions.

### **Recommendations**

1. The campus should assess its air travel patterns and seek alternatives to flying to conferences such as video and web conferencing.
2. The Facilities Department is in the process of creating an electronic travel claim form with the Fiscal Affairs department. This new form will capture carbon related mileage for inventory purposes. The electronic forms will track air mileage, car mileage and public transit mileage which will enable the campus to gather more accurate information for our future inventories.

### **Solid Waste**

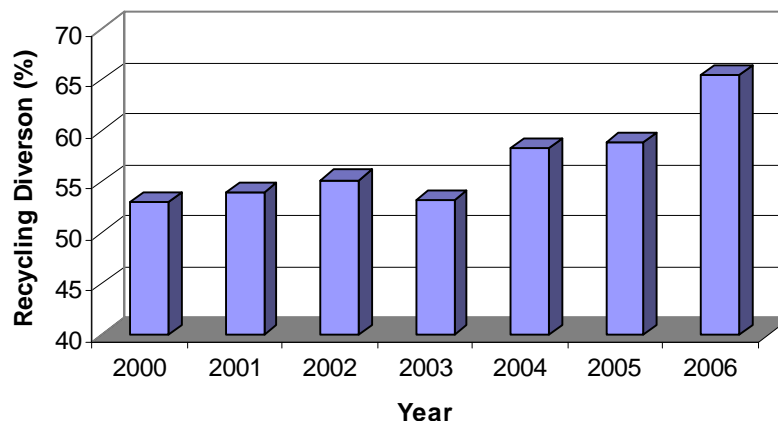
SF State keeps records of number of tons of disposed (landfill) and diverted waste produced every year. These totals are reported to the California Integrated Waste Management Board (CIWMB) every year dating back to 2000. For 1998 and 1999, records were located through the local waste management company, Sunset Scavengers. As data was not available on waste totals prior to 1998, the amount of waste for 1990 - 1997 was assumed to be at the 1998 level. The assumption was made because of the significant increase in recycling programs and education starting in the late 1980's and the increased waste generated from campus growth was offset by the increased recycling rates.

Campus waste from SF State is taken to the Altamont Landfill in Livermore, where the methane is recovered for electric generation. This method of solid waste disposal creates the lowest levels of GHG emissions.

### **Key Findings**

Solid waste is not a significant source of GHG emissions, the emissions are less than 1% of the total. Currently SF State diverts over 75% of its waste from the landfill through recycling efforts. The campus recycles: Construction & Demolition waste (C&D), ewaste, toners, batteries, bottles, cans, cardboard, all paper, plastics # 1-7, and tires.

**Recycling Diversion Rates**



## **Recommendations**

1. The campus will continue to the goal of Zero Waste by 2020 by conducting waste audits, creating new recycling streams, educating the campus, and continually expanding its composting program.

## **Refrigerants and Other Chemicals**

Due to SF State's mild climate there are only a handful of air conditioners on campus leading to a negligible amount of refrigerant leak. Refrigerator disposal, including capture of refrigerant gases, are properly handled by the Environmental Health and Occupational Safety office (EHOS).

## **Key findings & Recommendations**

1. For future needs, a reporting procedure should be set in place to gather data on the small amount of refrigerant leaks that could occur.

## **Offsets**

### **Compost**

SF State's long standing compost program is the only section in the inventory that acts as a 'credit', thus lowering overall total emissions. SF State's composting of yard waste, xeriscaping, and organic food waste collection reduced the overall total by 63 MTCDE in 2006, which is about a tenth of one percent of total emissions. Data on composting was gathered through the online reports available on the California Integrated Waste Management Board website.

### **Key Findings**

Although SF State has composted for over twenty years the organic food waste composting program is relatively new. The Facilities Department, The Cesar Chavez Student Center, Housing's Dining Center, and the ECO-Students started food composting at four different locations on campus over the past three years. The campus has many more opportunities to lower its tons of waste dumped in landfills every year and increase its composting rates.

### **Recommendations**

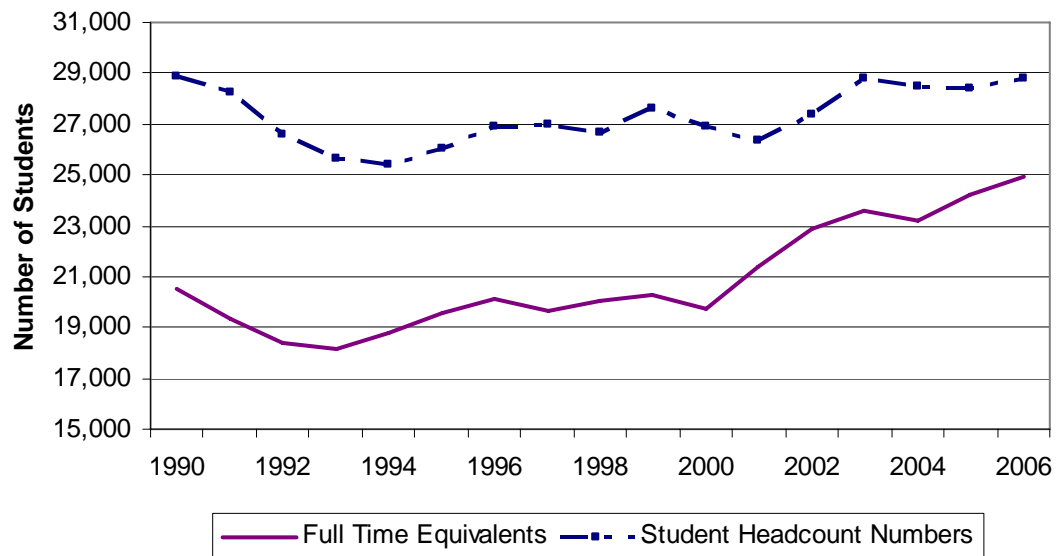
1. The University should investigate affordable compostable foodware options and incorporate composting programs into all areas of campus. While composting on campus is not an important GHG reduction strategy, it is important for other sustainability considerations including meeting the zero waste by 2020 goal.

## **Institutional Data**

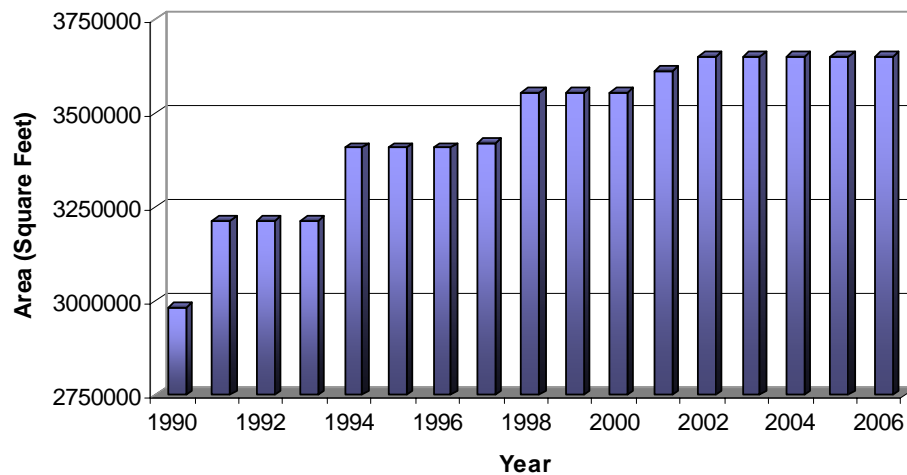
Although institutional data does not directly reflect Greenhouse Gas emissions this data is used to gain a better understanding of the breakdown of campus emissions. Institutional data includes the number of students (full time, part time, and summer school), staff, and faculty numbers as well as square footage totals from 1990-2006.

The numbers for full time and part time students for spring and fall sessions were provided by the Office of University Budget Planning. Student enrollment numbers in summer sessions were obtained from the College of Extended Learning and the University Budget Planning Office. Summer school enrollment numbers were only found from 1999 on. Staff and faculty totals were obtained from the Office of Human Resources. Although the CSU system keeps track of student numbers through Full-time Equivalents (FTE) totals actual student headcount numbers were needed for the carbon inventory process. Total building square footages were supplied by Capital Planning.

### Student Enrollment Numbers



### Total Building Space (Sq. Feet)



#### Key Findings

Overall campus population continues to grow. Total greenhouse gas emissions per student at SF State in 2005 were 2.11 MTCDE compared to 3.5 MCTCDE at Cal Poly San Luis Obispo, the only other CSU for which there is a comparable emissions inventory.

From 1990 to 2006 University square footage increased by 25% from 2.9 to 3.6 million square feet.

## **Conclusions**

The next step is for SF State to develop a climate action plan stating its emissions reductions targets and actions to achieve those targets, based on the data in this greenhouse gas emissions inventory. The 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 the universities emissions target.

Given that almost half of SF State's total greenhouse gas emissions are from commuting, reducing emissions from commuting will play a major role in our climate action plan. A universal transit pass for students is an attractive means to increasing use of public transit. The campus, working with the SF Bike Coalition, is already making the campus more bike friendly to increase bike ridership.

Although commute is the single largest source of emissions, electricity and natural gas use are large emissions sources. SF State's emissions increased significantly in 1998 when it changed, under Direct Access, to a utility that uses a large amount of coal in their power mix. Greenhouse Gas Emissions should be factored into SF State's new contract with a utility. On campus projects to reduce emissions from these sources, can reduce energy costs, and be financially beneficial.

Along with cleaner energy sources, energy efficient buildings and equipment will help the campus lower its emissions. Further expansion of the Environmentally Preferred Purchasing program that supports the purchase of Energy Star rated equipment and products will help reduce energy use. These efforts can be furthered through educating the campus community on energy awareness.

Reducing Greenhouse Gas emissions is an enormous challenge. SF State has begun to address this through its dedication to sustainability projects, signing the President's Climate Commitment, and by completing this inventory. With a concerted effort from the entire community, SF state can reach its goals of significantly reducing its GHG emissions.



## **Acknowledgements**

This first greenhouse gas inventory for SF State was a large undertaking and would not have been possible without the support and help of many people. We wish to thank President Corrigan for signing the President's Climate Commitment. We wish to also thank Vice President & Chief Financial Officer Leroy Morishita for supporting and initiating the inventory process. Andrew Foster, William A. Rutledge, and Lauren Kamiya helped with writing, graphics and data collection. The students from Environmental Studies 570, Campus Sustainability who gathered key data: Mark Abraham, Andy Battles, Leah Clark, Andrea Deleon, Nicolas Garza, Woody Hastings, Derek Hornbuckle, Sandy Jungwirth, Suzanne McNulty, Emily Naud, Janice Parr, Hallie Richard, Nichole Roether, Denise Root, Elsa Torres, Jacklyn Vargo, Emily Williams, and Christine Wiseman.

We wish to thank the following staff for their help and patience in providing data: Eva Allen - University and Budget Planning, Wendy Bloom – Capital Planning, Victor Lai – Facilities, Henry McCoy - Human Resources, Karen Mucci - College of Extended Learning, Jason Porth – Government Relations, Julie Savignano – Fiscal Affairs, Kasra Varzaghani - Academic Planning and Educational Effectiveness, and Jo Volkert - Enrollment Management.

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## **Appendices**

Appendix A. Totals used in the Clean Air Cool Planet Calculator

Appendix B. Total Greenhouse Gas Emissions in Metric Tonnes eCO<sub>2</sub>

Appendix C. 1990 – 2006 Percent change in Metric Tonnes of CO<sub>2</sub> emissions by Sector

Appendix D. MMBtu's Per Square Foot

Appendix E. Metric Tonnes of eCO<sub>2</sub> per Student and per Community

## Appendix A. Totals used calculating emissions

Fiscal Year	Purchased Electricity	Natural Gas		Transportation						Solid Waste	Offsets
		Non Co-Gen	Co-Gen	Fleet		Air Travel	Staff, Faculty & Student Commute				
	(kWh)	(MMBtu)		Gasoline (Gal)	Diesel Fuel (Gal)	(Miles)	Gasoline (Gal)	Diesel Fuel (Gal)	Electricity (kWh)	(Short Tons)	(Short Tons)
1990	25,695,521	156,879	34,749	63,642	3,926	3,113,563	1,773,031	567,868	9,097,015	1,773	200
1991	24,880,660	157,591	5,468	59,980	3,700	3,104,817	1,681,654	555,813	8,902,990	1,773	200
1992	21,264,699	138,107	8,691	57,054	3,519	3,096,070	1,619,893	527,572	8,454,380	1,773	200
1993	20,265,923	127,279	10,760	56,323	3,474	3,087,324	1,607,298	512,034	8,205,573	1,773	200
1994	20,122,200	170,362	8,221	58,242	3,593	3,078,577	1,621,382	557,255	7,317,289	1,773	200
1995	22,424,954	156,380	8,212	60,774	3,749	3,069,831	1,636,115	567,528	7,340,909	1,773	200
1996	22,564,509	150,007	46,146	62,410	3,850	3,277,828	1,711,705	582,923	7,563,620	1,773	200
1997	24,053,646	143,121	66,872	60,954	3,760	3,289,561	1,708,568	606,482	7,970,725	1,773	200
1998	22,850,928	140,000*	72,000*	62,185	3,836	3,335,427	1,693,783	597,488	7,485,140	1,773	200
1999	23,059,005	140,000*	76,000*	62,855	3,877	3,435,693	1,850,568	765,040	10,502,625	1,773	200
2000	22,672,423	112,285	82,655	61,251	3,778	3,462,359	1,779,726	712,704	10,020,122	1,752	202
2001	29,477,104	140,706	7,345	66,207	4,084	3,617,024	1,773,162	695,393	10,094,911	1,702	272
2002	27,310,185	133,556	72,991	70,908	4,374	3,555,158	1,824,771	709,865	10,356,348	1,741	360
2003	24,304,532	105,224	77,561	73,119	4,510	3,494,359	1,859,748	713,667	10,605,477	1,647	334
2004	24,261,415	127,963	104,382	71,979	4,440	3,276,762	1,735,660	692,409	10,213,472	1,783	222
2005	25,457,486	134,129	121,700	49,962	3,561	3,845,288	1,817,252	702,759	10,360,077	1,723	335
2006	30,385,587	136,516	73,943	65,530	5,879	4,086,352	1,873,855	717,628	10,571,289	1,800	345

\*estimated values for natural gas use during 1998 and 1999

## Appendix B. Total Greenhouse Gas Emissions per Metric Tonnes eCO<sub>2</sub>

### *Total Greenhouse Emissions (Metric Tonnes eCO<sub>2</sub>)*

Fiscal Year	Purchased Electricity	On-campus Stationary		Transportation				Solid Waste	Offsets	Net Emissions (Metric Tonnes eCO <sub>2</sub> )
		Non Co-Gen	Co-Gen Electric	Fleet	Student Commuters	Faculty/Staff Commuters	Air Travel			
1990	4,380	8,306	1,840	614	18,969	4,323	3,039	260	(37)	41,693
1991	4,220	8,344	290	579	18,095	4,208	2,870	260	(37)	38,828
1992	3,550	7,312	460	551	17,124	4,243	2,795	260	(37)	36,259
1993	3,325	6,739	570	544	16,720	4,320	2,780	260	(37)	35,221
1994	3,294	9,020	435	561	17,093	4,333	2,700	260	(37)	37,660
1995	3,671	8,279	435	582	17,296	4,276	2,654	260	(37)	37,416
1996	3,649	7,942	2,443	597	17,827	4,586	2,703	260	(37)	39,972
1997	4,628	7,577	3,540	583	18,277	4,640	2,702	260	(37)	42,170
1998	4,439	10,679*	7,828*	594	17,903	4,694	2,711	260	(37)	49,108*
1999	12,864	13,079*	7,477*	600	24,896	5,190	2,743	260	(37)	67,111*
2000	12,633	5,945	4,376	585	23,598	5,057	2,691	257	(37)	55,105
2001	16,182	7,450	389	632	23,133	5,248	2,810	250	(50)	56,042
2002	14,765	7,071	3,864	677	23,901	5,145	2,762	255	(66)	58,374
2003	13,013	5,571	4,106	697	24,414	5,042	2,715	242	(61)	55,738
2004	12,996	6,775	5,526	688	23,414	4,538	2,546	262	(41)	56,704
2005	13,663	7,101	6,443	482	23,424	5,458	2,987	253	(61)	59,750
2006	16,307	7,228	3,915	645	23,832	5,819	3,175	264	(63)	61,121

\*estimated values for natural gas use during 1998 and 1999

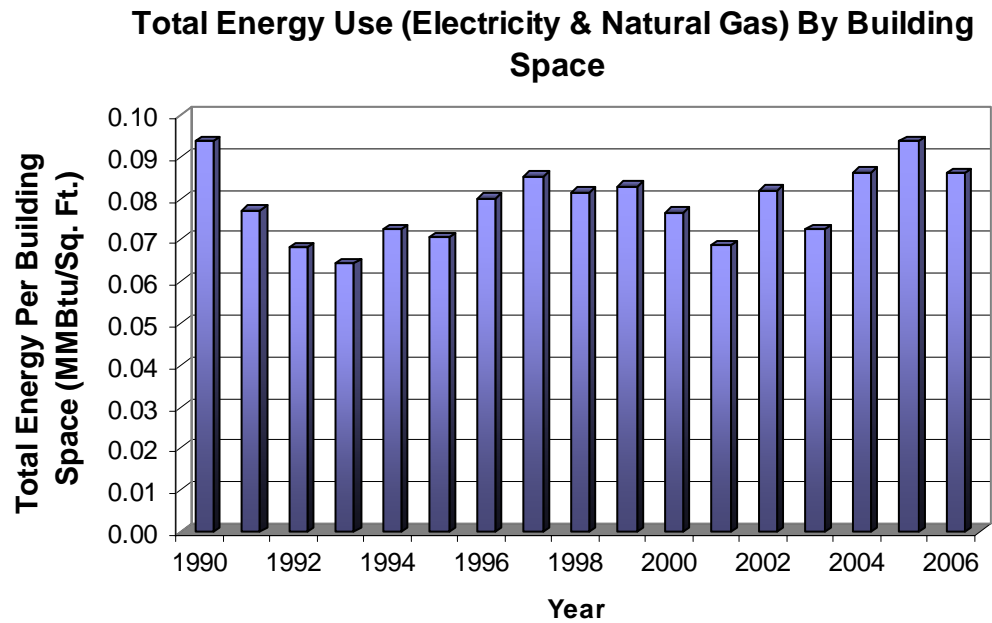
## Appendix C. 1990 – 2006 Percent change in Metric Tonnes of CO<sub>2</sub> Emissions by Sector

### 1990- 2006 Change in SF State 2006 Greenhouse Gas Emissions by Sector

Source	1990 eCO <sub>2</sub> metric tonnes	2006 eCO <sub>2</sub> metric tonnes	Percent change
Purchased Electricity	4,380	16,307	272%
Natural gas - Non Co-Gen	8,306	7,228	-13%
Natural gas - Co-Generator	1,840	3,915	113%
University Fleet	614	645	5%
Student Commuters	18,969	23,832	26%
Faculty/Staff Commuters	4,323	5,818	35%
Air Travel	3,039	3,175	4%
Solid Waste	260	264	2%
Total	41,730	61,184	47%
Composting offset	(37)	(63)	73%
Net Emissions	41,693	61,121	47%

Note: eCO<sub>2</sub> is carbon dioxide equivalents

Appendix D. Total MMBtu's per total campus building area



Appendix E. Metric Tonnes of eCO<sub>2</sub> per Student vs. per Entire Community (Student, Faculty, and Staff)

