CALIFORNIA STATE UNIVERSITY, CHICO GREENHOUSE GAS EMISSIONS INVENTORY FISCAL YEAR 2010-2011

January, 2013

Today Decides Tomorrow

California State University, Chico was responsible for 26,846 $MTeCO_2$ in fiscal year 2010-2011. This represents a 37% decrease from 2007-2008 levels of 42,801 MtCO2e.

ACKNOWLEDGEMENTS

The FY 2010-2011 greenhouse gas emissions inventory for California State University, Chico was conducted and this report prepared by the Institute for Sustainable Development.

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American College and University Presidents' Climate Commitment:

A high-visibility effort to make campuses more sustainable and address global warming by garnering institutional commitments to reduce and ultimately neutralize greenhouse gas emissions on campus[1].

Carbon Dioxide Equivalent:

A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP) established by the Environmental Protection Agency (EPA). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP[2].

Climate Change:

Climate change as referred to in the observational record of climate occurs due to internal changes within the climate system or an interaction between its components, or because of changes in external forcing either for natural reasons or because of human activities[3].

Global Warming Potential:

An index, based upon radiative properties of well-mixed greenhouse gases, measuring the radiative forcing of a unit mass of a given well-mixed greenhouse gas in the present-day atmosphere integrated over a chosen time horizon, relative to that of carbon dioxide. The GWP represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation. The Kyoto Protocol is based on GWPs from pulse emissions over a 100-year time frame[4].

Greenhouse Gas:

A gas that absorbs radiation at specific wavelengths within the spectrum of radiation (infrared radiation) emitted by the Earth's surface and by clouds. The gas in turn emits infrared radiation from a level where the temperature is colder than the surface. The net effect is a local trapping of part of the absorbed energy and a tendency to warm the planetary surface. Water vapour (H2O), carbon dioxide (CO_2), nitrous

[1] See: http://www.presidentsclimatecommitment.org/about/mission-history#documents

[2] See http://www.epa.gov/climatechange/glossary.html

[3] See: http://www.ipcc.ch/pdf/glossary/ipcc-glossary.pdf

[4] See: Solomon, S. (Ed.). (2007). Climate Change 2007: The Physical Science Basis : Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge New York: Cambridge University Press.

oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere[5].

Inter-Governmental Panel on Climate Change:

A scientific intergovernmental body set up by the World Meteorological Organization (WMO) and by the United Nations Environment Programme (UNEP)[6].

Scope 1 Emissions:

Scope 1 refers to direct GHG emissions occurring from sources that are owned or controlled by the institution, including: on-campus stationary combustion of fossil fuels; mobile combustion of fossil fuels by institution owned/controlled vehicles; and "fugitive" emissions [7].

Scope 2 Emissions:

Scope 2 refers to indirect emissions generated in the production of electricity consumed by the institution[8].

Scope 3 Emissions:

Scope 3 refers to all other indirect emissions - those that are a consequence of the activities of the institution, but occur from sources not owned or controlled by the institution[9].

[5] See: http://www.ipcc.ch/pdf/glossary/ipcc-glossary.pdf

[6]See: http://www.ipcc.ch/organization/organization.htm

[7,8,9] See: http://www2.presidentsclimatecommitment.org/pdf/ACUPCC_IG_Final.pdf

1.0 EXECUTIVE SUMMARY

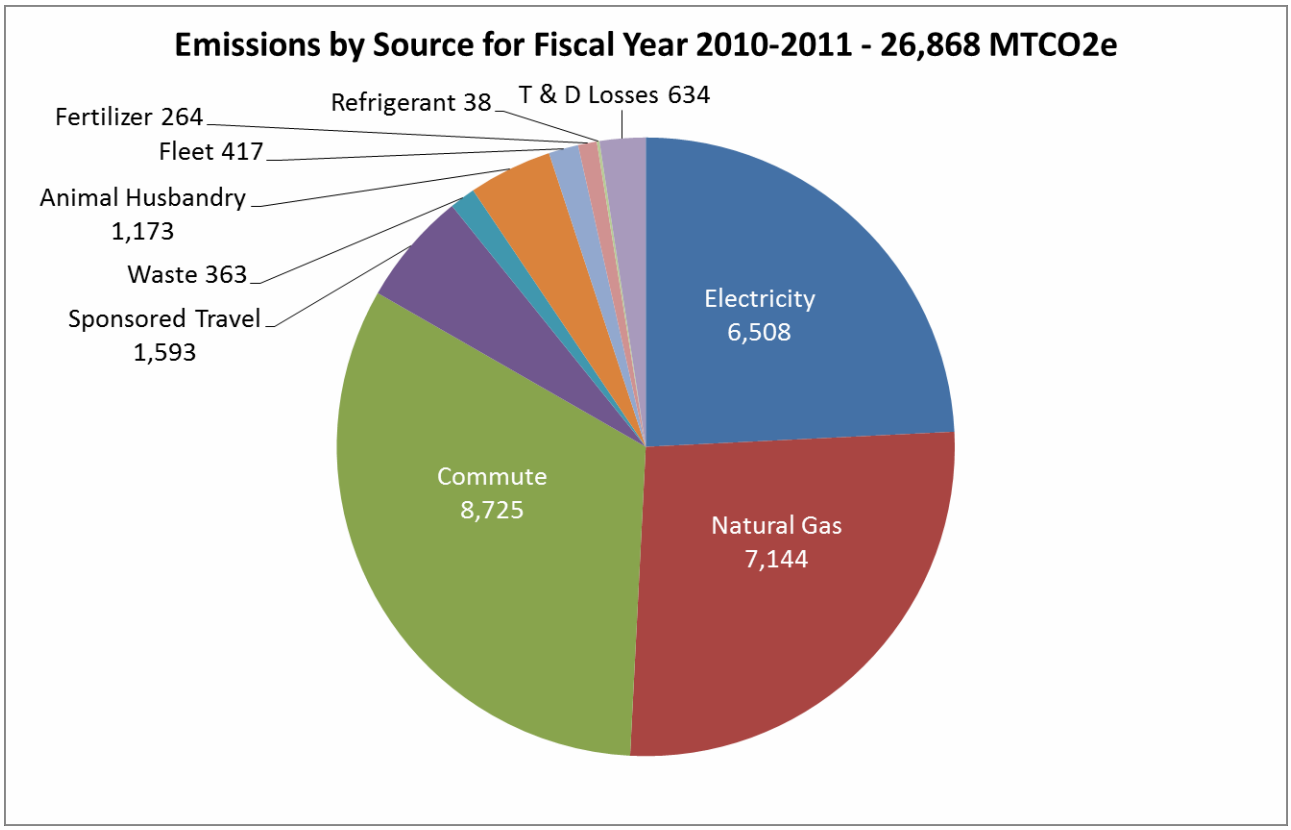
For the fiscal year 2010/2011 California State University, Chico was responsible for 26,868 Metric tons of Carbon Dioxide equivalent emissions.

This represents a 37% decrease from '07/'08 emissions levels of 42,801 MtCO2e. This substantial decrease was realized over a three-year period as a result of a range of actions initiated by the campus – and some other, larger factors.

The single largest reduction came from a switch in energy providers for the campus to Pacific Gas & Electric (PG&E) – which, with its extensive hydro-electric and renewable generation, has one of the cleanest grid mixes in the nation. Substantial reductions also occurred in the Transportation Sector. Decreased fleet vehicle fuel consumption, commute miles, and sponsored-travel all contributed to reduced emissions.

Of the total emissions for '10/'11 roughly ¼ were generated from electricity consumption, ¼ from natural gas consumption, and 1/3 from commuting – with all other emissions sources making up the remainder.

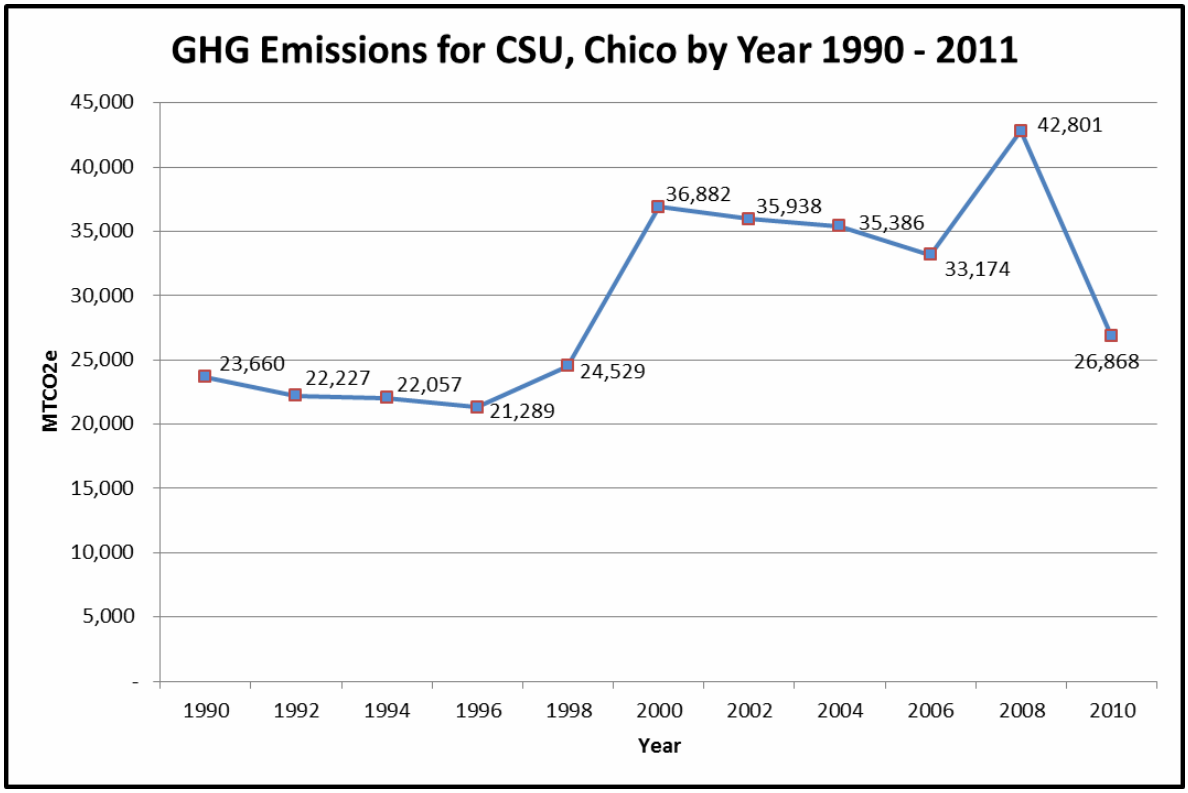
Emissions by Source for Fiscal Year '10/'11 – 26,868 MtCO2e Total



Emissions by Source 2006 – '07/'08 – '10/'11

Emissions by Source 2006 - '07/'08 - '10/'11						
Emissions Source	Emissions Scope	2006 MtCO2e	2007 / 2008 MtCO2e	% Change from Previous	2010 / 2011 MtCO2e	% Change from Previous
Purchased Electricity	2	15,932	16,268	2.1%	6,508	-60.0%
Natural Gas	1	6,408	5,762	-10.1%	7,144	24.0%
T & D Losses	3	1,576	1,609	2.1%	644	-60.0%
Fleet Vehicles	1	536	743	38.6%	417	-43.9%
S, S, & F Commute	3	7,522	11,709	55.7%	8,725	-25.5%
Sponsored Travel	3	N/A	5,318	N/A	1,593	-70.0%
Waste to Landfill	3	538	339	-37.0%	405	19.5%
Composting	3	-204	-130	-36.3%	-42	-67.8%
Fertilizer Application	1	232	278	19.8%	264	-5.2%
Refrigerant	1	69	77	11.6%	38	-50.5%
Animal Husbandry	1	562	828	47.3%	1,173	41.7%
TOTAL	N/A	33,171	42,801	29.0%	26,868	-37.2%

GHG Emissions for CSU, Chico by Year 1990 – 2011



2.0 INTRODUCTION

2.1 Purpose

In January of 2007, building on years of momentum surrounding sustainable development at California State University, Chico (CSUC), university President Paul Zingg became one of the 12 founding signatories of the American College and University Presidents' Climate Commitment (ACUPCC). The commitment, which is overseen by the nonprofit organization Second Nature, currently has over 650 institutions of higher education in the United States signed on by the beginning of 2013. The ACUPCC commits an institution to:

1. *Create institutional structures to guide the development and implementation of a comprehensive plan to achieve climate neutrality as soon as possible.*[10] CSUC set this structure permanently in place in February of 2011 when President Zingg signed Executive Memorandum 11 – 017 establishing the Campus Sustainability Committee.

   http://www.csuchico.edu/prs/EMs/2011/11-017.shtml

2. *Complete a comprehensive inventory of all greenhouse gas emissions and update the inventory every other year thereafter*. CSUC submitted its first inventory, of calendar year 2006, to Second Nature in September of 2008; and its second inventory, of fiscal year 2007/2008, in September of 2010.

   http://rs.acupcc.org/ghg/399/

   http://rs.acupcc.org/ghg/1431/

3. *Develop an institutional action plan for becoming climate neutral*. The Sustainability Committee formally adopted a Climate Action Plan (CAP) in May of 2011. This plan outlines strategies for reducing GHG emissions to 1990 levels by 2020, and an amendment process for expanding the strategies to achieve climate neutrality (net zero emissions) by 2030.

   http://rs.acupcc.org/cap/22/

4. *Initiate action to reduce greenhouse gas emissions*. CSUC has taken a range of actions to reduce GHG emissions since signing onto the ACUPCC, including switching power providers to a utility with substantial renewable inputs into its grid mix, and aggressively expanding alternative transportation.

   http://rs.acupcc.org/ip/820/

[10] Italicized text from ACUPCC Commitment http://www.presidentsclimatecommitment.org/about/commitment

5. *Make the action plan, inventory, and periodic progress reports publicly available by submitting them to the ACUPCC Reporting System.*

   http://rs.acupcc.org/search/?abs=&q=California%20State%20University-Chico

This Greenhouse Gas Emissions Inventory is the third comprehensive inventory report that has been developed by California State University, Chico. It is an inventory of the 12 months of fiscal year 2010/2011, and the first inventory conducted since the adoption of the University's Climate Action Plan in May of 2011. It is worth noting that the CAP was adopted at the end of the 12 month period audited for this inventory, and due to the lag time in reports of this nature resulting from data availability and other factors, the impacts of the actions taken as a result of the Climate Action Plan may not be fully reflected.

2.2 Institutional Context

California State University, Chico has a full-time equivalency (FTE) of 15,007 students and 1,797 faculty and staff (as of Spring 2011), and has a 119 acre main campus, an 800 acre farm, and 4,000 acres of nature reserves. The main campus is adjacent to downtown Chico, California. The City of Chico is roughly 33.14 square miles and has a population of just below 90,000 residents.

CSU, Chico is part of the 23 campus California State University (CSU) System. CSU, Chico is a comprehensive university principally serving Northern California, our state and nation, through excellence in instruction, research, creative activity, and public service.

CSU, Chico has a longstanding commitment to sustainability. Prior to signing the ACUPCC, in 2002, the University signed the Talloires Declaration – a ten point action plan for incorporating sustainability and environmental literacy into teaching, research, operations, and outreach. In 2006 the university updated its Strategic Plan to include a sixth Strategic Priority pertaining to sustainability:

> **Believing that each generation owes something to those which follow, we will create environmentally literate citizens, who embrace sustainability as a way of living. We will be wise stewards of scarce resources and, in seeking to develop the whole person, be aware that our individual and collective actions have economic, social, and environmental consequences locally, regionally, and globally.**

In 2007 the campus established a sustainability office - The Institute for Sustainable Development (ISD) – to focus the sustainability efforts of the campus, to be a central point of contact for sustainability efforts between the campus and community, and to implement the university's sixth strategic priority and the ACUPCC. A student referendum that same year established a sustainability fee that funds both a student green fund to support campus and student sustainability efforts, and an Associated Students (AS) Sustainability Program. The University has also hosted an annual sustainability conference, *This Way to Sustainability*, for the past eight years that is one of the largest student-organized conferences of its kind in the U.S.

CSU, Chico has received a number of awards and national recognition for its leadership in sustainability, including being named to the Princeton Review's Green Guide Honor Roll for 2013 – a distinction given to only 21 of over 800 colleges and universities surveyed.

3.0 METHODOLOGY

3.1 Inventory Process

This report documents greenhouse gas emissions generated by or on behalf of CSU, Chico over a twelve month period (7/1/10 – 6/30/11). It is the third biennial GHG emissions inventory conducted by the university in a process that has five basic steps:

1. Identifying the emissions-producing actions to be included, their spatial boundaries, and the time period to be inventoried. This was completed with the guidance of the ACUPCC Reporting System (see Section 3.3 *Inventory Boundaries* below).

2. Identifying a metric for measuring the scale on which those actions occur. These metrics were established by the Clean Air – Cool Planet Campus Carbon Calculator v6.8. (See Section 3.2 *Inventory Calculator* below and Appendix A – *Input Values*).

3. Determining the scale on which the actions occurred during the time period being inventoried. This was completed by gathering data from around campus related to energy consumption, commute miles, waste picked up by haulers, etc. (For a full list see Appendix A - *Input Values*).

4. Multiplying those impacts against an emissions factor – a per unit measurement of GHG emission production associated with a certain action. These factors are established by the EPA, IPCC, and others, and are organized and standardized for higher education institutions in the CA-CP Calculator. They are coefficients that have a number of averaged assumptions built into them and that convert an input from primary form into an estimate of GHG emissions, measured in Metric Tons of Carbon Dioxide Equivalent (MtCO2e). (For a full list see Appendix B – *Emissions* Factors).

5. Aggregating the emissions impacts into a net annual institutional GHG emissions estimate - measured in Metric tons of Carbon Dioxide equivalent (MtCO2e), analyzing the results and trending against previous years' results. This is the function of this report.

3.2 Inventory Calculator

The Clean Air – Cool Planet (CA-CP) Campus Carbon Calculator is the standard greenhouse gas emissions inventory calculator for higher education institutions that are tracking GHG emissions. It is a comprehensive,

transparent, customizable excel-based calculator that was first made available in 2002. The calculator's principal function is to convert activities from a primary form input into a GHG emissions estimate using a range of up-to-date emissions factors. Version 6.8 of the calculator was used for this inventory; version 6.4 was used for the '07/'08 inventory. The main updates between these versions were to the emissions factors (the coefficients used to convert primary input data into MtCO2e), and for the most part were not significant.

3.3 Inventory Boundaries

The process of conducting an institutional GHG emissions inventory has parameters that are clearly defined by the ACUPCC reporting protocol.

http://rs.acupcc.org/instructions/ghg/

Temporal Boundary

A full twelve month period - fiscal year 2010/2011 - was inventoried. This timeframe includes all activities from July 1, 2010 through June 30, 2011.

Spatial Boundary

All institutional operations were included in the inventory. This includes the Main Campus, the Agricultural Teaching & Research Center (University Farm), the University Foundation and Research Foundation, and the two primary campus auxiliaries - University Housing and Food Service and the Associated Students.

Emissions Scopes

Scope 1 – *Direct GHG emission occurring from sources owned or controlled by the institution.*[11]

Scope 1 emissions accounted for in this inventory include stationary combustion from natural gas consumption; mobile combustion from campus fleet vehicles; and fugitive emissions from livestock, fertilizer application, and refrigerant consumption.

Scope 2 – *Indirect GHG emissions that are a consequence of activities that take place within the organizational boundaries of the institution, but that occur at sources owned or controlled by another entity.*

Scope 2 emissions accounted for in this inventory include emissions from purchased electricity.

Scope 3 – *All indirect GHG emissions no covered in Scope 2.*

[11] Italicized text from ACUPCC Reporting Instructions http://rs.acupcc.org/instructions/ghg/

Scope 3 emissions accounted for in this inventory include emissions from commuting, university sponsored air travel, and decomposition of waste sent to the landfill.

Emissions Not Included

This inventory takes into account the emissions sources generally accepted as the standard for universities and outlined by the ACUPCC. This includes Scope 1 and 2 emissions and many Scope 3 emissions sources. The University recognizes that there are additional Scope 3 emissions sources which the University does not assume direct responsibility for, but which it is in a position to impact. These additional sources include emissions from the transportation and treatment of water; 'up-stream' supply chain emissions associated with the manufacture and transportation of goods purchased by the university; emissions from the cultivation, processing, and transportation of food served on campus; and emissions generated from campus construction projects.

3.4 Energy Sector Methods

Energy sector data was gathered for two emissions sources – purchased electricity and onsite natural gas consumption. This data was gathered by Facilities Management and Services for the main campus, the University Farm, the University Foundation and Research Foundation, the Associated Students, and University Housing and Food Services.

The CA-CP calculator allows for the customization of an emissions factor for electricity consumption if a provider-specific grid mix is known. Pacific Gas and Electric provided this data for both the year 2010 and 2011, and we utilized this feature of the calculator to refine this emissions factor. For more information see Section 4.3 *Energy Sector Analysis and Results*.

3.5 Transportation Sector Methods

Data for the transportation sector was collected for three emissions sources – fleet vehicles, sponsored travel, and student, staff, and faculty commute. Fleet fuel consumption data was provided by Facilities Management and Services, who operate the campus' fueling station, and the University Farm. This data was provided as gallons of gasoline and diesel fuel consumed. The Associated Students and University Housing and Food Services also provided fleet vehicle data, in the form of vehicle miles travelled. This was converted into gallons of gasoline consumed using an EPA factor for average vehicle fuel efficiency for 2011 of 24.3 miles per gallon.

University-sponsored travel data was gathered from the University Accounting Operations office – which processes Travel Expense Claims (TECs) for the University, the University Research Foundation (RF) – which processes the TECs for all RF projects, and the Associated Students. Data collected included distance travelled by mode - including by air, rental car/taxi, bus, rail, and personal automobile. One significant change in methodology between the '07/'08 inventory and this inventory is that all TECs moving through the University Accounting Operations office had the information relating to distances travelled by mode gathered from each claim as it was filed and aggregated into a spreadsheet. In the '07/'08 inventory, and with TECs from the RF in this inventory, that information was collected by audit of the files at a later date.

Commute data was collected by a survey of the three campus populations – students, staff, and faculty. This survey was designed by the Institute for Sustainable Development and the Institutional Research office, and was based in part on previous surveys conducted by Transportation and Parking Services. The survey was distributed by email in spring of 2011 and received 722 students responses (4.5% of total population), 416 staff responses (45% of total population), and 237 faculty responses (27% of total population). Data gathered for the emissions inventory included mode of commute – drive alone, carpool, dropped off, bus, walk, bike, scooter/motorcycle, skateboard, and 'other' – frequency of commute by mode, and distance of commute. The survey data was structured by week, and was extrapolated across the academic year and summer, and across the full campus population.

3.6 Waste Sector Methods

Waste sector data was collected from the Associated Students – which manages the University's recycling program, the Business Services office, Facilities Management and Services, and Recology – the University's contracted waste hauler. This data is aggregated annually into an SB 1016 report in total short tons sent to the landfill per year.

In gathering this data it became clear that there was an opportunity to make this inventory and the '07/'08 inventory more consistent by making a revision to the waste numbers in that inventory. Originally, due to data availability, the '07/'08 inventory used waste weights for calendar year 2007 as the input for FY '07/'08. This was revised so that for fiscal year '07/'08 the amount of waste (in short tons) used as the input into the inventory calculator was the average of both calendar years the inventory overlapped (2007 and 2008). The same methodology was used for FY '10/'11. This approach resulted in a change to the amount of emissions from waste calculated for the '07/'08 fiscal year from 280 to 339 MtCO2e.

There are inherent uncertainties in tracking waste weights. These include assumptions about the weight of waste in unweighed bins – which makes up roughly one half of the University's hauled waste, and about the fullness of unweighed bins – which are assumed to always be full on pickup. These assumptions can have the impact of skewing up or down shifts in waste weights over time.

In the near future the University will begin weighing all of its waste in a compacter at Facilities Management and Services. This will allow for much more accurate assesment of waste weights. It is anticipated that monthly waste weight data will be available to calculate a more exact amount generated per fiscal year.

Compost data for the entire campus was collected in pounds of material composted from the Associated Students.

3.7 Fertilizer Sector Methods

Fertilizer sector data was gathered from Facilities Management and Services and the University Farm. This information was gathered in pounds by type – synthetic or organic – and percentage of nitrogen. Fertilizer consumption occurred primarily at the University Farm for agricultural applications, as well as on the main campus for grounds keeping.

3.8 Refrigerant Sector Methods

Refrigerant sector data was gathered from Facilities Management and Services in pounds consumed by type. Because refrigerant is used in a closed-loop system, only the amount leaked or used for repairs in a given year is taken into account. University Housing and Food Services had no refrigerant consumption for the period inventoried.

3.9 Animal Management Sector Methods

Data for the animal management sector was collected from the University Farm. As part of its 800 acre Agriculture Teaching and Research Center the College of Agriculture raises a range of livestock for various purposes at the farm. The number of each type of animal – including dairy cows, beef, swine, goats, and sheep – was collected.

3.10 CSU, Chico Greenhouse Gas Emissions Tracking History

CSU, Chico's first GHG emissions inventory was completed in 2007 by a graduate student in the Geography and Planning Department. The inventory documented GHG emissions for the University from 1990 to 2006, and was conducted with an emissions calculator that was developed at the University of Pennsylvania.

The University's second emissions inventory was completed in 2009 by the Institute for Sustainable Development, and documented emissions for the fiscal year 2007/2008. The second inventory was conducted with the CA-CP calculator, and at that time the data for the years 1990 – 2006 was migrated into the CA-CP calculator as well. There was an important inclusion in the '07/'08 inventory that was not a part of the 2006 inventory – Scope 3 emissions from university-sponsored travel.

This inventory, the University's third, was conducted by the Institute for Sustainable Development and completed in January of 2013, and documents emissions for the fiscal year 2010/2011. The methodology for this inventory (with the exception of the Transportation Sector adjustments outlined in Section 3.5 above and the Waste Sector revision outlined in Section 3.6 above) is consistent with the methodology used for the '07/'08 inventory.

4.0 RESULTS

4.1 2010/2011 Greenhouse Gas Emissions Inventory Results

For the fiscal year 2010/2011 California State University, Chico was responsible for 26,868 Metric tons of Carbon Dioxide equivalent emissions. This represents a 37% decrease from '07/'08 emissions levels of 42,801 MtCO2e. This substantial decrease was realized over a three-year period as a result of a range of actions initiated by the campus – and some other, larger factors.

The single largest reduction came from a switch in energy providers for the campus to Pacific Gas & Electric (PG&E) – which, with its extensive hydro-electric and renewable generation, has one of the cleanest grid mixes in the nation. Substantial reductions also occurred in the Transportation Sector. Decreased fleet vehicle fuel consumption, commute miles, and sponsored-travel all contributed to reduced emissions.

Of the total emissions for '10/'11 roughly ¼ were generated from electricity consumption, ¼ from natural gas consumption, and 1/3 from commuting – with all other emissions sources making up the remainder. This portion of the document includes a sector by sector analysis of the results of the '10/'11 GHG emissions inventory – including comparisons between this inventory and the '07/'08 results.

Fig. 4.1: Emissions by Source for Fiscal Year '10/'11 – 26,868 MtCO2e Total

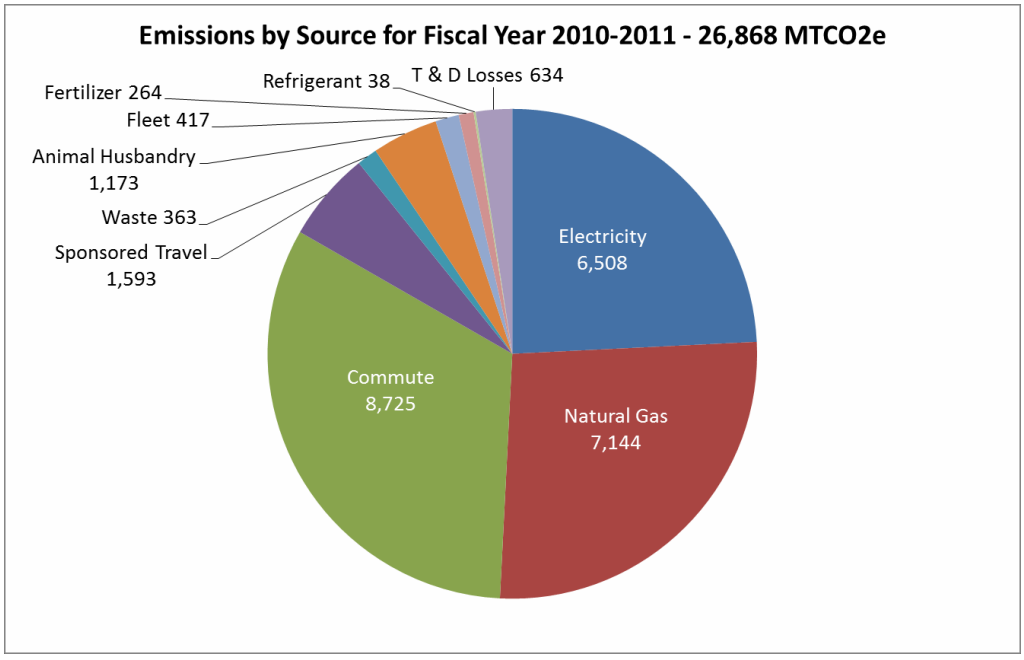


Figure 4.1 above illustrates the relative contribution and net value of emissions by source to the '10/'11 total.

Fig. 4.2: Emissions by Source for Fiscal Year '10/'11 – % Contributions

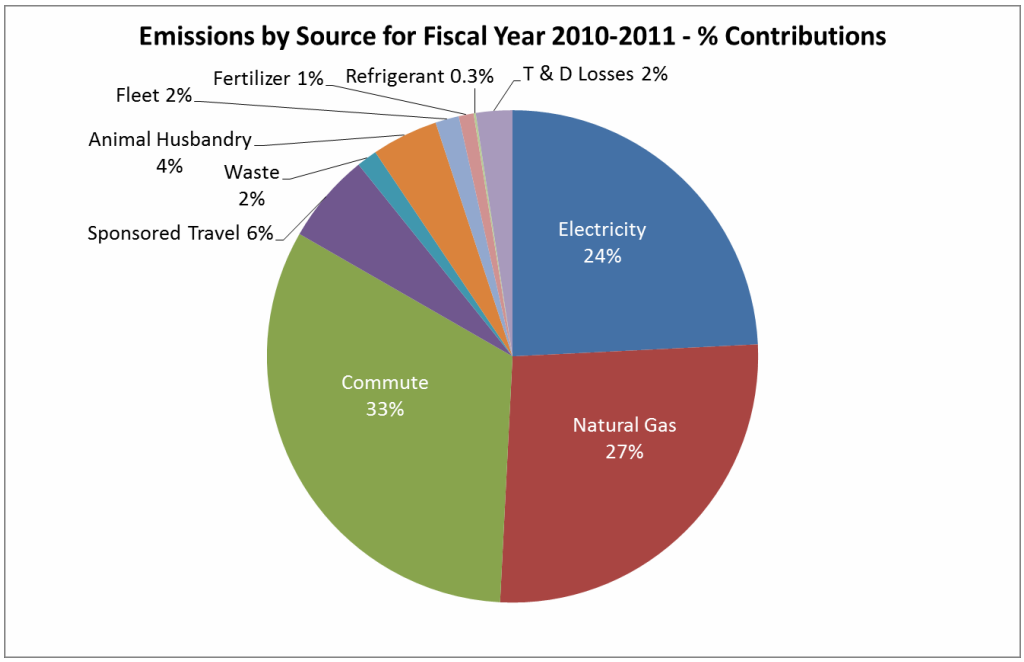


Figure 4.2 above illustrates the percentage contribution of each emissions source to the '10/'11 total.

Fig. 4.3: Emissions by Source 2006 – '07/'08 – '10/'11

Emissions by Source 2006 - '07/'08 - '10/'11						
Emissions Source	Emissions Scope	2006 MtCO2e	2007 / 2008 MtCO2e	% Change from Previous	2010 / 2011 MtCO2e	% Change from Previous
Purchased Electricity	2	15,932	16,268	2.1%	6,508	-60.0%
Natural Gas	1	6,408	5,762	-10.1%	7,144	24.0%
T & D Losses	3	1,576	1,609	2.1%	644	-60.0%
Fleet Vehicles	1	536	743	38.6%	417	-43.9%
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Fertilizer Application	1	232	278	19.8%	264	-5.2%
Refrigerant	1	69	77	11.6%	38	-50.5%
Animal Husbandry	1	562	828	47.3%	1,173	41.7%
TOTAL	N/A	33,171	42,801	29.0%	26,868	-37.2%

Figure 4.3 above lists emissions by source (specific emissions-generating activity) for CSU, Chico's three GHG emissions inventories – and percentage change in emissions by source between inventories.

Fig 4.4: Emissions by Sector 2006 – '07/'08 – '10/'11

Emissions by Sector 2006 - '07/'08 - '10/'11					
Emissions Sector	2006 MtCO2e	2007 / 2008 MtCO2e	% Change from Previous	2010 / 2011 MtCO2e	% Change from Previous
Energy	23,916	23,639	-1.2%	14,296	-39.5%
Transportation	8,058	17,770	120.5%	10,734	-39.6%
Waste	334	209	-37.4%	363	73.8%
Fertilizer	232	278	19.8%	264	-5.2%
Refrigerant	69	77	11.6%	38	-50.5%
Animal Management	562	828	47.3%	1,173	41.7%
TOTAL	33,171	42,801	29.0%	26,868	-37.2%

Figure 4.4 above lists emissions by sector (general operational area) for CSU, Chico's three GHG emissions inventories – and percentage change in emissions by sector between inventories.

Fig 4.5: Emissions by Scope 2006 – '07/'08 – '10/'11

Emissions by Scope 2006 - '07/'08 - '10/'11					
Emissions Scope	2006 MtCO2e	2007 / 2008 MtCO2e	% Change from Previous	2010 / 2011 MtCO2e	% Change from Previous
1	7,807	7,672	-1.7%	9,035	47.6%
2	15,932	16,268	2.1%	6,508	-60.0%
3	9,432	18,861	100.0%	11,324	-40.0%
TOTAL	33,171	42,801	29.0%	26,868	-37.2%

Figure 4.5 above lists emissions by scope (direct, indirect, and other) for CSU, Chico's three GHG emissions inventories – and percentage change in emissions by scope between inventories.

4.2 CSU, Chico Historical GHG Emissions and Trends

Fig. 4.6: GHG Emissions for CSU, Chico by Year 1990 – 2011

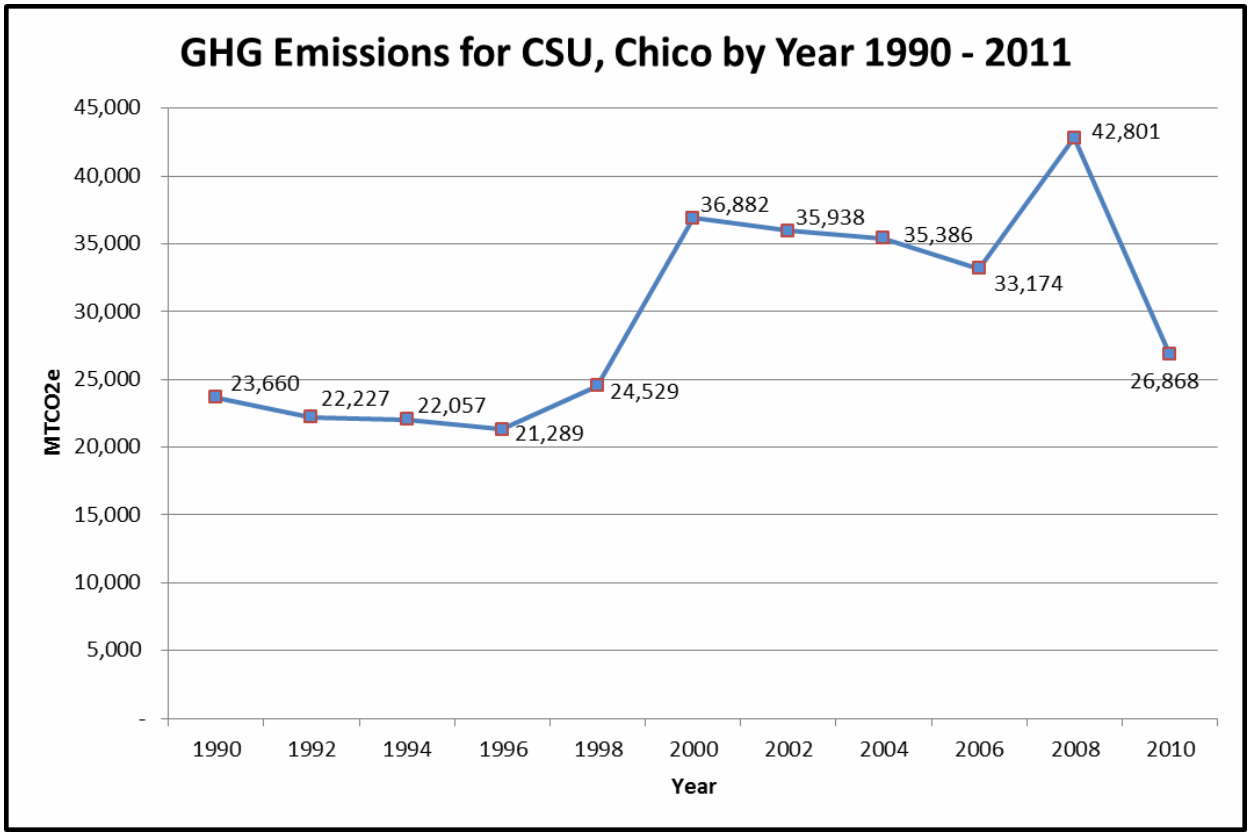


Figure 4.6 above illustrates CSU, Chico's greenhouse gas emissions history going back to the year 1990. This history contains three significant jumps or dips that stand out on a trend line and require special explanation. The first jump occurs between 1998 and 2000 and was the result of a change in energy providers from PG&E to Arizona Power Supply (APS). The second jump occurs between 2006 and 2008 and is the result of the inclusion of university-sponsored travel as a Scope 3 emissions source. Both the 2008 and 2010 aggregate emissions values include these emissions from travel – none of the 1990 – 2006 values do. The dip in emissions between 2008 and 2010 is the result of actions discussed in the following sections of this document – including a switch in energy providers back to PG&E from APS – and is not the result of significant changes in methodology.

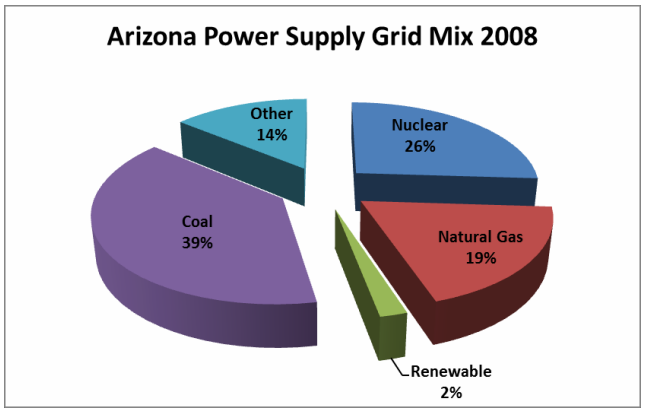
4.3 Energy Sector Results & Analysis

Emissions for the Energy Sector in '10/'11 were 14,296 MtCO2e – 53% of total emissions. 6,508 MtCO2e of these emissions came from electricity consumption – a 60% decrease from '07/'08 – and 7,144 from natural gas consumption – a 24% increase from '07/'08. 644 MtCO2e came from Transportation and Distribution (T&D) Losses – a 60% decrease from '07/'08.

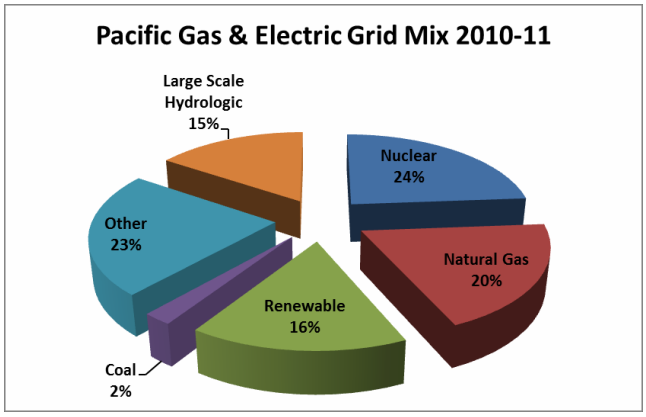
Electricity consumed (total kWh) by the campus decreased between '07/'08 and '10/'11 by 5%, despite the addition of the 110,000 square foot Wildcat Recreation Center (WREC) to the campus in 2009. This 5% decrease was achieved energy efficiency projects including the Meriam Library lighting retrofit, which won a best practices award at the California Higher Education Sustainability Conference in 2012, and MBCx projects in four other campus buildings. The decrease in emissions from electricity consumption of 60% is mostly the result of a change in emissions factors for electricity consumption. This factor decreased by 58% for a given amount of electricity consumption as a result of changing energy providers and the differences in their mix of generation sources.

Fig.s 4.7 & 4.8:

Arizona Power Supply Grid Mix 2008



Pacific Gas & Electric Grid Mix 2010-11



This energy provider switch is one of the principal actions outlined in the University's Climate Action Plan, and its implementation represents a powerful early step towards the University's long term sustainability goals. In combination with the 5% decrease in electricity consumption between '07/'08 and '10/'11 this action eliminated nearly 23% of the University's GHG emissions.

Natural gas consumption by the campus increased by 24% between '07/'08, and resulted in a 24% increase in emissions from this sector. Part of this was due to the addition of the WREC to campus, which increased total gross square footage (gsf) of heated and cooled building space on campus by 3.8% from 2,913,484 to 3,023,378 gsf. This building space uses a relatively high amount of natural gas per gsf for heating due to its functions and the type of activities that it supports.

Another factor to be taken into consideration regarding the increase in natural gas consumption on campus between '07/'08 and '10/'11 is the relative difference in temperature between the two years. Heating Degree Days (HDD) are a common scientific measurement for tracking and comparing the average relative temperature of different time periods. HDDs are a measurement of the number of degrees that a day's average temperature is below 65 degrees Fahrenheit. The twelve months of fiscal year '07/'08 saw a total of 2,887 HDD in western Butte County, while the twelve months of fiscal year '10/'11 saw a total of 3,068.[12] This represents an increase of just over 6%.

The decrease in emissions associated with transportation and distribution of energy was the result of the change in energy providers, their generation sources and locations.

4.4 Transportation Sector Results & Analysis

Emissions for the Transportation Sector in '07/'08 were 10,734 MtCO2e – 40% of total emissions. 417 MtCO2e of these emissions came from campus fleet vehicle fuel consumption – a 44% decrease from '07/'08. 1,593 MtCO2e were generated by university-sponsored travel – a 70% decrease from '07/'08 – and 8,725 by student, staff, and faculty commute – a 26% decrease from '07/'08.

University fleet vehicle fuel consumption is by far the smallest contributor to Transportation Sector emissions, but is important in a special way because of its nature as a Scope 1 emission source, and the visibility of the fleets to the campus community. The University has a number of vehicle fleets, including Facilities Management and Services, University Police Department, University Housing and Food Services, the Associated Students, the University Farm, and a few other small fleets.

Many of these departments have been moving their fleets over time from conventional gasoline and diesel vehicles to electric and high efficiency vehicles, and this trend continued in the years between inventories. There has also been movement in recent years to limit fleet vehicle activity on campus as the campus, at 119 acres, is densely populated during the daytime and many of the fleet vehicle pathways are also popular pedestrian walkways.

University-sponsored travel saw a very significant decrease between '07/'08 and '10/'11. Of the four types of travel tracked – air, automobile, bus, and rail – automobile miles increased, by about 19%, while the other three decreased, by 72%, 84%, and 84% respectively. Much of this decrease can be attributed to a drastically changed budget climate in the State of California and within the CSU system in the three years between inventories.

Campus commute miles, by automobile and bus, saw a 26% decrease between '07/'08 and '10/'11. For staff and faculty, automobile miles decreased by 17% while bus miles decreased by 75%. For students,

[12] CIMIS Station 12 – Durham, CA http://wwwcimis.water.ca.gov/cimis/welcome.jsp

automobile miles decreased by 20% while bus miles decreased by 48%. As much of the decrease in sponsored travel is attributable to changes in the budget climate, part of the decrease in commute miles can probably be attributed to the recession and general economic conditions, including the price of fuel.

Campus alternative transportation efforts also played a role in reducing commute vehicle miles. As part of the Climate Action Plan development process, and spearheaded by the Institute for Sustainable Development, the three years between the '07/'08 inventory and the '10/'11 inventory saw the introduction and expansion of a range of alternative transportation initiatives on campus.

In August of 2009 the University launched Zipcar, a carsharing program in which the university hosts cars on campus that are available for use by student, staff, or faculty members 24/7. This program, especially for students, is an option that allows them to reconsider car ownership while in college. By the end of FY '10/'11 this program had almost 200 members.

In January of 2011 the University launched Zimride, a free, secure online ridesharing platform that promotes carpooling among campus community members. By the end of FY '10/'11 this program had over 400 users. CSU, Chico is in a relatively unique position to influence commuter behavior because of its nature as a residential campus and the proximity of most students, staff, and faculty to campus.

Fig. 4.9: Commute Mode Split - 2001, '06, '08, '11 – S, S, & F

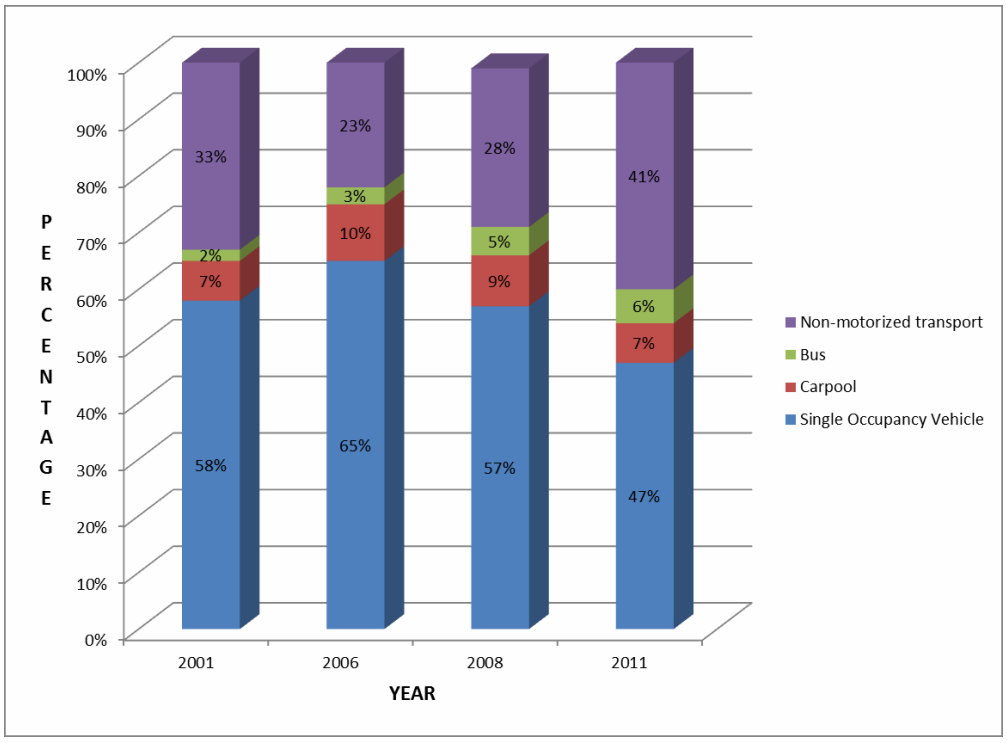


Figure 4.9 above illustrates changes in commute mode split for students, staff, and faculty over an 11-year period from 2001 to 2011. The four data points were established by the commute surveys discussed in

Section 2.5 *Transportation Sector Methods*. Between 2006 and 2011 single occupant vehicle (SOV) trips to campus declined from 65% of commuters to 47%, while non-motorized transport increased from 23% to 41%.

Fig. 4.10: Commute Mode Split 2008, 2010 & CAP 2020 Goals

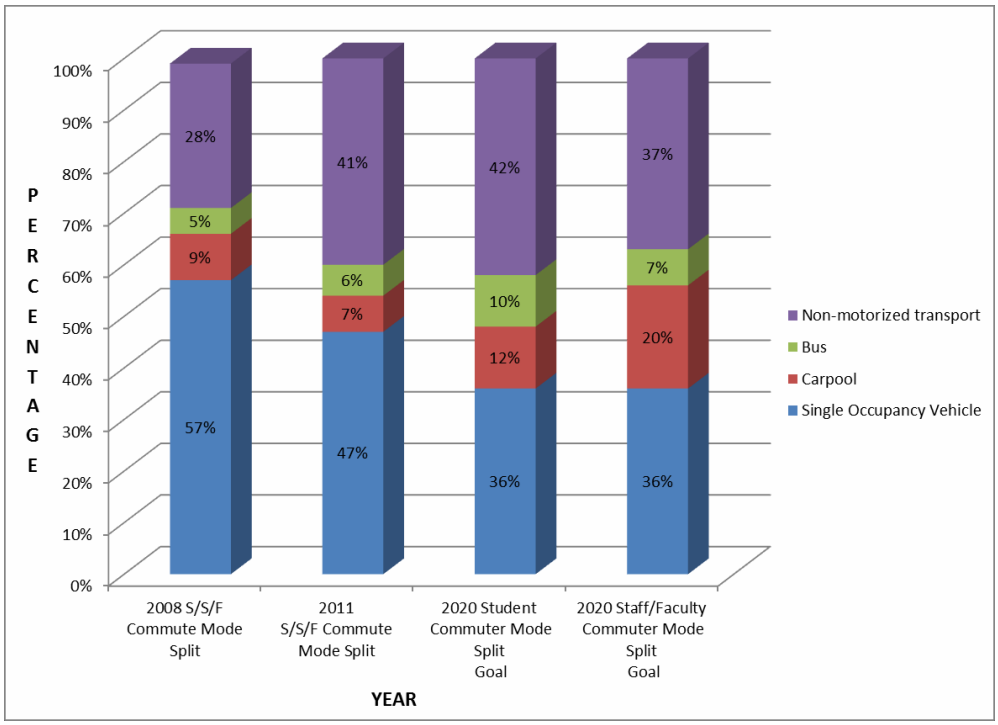


Figure 4.10 above shows campus commute mode splits for 2008 and 2011, and shows the commute mode split goals for 2020 from the Climate Action Plan. Significant progress has been made in reducing single occupant vehicle (SOV) trips and expanding non-motorized transport. Expanding transit usage and carpooling will be important objectives for the campus in coming years.

4.5 Waste and Compost Sector Results & Analysis

Emissions for the Waste Sector in '10/'11 were 363 MtCO2e – less than 2% of total emissions. 405 MtCO2e of these emissions came from waste sent to the landfill – a 20% increase from '07/'08 – and an offset of 42 MtCO2e came from campus composting – a 68% decrease from '07/'08.

The increase in tracked waste generation between '07/'08 and '10/'11 was probably mostly due to difficulties in accurately tracking waste weights and methodological inconsistencies. The University operates a nationally recognized recycling program and has made great progress in expanding waste diversion since the passage of AB 75 in 1999 – and has seen a general trend of annual decreases in waste generation since then.

In late 2012 the Butte County Landfill, to which CSU, Chico's waste is hauled, began operating a methane capture and energy generation facility onsite. This system captures much of the methane emitted by the landfill as a result of the decomposition of organic material and converts it into energy (it was previously flared). This will have the effect of drastically reducing the GHG impact of waste sent to the landfill.

4.6 Fertilizer Sector Results & Analysis

Emissions from the Fertilizer Sector in '10/'11 were 264 MtCO2e – 1% of total emissions. The vast majority of these emissions were generated at the University Farm. The '10/'11 emissions levels for fertilizer represents a 5% decrease from '07/'08 levels.

4.7 Refrigerant Sector Results & Analysis

Emissions from the Refrigerant Sector in '10/'11 were 38 MtCO2e – less than 1% of total emissions. The '10/'11 emissions levels for refrigerant represent a 51% decrease from '07/'08 levels. As mentioned in Section 4.8 *Refrigerant Sector Methods*, emissions from refrigerant consumption are only generated by a system leak and are a minimal contributor to aggregate institutional emissions levels.

4.8 Animal Management Sector Results & Analysis

Emissions from the Animal Management Sector in '10/'11 were 1,173 MtCO2e – less than 4% of total emissions. The '10/'11 emissions levels for animal management represent a 42% increase from '07/'08 levels. This increase is due primarily to increases in the amount of emissions associated with each head of livestock – built into the CA-CP calculator – in the process of emissions factor refinement.

APPENDICES

Appendix A – Changes in Input Values from '07/'08 – '10/'11

Changes in Input Values from '07/'08 to '10/'11				
Emissions Source	Input Metric	2007 / 2008 Input Value	2010 / 2011 Input Value	% Change
Purchased Electricity	kWh	32,955,589	31,269,863	-5.1%
Natural Gas	MMBtu	108,907	135,088	24.0%
S & F Commute	FS auto miles	3,181,578	2,634,835	-17.2%
	FS bus miles	273,939	68,784	-74.9%
Student Commute	S auto miles	24,326,154	19,553,478	-19.6%
	S bus miles	2,094,305	1,092,747	-47.8%
Sponsored Travel	air miles	6,183,365	1,764,601	-71.5%
	train miles	6,967	1,088	-84.4%
	auto miles	1,250,003	1,483,665	18.7%
	bus miles	44,635	7,057	-84.2%
Waste to Landfill	short tons to LF	1,207	1,307	8.3%
Animal Husbandry	dairy cows	149	149	0.0%
	beef cows	169	169	0.0%
	swine	123	123	0.0%
	goats	67	67	0.0%
	sheep	67	67	0.0%
Fleet Vehicles	gallons gasoline	64,312	32,055	-50.2%
	gallons diesel	16,743	12,524	-25.2%
Fertilizer Application	pounds syn (20%)	285,815	285,815	0.0%
	pounds org (2%)	304,000	304,000	0.0%
Refrigerant	pounds	240	151	-37.1%
T & D Losses	N/A			N/A
Composting	short tons	339	109	-67.8%

Appendix B – Changes in Emissions Factors from '07/'08 (CACP v 6.4) to '10/'11 (CACP v 6.8)

Changes in Emissions Factors from '07/'08 (CACP v 6.4) to '10/'11 (CACP v 6.8)							
Emissions Source	2007 / 2008			2010 / 2011			% Change
	Emissions Factor		Per Unit	Emissions Factor		Per Unit	
Purchased Electricity	0.000494	MtCO2e	kWh	0.000208	MtCO2e	kWh	-57.9%
Natural Gas	52.76	kg CO2	MMBtu	52.72	kg CO2	MMBtu	-0.1%
S & F Commute	0.394	kg CO2	auto mile	0.397	kg CO2	auto mile	0.8%
	0.252	kg CO2	bus mile	0.252	kg CO2	bus mile	0.0%
Student Commute	0.394	kg CO2	auto mile	0.397	kg CO2	auto mile	0.8%
	0.252	kg CO2	bus mile	0.256	kg CO2	bus mile	1.6%
Sponsored Travel	0.774	kg CO2	air mile	0.587	kg CO2	air mile	-24.2%
	0.394	kg CO2	auto mile	0.397	kg CO2	auto mile	0.8%
	0.158	kg CO2	train mile	0.038	kg CO2	train mile	-75.9%
	0.252	kg CO2	bus mile	0.252	kg CO2	bus mile	0.0%
Waste to Landfill	12.22	kg CH4	short ton landfilled	12.4	kg CH4	short ton landfilled	1.5%
Animal Husbandry	153.98	kg CH4	head dairy cows	206.35	kg CH4	head dairy cows	34.0%
	46.17	kg CH4	head beef cattle	58.04	kg CH4	head beef cattle	25.7%
	15.32	kg CH4	head swine	16.15	kg CH4	head swine	5.4%
	8.29	kg CH4	head sheep	9.01	kg CH4	head sheep	8.7%
	5.5	kg CH4	head goats	5.32	kg CH4	head goats	-3.3%
Fleet Vehicles	8.71	kg CO2	gallon gasoline	8.77	kg CO2	gallon gasoline	0.7%
	9.99	kg CO2	gallon diesel	10.15	kg CO2	gallon diesel	1.6%
Fertilizer Application	0.004	MtCO2e	pound nitrogen	0.014	kg N2O	pound nitrogen	N/A
	0.004	MtCO2e	pound nitrogen	0.014	kg N2O	pound nitrogen	N/A
Refrigerant	0.771	MtCO2e	pound	0.771	MtCO2e	pound	0.0%
T & D Losses	N/A			N/A			N/A
Composting	N/A			N/A			N/A

Appendix C – Emissions Per FTE & GSF '07/'08 – '10/'11

Emissions Per FTE and GSF '07/'08 - '10/'11								
Emissions Source	2007 / 2008			2010 / 2011			% Change Per FTE	% Change Per GSF
	MtCO2e	Per FTE	Per GSF	MtCO2e	Per FTE	Per GSF		
		15,664	2,913,484		15,007	3,023,378		
Purchased Electricity	16,268	1.04	0.00558	6,508	0.43	0.00215	-58.2%	-61.4%
Natural Gas	5,762	0.37	0.00198	7,144	0.48	0.00236	29.4%	19.5%
S, S, & F Commute	11,709	0.75	0.00402	8,725	0.58	0.00289	-22.2%	-28.2%
Sponsored Travel	5,318	0.34	0.00183	1,593	0.11	0.00053	-68.7%	-71.1%
Waste to Landfill	339	0.02	0.00012	405	0.03	0.00013	24.7%	15.1%
Animal Husbandry	828	0.05	0.00028	1,173	0.08	0.00039	47.9%	36.5%
Fleet Vehicles	743	0.05	0.00026	417	0.03	0.00014	-41.4%	-45.9%
Fertilizer Application	278	0.02	0.00010	264	0.02	0.00009	-0.9%	-8.5%
Refrigerant	77	0.00	0.00003	38	0.00	0.00001	-48.5%	-52.4%
T & D Losses	1,609	0.10	0.00055	644	0.04	0.00021	-58.2%	-61.4%
Composting	-130	-0.01	-0.00004	-42	0.00	-0.00001	-66.3%	-68.9%
TOTAL	42,801	2.73	0.01469	26,869	1.79	0.00889	-34.5%	-39.5%

California State University, Chico
Greenhouse Gas Emissions Inventory – FY 2010-2011
January, 2013