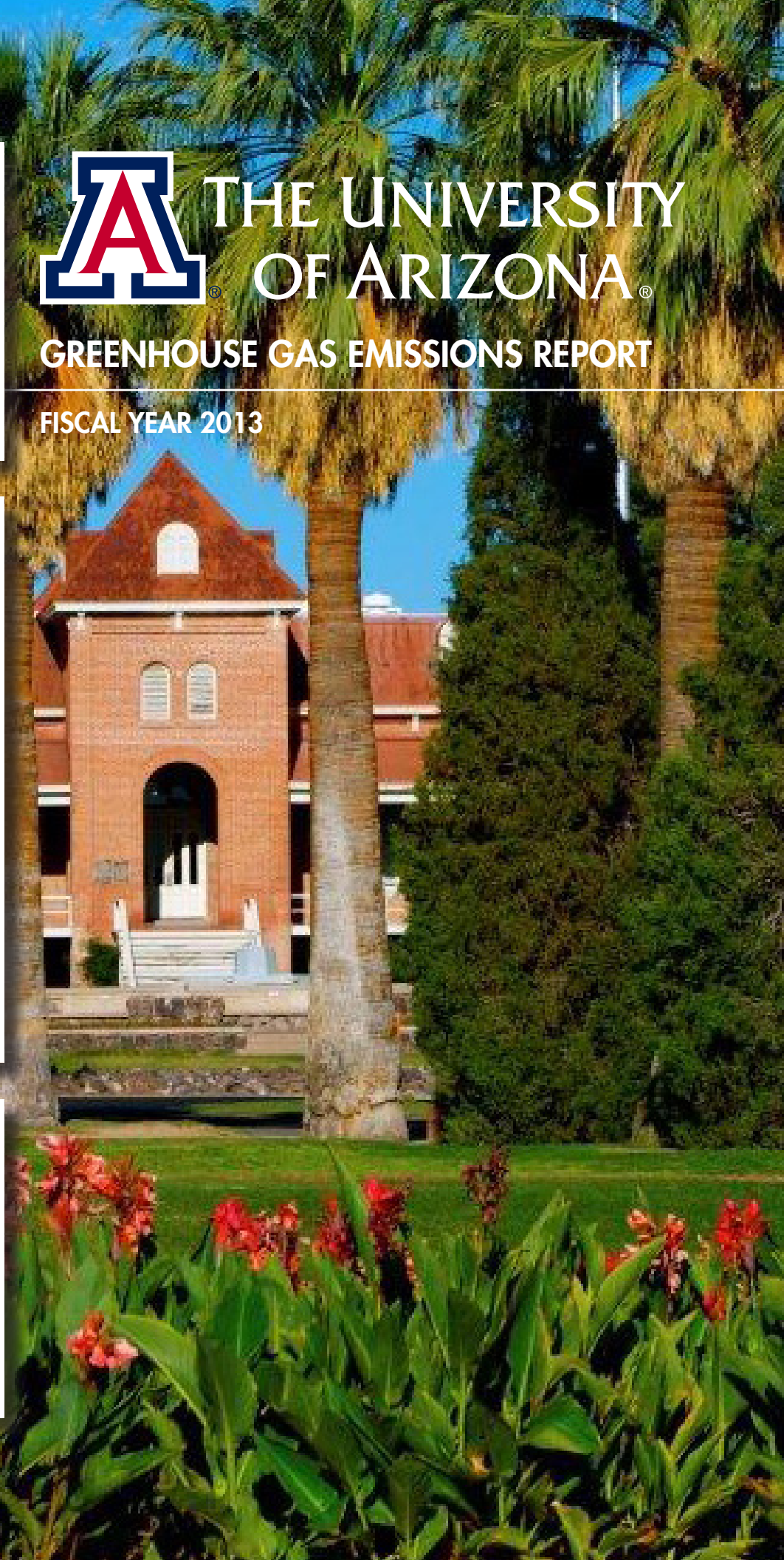




THE UNIVERSITY OF ARIZONA®

GREENHOUSE GAS EMISSIONS REPORT

FISCAL YEAR 2013





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March 11, 2015

GLHN Architects & Engineers, Inc. | 2939 E Broadway Blvd, Tucson, AZ 85716

T 520.881.4546 | F 520.795.1822 | GLHN.com

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INTRODUCTION

The University of Arizona (UA), located in Tucson, Arizona, has a headcount enrollment of more than 40,000 students in more than 350 academic programs. The campus consists of 207 buildings on Main Campus located on 391 acres in central Tucson. The campus is the oldest continually maintained green space in Arizona. The UA recognizes the need to conserve its natural resources and is committed to creating a sustainable community for its students, employees and the neighboring community.

The UA has signed The American College and University Presidents Climate Commitment (ACUPCC) and has pledged to become climate neutral as soon as possible. Climate neutrality is defined as minimizing greenhouse gas (GHG) emissions as much as possible and using carbon offsets, or other measures, to mitigate the remaining emissions. The ACUPCC also requires that a comprehensive inventory of all greenhouse gas emissions be accomplished and updated every other year.

In accordance with its commitment, this report details the UA's GHG emissions for Fiscal Year (FY) 2013. The report is divided into sections according to major sources of emissions. The UA began tracking its environmental impact in FY 2009 and its main sources of measured emissions are purchased utilities, air travel and commuting. The University is pursuing priorities in purchased utilities categories by improving operational efficiencies within all three Utility Plants.

METHODOLOGY

The most accurate data available was collected from several departments on campus including Parking and Transportation Services, Facilities Management (Utilities Services, Motor Pool, Grounds Services, Custodial Service, Recycling and Business Services) and the UA Office of Sustainability. Emissions are reported as CO₂ with all emissions given in metric tons of CO₂ equivalent (MtCO₂e). The UA's FY 2013 greenhouse gas report includes emissions from the Main Campus' electricity use, natural gas use, refrigerant use, fleet fuel use, shuttle bus fuel use, employee air travel, fertilizer use and solid waste disposal. Also included in the report are estimated CO₂ emissions due to faculty, staff and student commuting.

Data supplied for this report covers FY 2013 for the Main UA Campus. The fiscal year starts on the first day of July 2012 and ends on June 30 2013. This report does not include satellite locations or Biosphere 2.

Billion Dollar Green Challenge

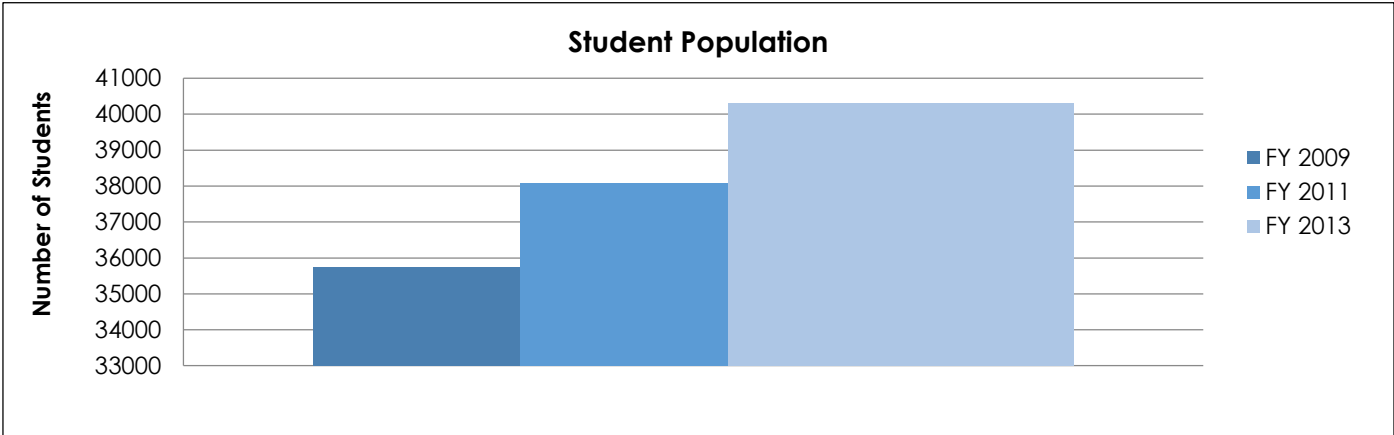
The University of Arizona has joined the Billion Dollar Green Challenge. The goal is to achieve reductions in operating expenses and greenhouse gas emissions, while creating regenerating funds for future projects.

The University is utilizing the "Green Revolving Investment Tracking System (GRITS)", a web tool for tracking projects energy and financial savings and return data throughout the life of the project.

CAMPUS GROWTH

Student population and the campus continue to grow. Fall 2012 showed a full time equivalent student population greater than 39,000 with approximately 7,200 students living on campus in residence halls. The University employs more than 15,200 faculty and staff with a full time employee count of greater than 12,000. The Main Campus size is 391 acres with more than 207 buildings. The building square footage has increased by 3.4% and student population has increased by 5.9% since fiscal year 2011, the last greenhouse gas reporting year.

Graph 1: University Student Population Growth



UTILITY OPERATIONS

FY 2013 showed that 75% of overall campus greenhouse gas emissions are attributable to purchased utilities in the form of electricity and natural gas. The main function of these utilities is to directly support building functions such as lighting, plug loads, cooling, heating, emergency generators, etc. The University is proactively taking steps to reduce the energy usage of new buildings constructed on campus. All new buildings require, at a minimum, LEED Silver certification. The use of solar energy for heating water and photovoltaic systems for generating electricity is highly encouraged in all new building projects.

New Buildings on Campus

Bryant Bannister Tree-Ring Building

Dedicated in March 2013 as the new home for the UA Laboratory of Tree Ring Research. The 41,152 GSF/18,283 NASF square foot building was built to LEED Silver certification.

Lowell-Stevens Football Facility (North End Zone)

Expansion of the north end-zone facility at Arizona Stadium adding 162,510 GSF/71,904 NASF. The expansion is pursuing LEED Gold certification.

Utility operations consists of natural gas used in turbines, utility plant boilers and building loads such as stand-alone heating systems, emergency generators and lab use; and purchased electricity to the campus grid. Combined, these sources produced greenhouse gas emissions equating to 180,376 MtCO_{2e}, a 3.5% increase compared to 174,325 MtCO_{2e} in FY 2011. The campus purchased electricity decreased while natural gas for turbines and utility plant boilers use increased.

Natural gas use in utility plant boilers and individual buildings increased 15.2% between FY 2011 and FY 2013.

The largest component of this increase is natural gas used in boilers at the utility plants. This data is based on local utility company billing and is consistent between FY reports leading to the conclusion that the increase is not likely due to a reporting error.

A review of the heating degree days* (base 65) for Tucson is shown for comparison:

FY 2011: 1622

FY 2013: 1641

*Heating Degree Days is defined as the number of degrees that a day's average temperature is below 65°F, the temperature below which buildings need to be heated.

It is not entirely clear what precipitated the significant increase in boiler natural gas use between FY 2011 and 2013; the heating degree days do not adequately provide justification. Upon deeper review, the increase in consumption occurs at both the CHRP and AHSC utility plants with increases of 12% and 14%, respectively.

Note: Data for fiscal year 2014, though not included in this report, shows a 15% decrease in the use of boiler natural gas. Weather data for FY 2014 shows 1218 heating degree days.

Natural gas used locally at buildings increased approximately 7%. This is most likely due all data not included in the previous reports. The reporting system was overhauled in calendar year 2013 and previously excluded meters are now included in the data set. The data and reporting system continues to undergo updates and refinements.

The purchased utility breakdown for electricity and natural gas are shown in Table 1. This data includes the percent change between FY 2011 and FY 2013.

Table 1: Purchased Utilities – Comparison

	FY 2011	FY 2013	% Increase
Purchased Electricity (kWh)	168,907,509	168,007,398	-0.5%
Purchased Turbine Natural Gas (mmbtu)	1,035,180	1,090,409	5.3%
Purchased Boiler Natural Gas (mmbtu)	409,924	475,398	16%
Purchased Building Natural Gas (mmbtu)	41,265	44,159	7%

Below are descriptions of significant projects undertaken by UA Facilities Management and UA Planning, Design and Construction. It is anticipated that these projects will reduce the University of Arizona Main Campus greenhouse gas emissions. It is important to note that the local electrical utility composition of generating units is 79% coal fired while the Western Electrify Coordinating Council sub region data for all of Arizona, New Mexico and Southern Nevada is 42% coal.

Steam and Chilled Water Tunnel Improvements

More than six miles of tunnel steam and chilled water distribution piping were assessed and repairs were made to leaking valve, steam traps and expansion joints. In addition, all missing or compromised piping insulation was replaced.

It is anticipated that these repairs will significantly reduce system losses attributable to piping transportation and thermal energy. This more efficient transportation system will reflect on the generation capacity required at the utility plants. The steam, and chilled water to a lesser degree, generation requirements will decrease, thus reducing University of Arizona greenhouse gas emissions. Decreased greenhouse gas emissions associated with the water mass flow loss will be garnered by the local Tucson water company.

Un-Islanding of 4.5 MW Turbine

The AHSC turbine, a 4.5 MW combined cycle unit, was previously islanded to specific equipment located within the refrigeration plant. This precluded the turbine from producing power and steam at full capacity. The turbine was recently un-islanded and now exports power to the campus electrical grid. This modification in operations allows the turbine to operate at full power and steam output.

With this change, a corresponding decrease in campus greenhouse gas emissions will result. The University's use of the natural gas turbine in lieu of the local electrical utility, which predominately utilizes coal based production units, is one more step towards reducing the campus carbon footprint.

Utilities Metering Upgrade Program

A comprehensive program has been instituted to measure all utilities and auxiliary equipment at the utility plants. This measure will enable Facilities Management to analyze its systems continually and respond to changes in data indicating possible maintenance issues. All generating equipment (chillers and boilers) are measured for input and output. Additions to the metering system include the pumps and fans associated with production. Eventually, all utility plant make-up water and sewer system discharge will be metered.

Metering will allow the plant operators to determine plant efficiencies for steam and chilled water production and respond to changes real time. This measure will reduce greenhouse gas emissions by implementing changes immediately when problems are discovered.

High Efficiency Chillers and Boilers Installation

Several new chillers and boilers were installed at the utility plants. The new chillers are the most efficient on campus and will be used for base loading the existing chiller fleet. New boilers are modular, high efficient, condensing type, able to quickly respond to changing loads and thus mitigating the requirement for larger, less efficient boilers to maintain standby status.

These measures will reduce source energy requirements, both electrical and natural gas, helping to reduce the greenhouse gas emissions at the University of Arizona.

FLEET OPERATIONS

Sources of greenhouse gas emissions from fleet operations consist of the on campus shuttle service operated by UA Parking and Transportation Services and the Motor Pool operated by UA Facilities Management. Fuel consumption is tracked using beginning and end of year inventory data and is therefore an accurate representation of the fuel used in the campus vehicles and the Cat Tran campus shuttle service.

UA's transportation requirements generated 2,173 MtCO₂e, a 28% decrease compared to 3,004 MtCO₂e in FY 2011.

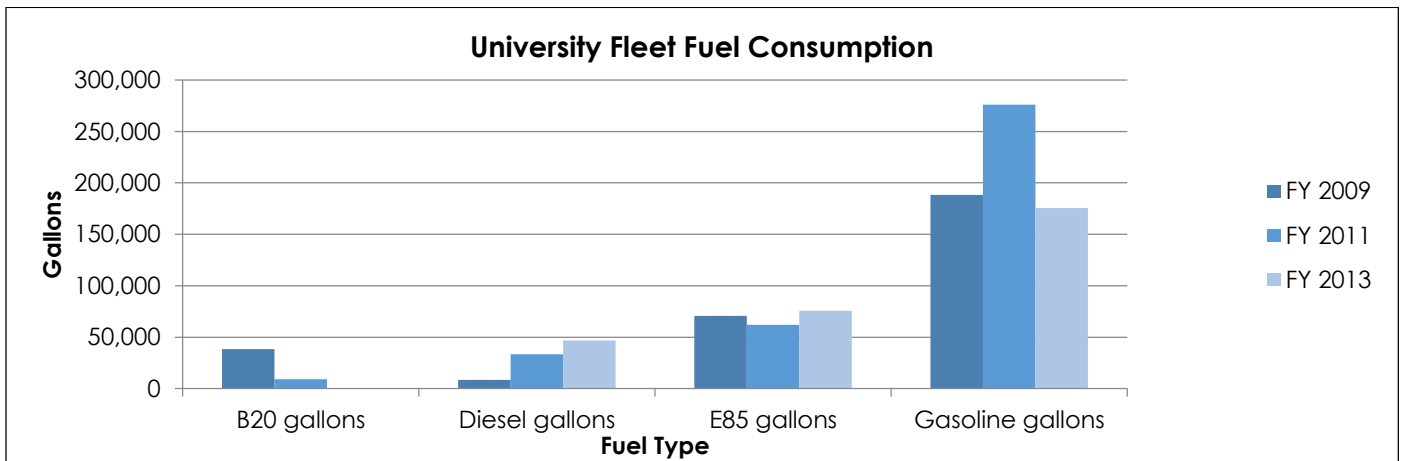
UNIVERSITY FLEET

Fleet vehicles use gasoline and Ethanol 85 as of FY 2013. The biodiesel fuel used in past years has been eliminated as a fuel source. Correspondingly, Ethanol 85 fuel use has increased 22% over FY 2011 data while gasoline fuel use decreased 36%. University fleet fuel also includes diesel and propane provided by the small engine shop for equipment such as forklifts, street sweepers, welders, and mowers.

CAT TRAN SHUTTLE FLEET

The Cat Tran shuttle traveled 234,542 miles and transported 469,572 passengers during FY 2013. The shuttle fleet utilizes ultra-low sulfur diesel in its busses having completely transitioned from the use of biodiesel fuel. Diesel fuel use has increased 40% since the FY 2011 reporting period.

Graph 2: University Fleet Fuel Consumption:



COMMUTING AND AIR TRAVEL

COMMUTING

In 2007, the UA Parking and Transportation Department conducted a survey to determine the number of miles traveled by students, faculty and staff to and from campus. The survey data was extrapolated for FY 2013 based on updated student, faculty and staff populations.

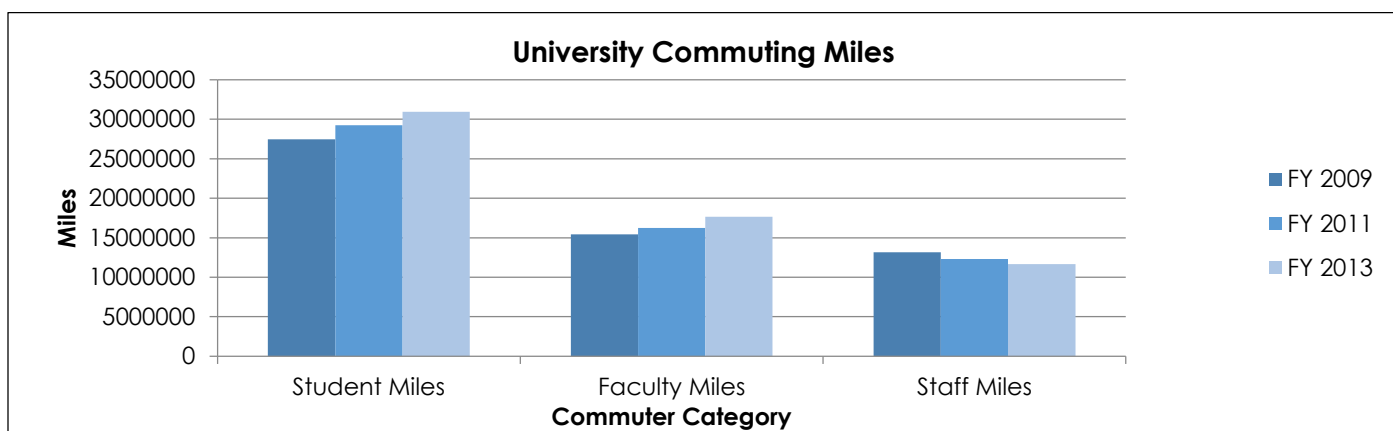
Approximately 60% of the student body uses a personal vehicle to commute to the University. Assuming 4 trips/week for 40 weeks/year at an average length of 8 miles per trip, a total mileage per year can be calculated.

Because commuting values are linearly derived from populations, the greenhouse gas emissions associated with commuting rise and fall with the student, staff and faculty population changes.

Student and faculty population grew by 5.9% and 8.7% while the staff population decreased by 5.4%.

Faculty and staff commuting were calculated similarly. 73% of personnel are assumed to use personal vehicles at a rate of 5 trips/week for 52 weeks (staff) 50 weeks (faculty)/year and an average length of 13 miles per trip.

Graph 3: University Commuting Miles



AIR TRAVEL

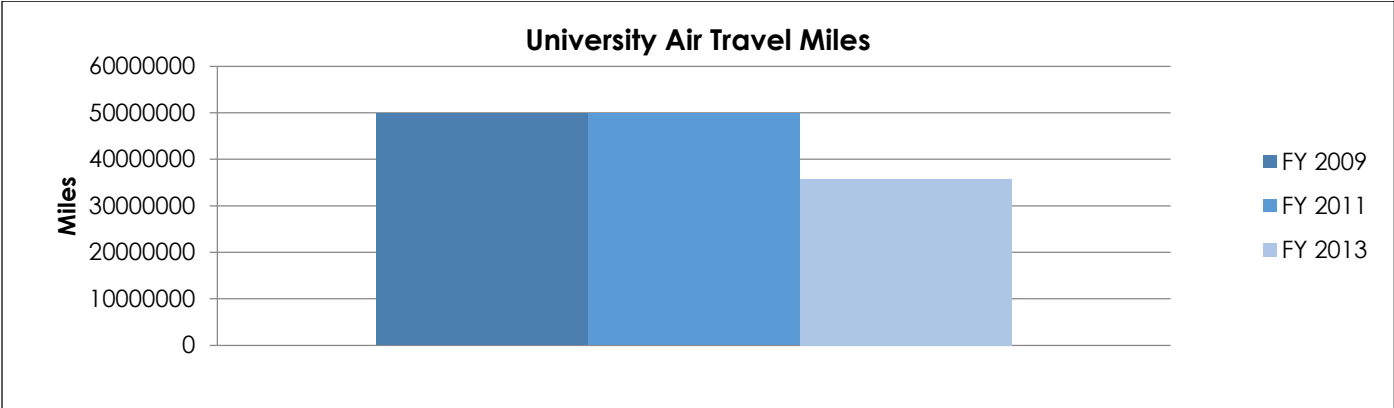
Air travel information was obtained from UA Procurement and Contracting Services Department (Purchasing Card (P-Card) Program). P-Cards are a direct method of charging air travel to the UA Financial Services Office (FSO). Due to a computer system change, data was only available for the January through June 2013 time period. Provided was a file with travel dates, and origination and destination airport designations. An Excel matching function was used to correlate airport codes to distances to obtain six month mileage data. This data was extrapolated to obtain a one year P-Card Program mileage value.

Another avenue for funding air travel is via direct reimbursement from UA FSO. UA FSO was able to provide the total number of trips reimbursed. Air travel mileage was not available. The average trip length from the P-Card data set was used as a multiplier to determine a reasonable total air travel mileage when evaluating the direct reimbursement data.

Air travel and resulting greenhouse gas emissions decreased approximately 28% from the FY 2011 greenhouse gas report. Air travel data confidence is low because averages, extrapolations and assumptions are used to derive the data. Methodologies used in calculating the air miles and the UA computer collection system have changed in the interim between FY 2011 and FY 2013.

Going forward, the University should work with Financial Services Office and/or Procurement and Contracting Services to develop custom computer queries to extract the required mileage data for all air travel by UA faculty and staff.

Graph 4: University Air Travel Miles



WASTE MANAGEMENT

In FY 2013, the UA sent approximately 2,892 tons of commercial, roll-off and owner hauled waste to the landfill, and recycled 537 tons of paper and baled old corrugated cardboard (OCC). The campus recycled 33% of total waste in fiscal year 2013 to include recycled paper, construction and demolition material, mixed metal, animal bedding and pallets. The overall amount of University solid waste generation decreased but due to the haul locations, the greenhouse gas emissions increased. The University attributed 8,965 MtCO₂ emissions due to solid waste production on campus in FY 2013, an increase of 1% from FY 2011.

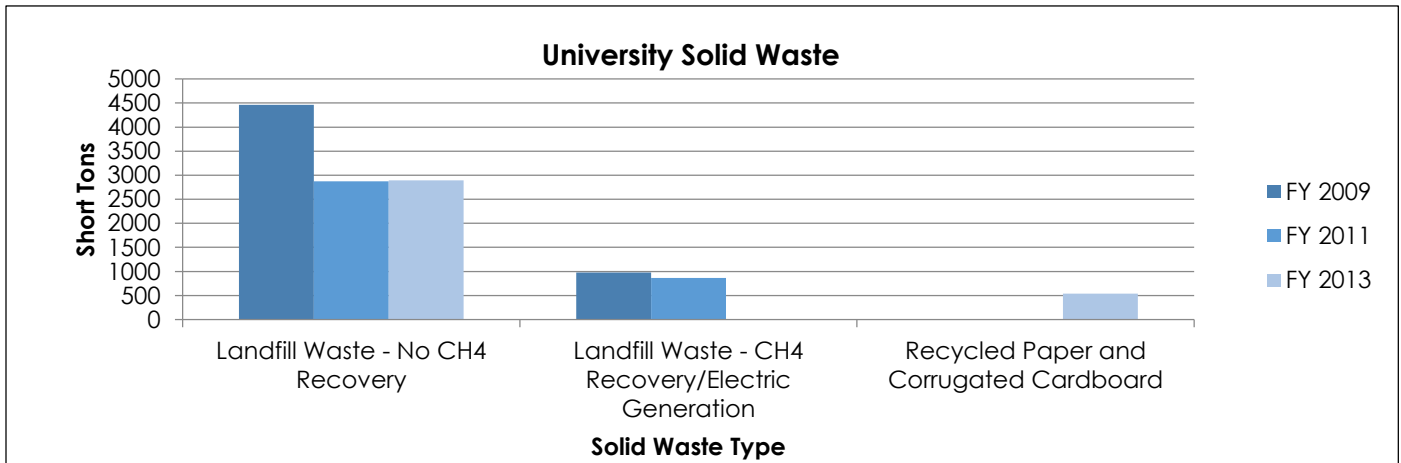
Waste removal from campus is either by UA hauling to a local landfill or the contracted waste disposal service (Waste Management (WM)) hauling both commercial and roll off waste to a local landfill. UA hauled waste was transported to the Ina Road Land Reclamation Facility which only accepts clean inert or clean green waste and CH₄ recovery is not accomplished. In the past, the University did haul to a local landfill with CH₄ recovery and electrical generation (Los Reales Landfill) but this is no longer the case.

Waste removed by WM is taken to the Marana Regional Landfill. CH₄ recovery is not accomplished at this facility.

FY 2013 is the first year recycled paper and corrugated cardboard was reported.

While overall waste disposal, in terms of tonnage, is decreasing, emissions are not similarly decreasing in proportionality. This can be attributed to landfill diversion methodology with more waste now going to non-CH₄ recovery landfills.

Graph 5: University Solid Waste

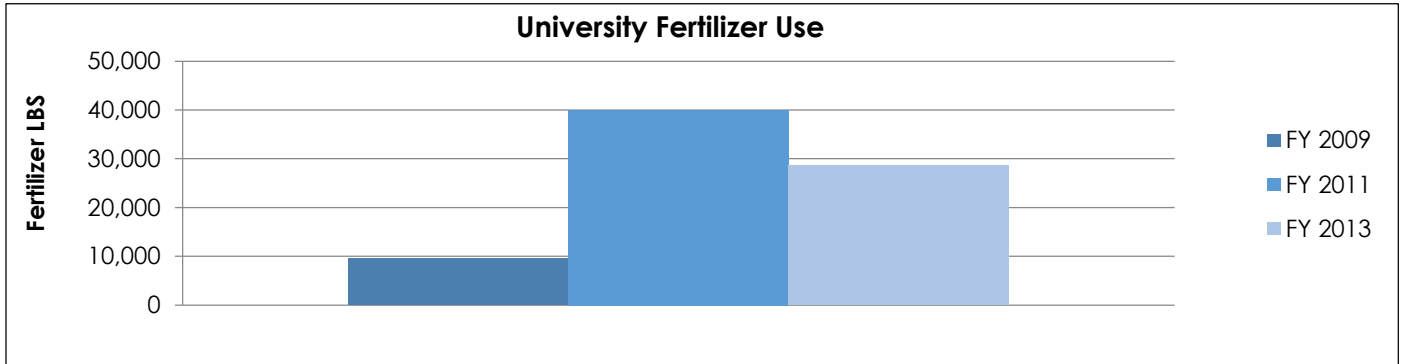


GROUNDS MANAGEMENT

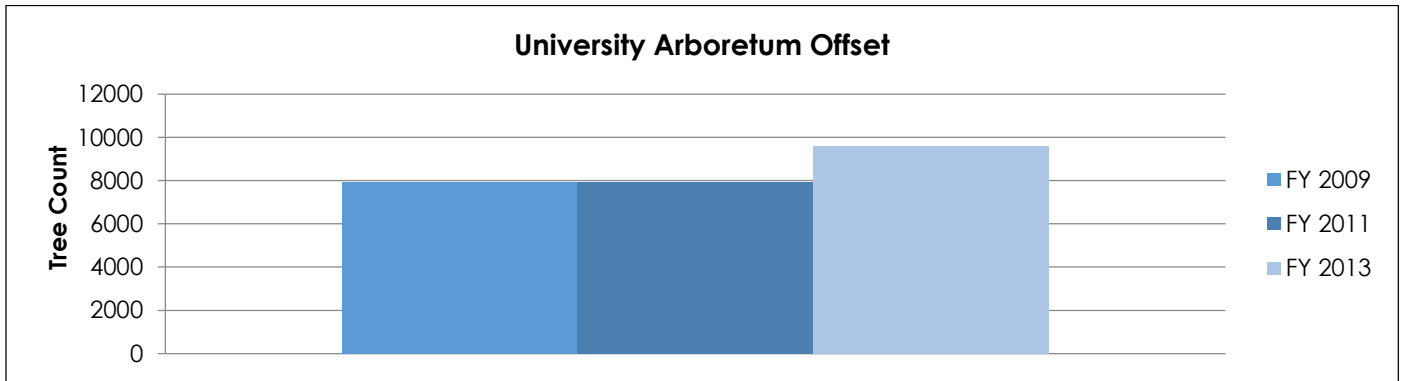
The University of Arizona has over 390 acres of land that is, for the most part, landscaped. During FY 2013, the campus continued to decrease its dependency on synthetic fertilizer. The University now purchases both synthetic fertilizer and compost. The amount of synthetic fertilizer used in FY 2013 and its subsequent MtC02e emissions decreased from the previous year. 28,625 pounds of synthetic fertilizer was installed in FY 2013 as compared to 40,000 pounds in FY 2011. Additionally, 255 cubic yards of compost was purchased for use on the University property during fiscal year 2013.

Tree data is used as an offset to the University of Arizona's greenhouse gas emissions. Total tree count for FY 2013 is 9,579 while the 2011 data showed a tree count of 7,925.

Graph 6: University Fertilizer Use



Graph 7: University Arboretum Offset



FISCAL YEAR 2013 GREENHOUSE GAS EMISSIONS FINDINGS

The University of Arizona emitted 232,618 MtCO₂e in FY 2013 as compared to 233,844 MtCO₂e in FY 2011. This represents a .5% decrease in overall CO₂ equivalent emissions.

The largest contributors to greenhouse gas emissions are listed below, in descending order of contribution (greatest to least):

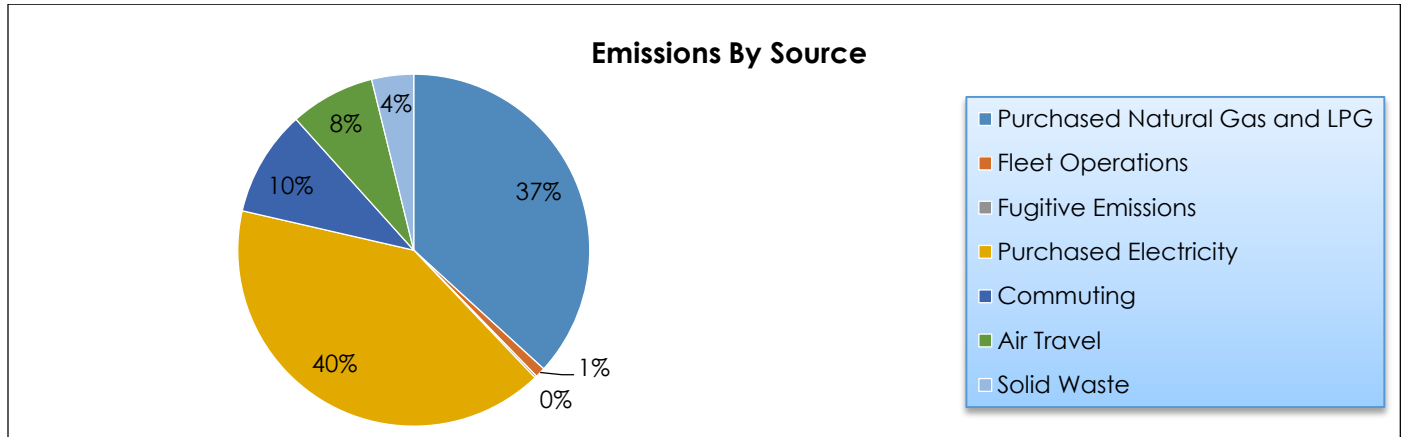
1. Purchased electricity
2. Purchased natural gas and propane - stationary combustion
3. Commuting
4. Air Travel
5. Waste Management
6. University fleet operations – mobile combustion
7. Fugitive emissions – refrigerants, chemicals, fertilizer

The following tables and graphs present data of general interest regarding the University of Arizona greenhouse gas emissions for fiscal year 2013.

Table 2: Metric Tons of CO₂ Equivalent (MtCO₂e)

Category	FY 2011	FY 2013	Change
Utility Operations			
Purchased Electricity	95,262	94,754	-.5%
Purchased Natural Gas and LPG	79,063	85,622	+8%
Air Travel	25,327	18,175	-28%
Commuting	21,753	22,688	+4%
Waste Management	8,881	8,966	+1%
University Fleet Operations	3,004	2,173	-28%
Fugitive Emissions			
Refrigerants, Chemicals and Fertilizers	721	442	-39%
Offsets			
Arboretum Tree Count	166	201	+21%
Transmissions and Distribution Losses	6275	6242	-.5%
TOTAL	240,119	238,861	-.5%

Graph 8: Emissions by Source



Graph 9: Metric Tons of CO2 Equivalent (MtCO2e) by Fiscal Year

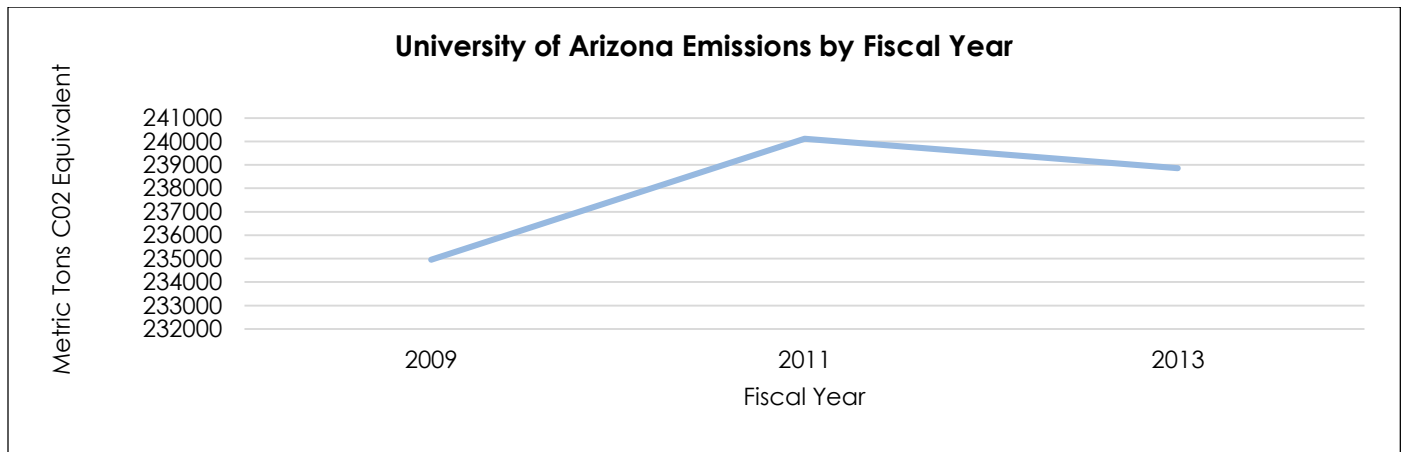


Table 3: Normalization Data for MtCO2 Emissions

Fiscal Year	MtCO ₂ /SF	MtCO ₂ /Student	MtCO ₂ /Total Population
2009	.0251	6.5734	4.9375
2011	.0244	6.3063	4.8109
2013	.0239	5.9250	4.5516

*Total Population = Student + Staff + Faculty

INSTITUTIONAL DATA SOURCES FY 2013

Population

FTE students	40,314 note 1
Residential students'	7209 note 2
Full time commuting students	not available
Part time commuting students	not available
Noncredit students	not available
Summer students	not available
Full time staff	4719 note 3
Part time staff	not available
Full time faculty	7445 note 4
Part time faculty	not available

Budget

Total Operating budget	\$1,971,598,600 note 5
Research budget	\$610,565,000 note 6
Energy budget	not available

Physical Space Data

Total Space GSF	9,992,812 note 7
Laboratory Space	not available
Parking Structure	2,884,993 note 7
Dining Space	not available
Residential Space	1,854,585 note 7
Athletic	not available

2012-2013 FACT BOOK DATA

Note 1: Students/FTE

<http://factbook.arizona.edu/2012-13/students/fte>

Note 3: Employees (use FTE value for classified staff and Administrator)

<http://factbook.arizona.edu/2012-13/employees>

Note 4: Employees (use FTE value for Faculty, Other appointed, Classified Staff and GA and Associates)

<http://factbook.arizona.edu/2012-13/employees>

Note 5: Total Operating Budget (use total funds)

<http://factbook.arizona.edu/2012-13/finances>

Note 5: Research Budget (use Total R&D)

<http://factbook.arizona.edu/2012-13/finances>

2012-2013 FAQ BROCHURE

Note 2: Residence Hall Data (Use residence hall capacity)

http://factbook.arizona.edu/sites/default/files/FAQ_broch_2012-13_V2.pdf

Fall 2013 The University of Arizona Real Estate Administration – Physical Space Inventory

Summary of Physical Space Inventory by Location

Note 7: Total Space GSF, Residential, permanent and non-permanent, and Parking Structures (use Main Campus)

<http://www.space.arizona.edu/reports/Physical%20Space%20-%202013.pdf>