

Treading Lightly

Steps Toward Reducing Our Carbon Footprint

CLIMATE ACTION PLAN



THE UNIVERSITY OF ARIZONA



One of our original school colors was **green**.

It was inspired by the sagebrush, a hardy shrub with a small footprint that uses precious few resources yet it thrives in the Arizona desert. More than a century later, our ingenuity is thriving as we aspire to live as prudently as the plant that made us green years ago.

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From the President

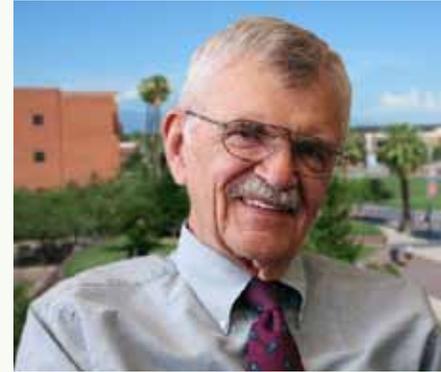
The University of Arizona has been committed to sustainability since our beginning in 1885. There was no LEED certification then but our first building, Old Main, which is 120 years old and still is used today, was constructed with local materials and designed for climate control using common-sense principals. In 2012, we are proud to continue this tradition as a signatory of the American College and University President's Climate Commitment.

It is clear that solutions to reducing global greenhouse gases will come from American research universities such as this one. Last fiscal year, UA faculty were awarded 71 research projects related to climate change science and solutions, totaling \$24 million in federal funds. Our Institute of the Environment, which includes more than 300 faculty members, fosters and facilitates collaborations across the state and around the world to help explain and resolve environmental challenges.

The UA professionals who work in every aspect of construction and facilities management are fully committed to sustainability. Our three most recent new buildings have achieved Platinum LEED status and innovations take place every month to reduce waste and utility use. The UA solar power installations are among the top 10 of American universities, and we recently achieved an AASHE STARS Gold rating for campus-wide sustainability. University of Arizona students are also leading the way by establishing their own innovative programs that reduce our carbon footprint and funding a range of other sustainability projects.

It is also clear that achieving the goal of carbon neutrality, even on one college campus, may be decades away and will require major technological breakthroughs. The UA will continue to lead by example so that our students and the communities we serve see this university as a role model. We will continue to partner with local governments for additional impact. For a document such as this to be scientifically relevant, it must appropriately be considered a living document and be used as a benchmarking tool. I am proud to submit this climate action plan and pledge the University of Arizona's ongoing support to creating a more sustainable future.

Eugene G. Sander
President, The University of Arizona





UA Meets Gold Standard for Sustainability

Top rating from the Association for the Advancement of Sustainability in Higher Education

In February 2012, the University of Arizona received a Gold rating for sustainability from AASHE STARS – a designation that puts UA in the upper echelon of colleges and universities leading the way to a sustainable future.

STARS stands for the Sustainability Tracking Assessment and Rating System, a program of the AAHSE, an organization with more than 850 university and college members committed to advancing sustainability in higher education.

Considered the gold standard in rating systems for sustainability in higher education, STARS was developed with broad input from these members in order to provide a framework for understanding sustainability across all sectors of higher education, and to enable meaningful comparisons over time and across institutions.

As of February 2012, only 30 of 160 colleges and universities who have applied for an AASHE STARS rating have earned Gold.



The STARS report is a comprehensive look at sustainability throughout the UA community – from research to recycling to human resources. The rating is important because it not only highlights UA’s achievements in sustainability to date, but also establishes a baseline to gauge future endeavors.

The STARS report is based on self-reported data and all reports are available online.



Lead the Way

The UA is a Living Laboratory for Sustainability

The entire University of Arizona campus is a living laboratory for sustainable design and practices – and has been for more than a century.

This land-grant institution began its long investment in living sustainably in an arid region when the UA Agricultural Experiment Station opened in 1890, a year before the first classes were held.

Today the UA is recognized internationally as the home of multi-disciplinary experts in global climate science and climate change solutions. This visionary science influences decisions made today about managing the world's resources for tomorrow.

The university offers more than 323 courses related to sustainability in 59 departments and leads collaborations across the campus and around the planet – helping people, institutions and governments plan for climate-related changes, minimize negative impacts and enhance the benefits to natural systems and societies. Students and faculty work in sustainability research in centers, institutes and field sites around the world.

The UA ranks 18th in the nation among public universities for research funding from the National Science Foundation. In fiscal year 2010-2011 alone the UA was awarded approximately \$10 million to support 71 research projects related to climate change science and solutions. The UA also is member of the invitation-only American Association of Universities – 61 leading public and private research universities in the United States and Canada.

As a world leader in global climate change and sustainable practices, the UA has created a campus that is a model of sustainability. At this laboratory for testing, implementing and teaching earth-friendly practices, the UA is clearly committed to “walking the walk.”

Walking the Walk

Start with walking – and cycling. The campus is designed for easy access for pedestrians and bicycles. It's shaded by an urban forest of nearly 8,000 drought-tolerant trees that provide green spaces and reduce utility costs. Buildings, even the oldest, incorporate sustainable designs. Dramatic architecture features everything from Arizona's only turf roof to the first solar thermal units that both heat and cool. Retrofitting everything from fume vents to lighting fixtures and toilets reduces energy use. The UA generates electricity from natural gas, saves energy by cooling buildings with chilled water, has a green motor fleet and motivates employees and students to recycle and reduce energy consumption with incentives and competitions. The UA is a showcase of eco-friendly options – and the next generation is already living green on campus. This document includes more about these and other examples of how the UA already “walks the walk.”

ACUPCC

The University of Arizona is one of more than 650 universities that have signed the American College and University Presidents' Climate Commitment.

The presidents and chancellors who signed this commitment are deeply concerned about the unprecedented scale and speed of global warming and its potential for large-scale, adverse health, social, economic and ecological effects. They believe colleges and universities must exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality.

Each of these institutions is committed to developing a comprehensive plan to achieve climate neutrality as soon as possible. This includes:

- Creating institutional structures to guide the development and implementation of the plan.
- Completing a comprehensive inventory of all greenhouse gas emissions (including emissions from electricity, heating, commuting and air travel) and update the inventory every other year thereafter.
- Developing an institutional action plan for becoming climate neutral.

The UA has long been a leader in sustainable research, designs and practices. By signing the ACUPCC, the UA affirms its commitment to continue to lead by example in reducing its carbon footprint and continue to improve its ability to track greenhouse gas emissions, report comprehensively on all steps being taken to reduce them and share proven innovations.



University of Arizona has taken many steps to leave a lighter footprint on the earth.

The university already:

- Generates approximately one-third its electric power onsite from natural gas, not coal
- Invests in centralized chilling systems to reduce energy use for air conditioning
- Designs new buildings to meet or exceed LEED silver or better standards
- Renovates and retrofits older buildings
- Provides robust alternative transportation programs
- Implements green purchasing standards
- Recycles and re-purposes to keep solid waste out of landfills
- Trains the next generation in sustainability science and solutions



Take Stock of Emissions

Monitoring Annual Greenhouse Gas Emissions Since 2009

The University of Arizona currently measures only the carbon footprint of the 390-acre main campus in central Tucson, and the 25-acre medical center, producing a total of 242,000 metric tons of carbon dioxide equivalent annually.

This represents the majority of the entire institutional carbon footprint of the UA. As Arizona's land-grant institution, the university also has facilities across the state, which are not currently measured. The university's commitment to reducing greenhouse gas emissions extends to all UA employees, students and facilities statewide.

The UA began tracking its annual greenhouse gas emissions in 2009. Approximately 70 percent of the main campus carbon footprint comes from meeting building energy needs. About 25 percent comes student and employee commuting and air travel.

Approximately 70 percent of the total comes from production of electricity and steam. Another 28 percent of emissions come from commuting and air travel.

How Much is a Metric Ton of Carbon Dioxide?

Greenhouse gas emissions are typically expressed in metric tons, an international unit of measurement equivalent to approximately 2,200 pounds.

One metric ton of carbon dioxide is produced to meet the energy demands of a typical American household every month.

One metric ton of CO₂ is released into the atmosphere for every 103 gallons of gasoline used. For a car that gets 25 miles per gallon, that's a bit more than 2,500 miles, which is about two months of driving for many Americans.

Six Greenhouse Gases

Every university that signed the America College and University Presidents' Climate Change Commitment is required to track and report the following greenhouse gases:

- Carbon Dioxide (CO₂)
- Methane (CH₄)
- Nitrous Oxide (N₂O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur Hexafluoride (SF₆)

Greenhouse gas emissions are typically reported as CO₂ equivalents. Carbon dioxide equivalents are commonly expressed as "million metric tons of carbon dioxide equivalents (MMTCO₂Eq)." The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated global warming potential.

The carbon footprint of the University of Arizona is equivalent to 533,368,000 pounds of carbon dioxide – or almost 242,000 metric tons of carbon-dioxide equivalents. The total amount of greenhouse gases emitted into the atmosphere from landfills in the United States in 2007 was equivalent to more than 132 million metric tons of carbon dioxide, according to U.S. Environmental Protection Agency estimates.

UA Emissions Inventory

The UA emission inventory is based on the following sources of emissions, and includes storage of atmospheric carbon dioxide in the biomass of the main campus trees.

Energy 70%

- On-site energy production is primarily natural gas, plus other fossil fuels and solar photovoltaic and hot water systems
- Electricity purchased from and generated by Tucson Electric Power is largely coal-based

Transportation 24%

- Air travel includes trips for which payment and reimbursement was processed through UA Financial Services
- Student and employee commuting, include daily trips between home and the UA main campus
- UA operations and motor-pool vehicle use

Solid Waste <1%

- Methane emissions, resulting from UA waste decomposing in nearby landfills

Refrigerants <1%

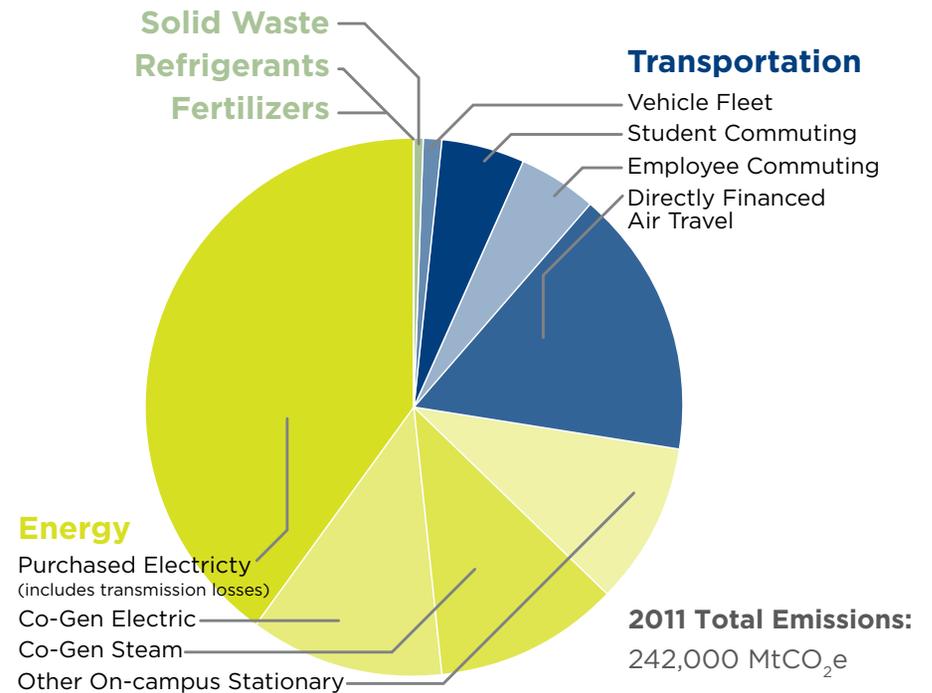
- Various refrigerant chemicals (hydrofluorocarbons, etc.), based on as-needed purchases, with no stockpiling

Fertilizers <1%

- Nitrous oxide emissions resulting from the application of fertilizers to campus grounds, green spaces and sports fields.

Carbon sequestration (-166MtCO₂e)

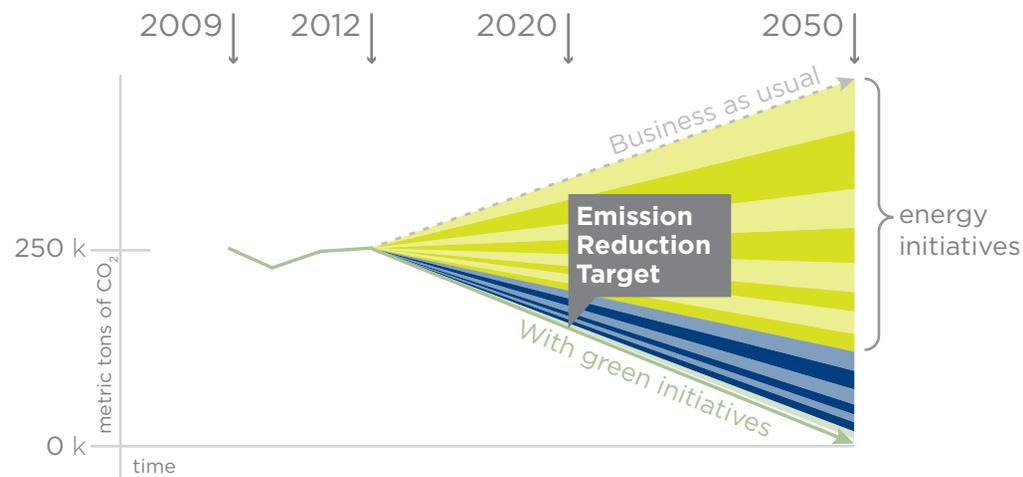
- Net conversion of atmospheric carbon dioxide as permanent main campus plant biomass, measured by the UA Campus Arboretum. (See article on page 18.)



Moving Forward

The UA will continue to improve its ability to track greenhouse gas emissions, report comprehensively on the current emissions and all steps being taken to reduce them. The UA also is committed to using this opportunity as a learning experience for students who see carbon management as an increasingly important professional skill set.

Emissions Goal



The UA is currently conducting an assessment to determine an achievable emission reduction goal for 2020. This plan will be updated by June 2013 to include that goal and will set in place actions to achieve the goal.

There is so much more we can and will do to reduce greenhouse gas emissions:

- **This is a long-term commitment.** The university fully acknowledges that the goal of carbon neutrality may be decades away, and will require major technological breakthroughs before the success is at hand. The realities of a growing major research university in the desert generate significant greenhouse gas emissions – with 185 buildings to heat, cool and maintain; 390+ acres with 7,810 trees and other vegetation to manage, plus pedestrian and bike paths, parking garages, solar installations, medical facilities and 24/7 research labs.
- **The UA will continue to lead by example** in reducing its carbon footprint with a focus on innovative strategies, designs and policies; adopting proven technologies, and engaging all employees and students as energy-efficiency stewards.
- **The UA will continue to partner** with the City of Tucson, Pima County and the State of Arizona to assist in the development of effective policies and actions that reduce this region's greenhouse gas emissions and improve our preparedness and resilience to impacts of climate change.
- **UA intends this to be a “living document”** to be updated regularly, guided by a group of institutional leaders who are fully committed to implementing this Climate Action Plan and reducing the university's carbon footprint.

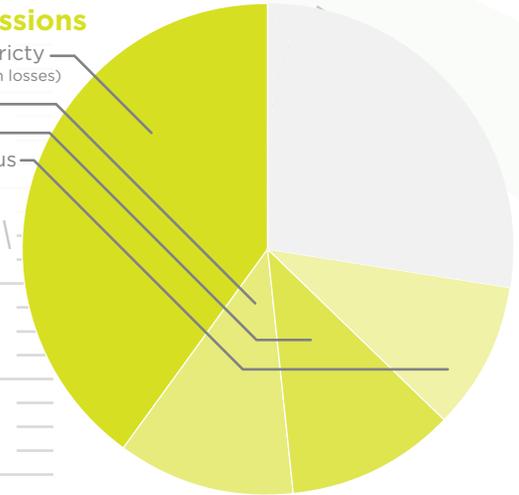


Reduce Energy Use/ Develop “Green” Energy

- UA co-generates approximately one-third of its electric power onsite
- First 3 buildings submitted earn LEED-Platinum
- UA Tech Park includes 222-acre Solar Zone

Energy Emissions

Purchased Electricity
(includes transmission losses)
Co-Gen Electric
Co-Gen Steam
Other On-campus
Stationary





UA Campus – A Model of Sustainability

Reducing Energy Use

A world leader in climate research, the University of Arizona sets the bar high for designing durable energy-efficient buildings and for pioneering technologies that heat and cool them.

The UA is a living laboratory of sustainability.

The very first building, the venerable Old Main, is 120 years old and features thick walls and deep wrap-around porches that shade and cool the building, sunk a half story into the ground. Good solid fundamentals.

The core of the campus, now listed on the National Register of Historic Places, features red-brick buildings aligned to face either north or south – the best orientation for shading and energy conservation.

Construction over the past 20 years showcases energy-saving innovations and designs that could meet LEED Silver standards – long before the U.S. Green Building Council launched the Leadership in Energy and Environmental Design program.

Only recently did the UA apply for its first LEED certification – and achieved Platinum, the highest rating possible, for the new student recreation center.

This is the first university facility in the nation to use thermal solar energy to power both heating and cooling operations. The next two buildings – both residence halls – also attained LEED Platinum certification. Today all new construction on the UA campus is designed to meet or exceed LEED Silver standards.

For decades the UA has been a “green” leader – down to the details. In some buildings when a window is opened for fresh air, sensors shut down the cooling or heating.

Air conditioning condensation is recycled as mist to cool outdoor courtyards. A turf roof insulates the below-grade freshman learning center.

After the sun sets, the university freezes massive amounts of ice through the night, then cools 129 campus buildings by day using one of the largest chilled-water loop systems in the world. The UA also generates approximately one-third its electric power onsite, using natural gas – and has since 2002.

The entire 390-acre campus is green – an arboretum with 7,810 trees adapted to arid regions. They shade buildings and greatly reduce greenhouse gas emissions by absorbing carbon dioxide.

Before the terms “sustainable” or “green” became widely used, the UA was already designing and constructing high-performance energy-efficient buildings intended to last 50 to 100 years. Existing buildings are retrofitted, renovated and expanded. New structures are strategically placed for infill and flow. The UA leads by example and trains the next generation in Earth-friendly sustainable practices.



UA's LEED-Platinum Recreation Center

The University of Arizona Student Recreation Center is the first facility in the nation to use thermal energy from the sun not only for heating but also for cooling. This is the first university recreation center to earn a LEED Platinum rating from the U.S. Green Building Council.



This project is green from the ground up. It was built on the site of a parking lot, which was pulverized and used for stabilizing the footings of the building. On the roof are 346 argon-filled vacuum-tube solar thermal collectors that are expected to harvest almost 2 million kilowatt hours of solar energy per year.

The collectors utilize heat from the sun as a free energy source to drive an absorption chilling system that helps cool campus buildings. Heat is a byproduct of this process, which is captured and used to warm the recreation center's 55,000-gallon Olympic-sized swimming pool. The solar

thermal array provides a third of the energy needed to heat the pool and offsets the use of natural gas heating.

A series of courtyards for outdoor recreational activity, shaded walkways and other features reduced the total amount of indoor square footage required, cutting utility and maintenance costs. The structure is oriented so natural light is abundant, but direct sunlight is controlled by the building's signature roof overhangs. Flooring is made from recycled rubber, including tires. Eighty-five percent of the construction waste was recycled or reused. Water harvesting, high-efficiency lighting and plumbing and the use of recycled building materials also contributed to the LEED Platinum rating.



The UA has long been a leader in designing and constructing energy efficient sustainable buildings and in efficient construction practices such as use of local materials and recycling construction waste – yet this is the first building the UA ever submitted for LEED certification.

The project team set out to meet LEED Silver standards. Early evaluations of the project indicated that Platinum – the highest possible rating – was within reach. Only minor adaptations were needed with no impact on project cost or the construction timeline.

The design team accessed the expertise of campus sustainability leaders – the faculty who teach sustainable design and construction, as well the architects, engineers and contractors on staff who oversee green initiatives on campus. Many are

- First facility in the nation to use solar thermal energy for both heating and cooling
- Earned LEED Platinum certification for the U.S Green Building Council
- Eighty-five percent of construction waste was recycled or reused

LEED accredited. Students also were involved in the project to educate future construction and design leaders.

The 53,000-square-foot recreation center opened in 2009.



Ice in the Night

In the summer, when daytime temperatures top 100 degrees, it's hard to imagine that the University of Arizona's air-conditioning system is cooled by ice.



Engineers travel from around the world to tour the university's chilling system that freezes water into ice at night, then by day circulates chilled melted water to cool every laboratory, hospital and classroom on campus. This is one of the largest chilled-water loop systems in the world.

In this desert climate where summer can extend from May to October, the Thermal Ice Storage Project transfers the bulk of the UA's electrical load from hot daylight hours to cooler off-peak hours after dark. This accomplishes the same task while using electricity at a lower cost.

Known informally as the "ice plant," the high-tech chilled water production and distribution system provides air conditioning for the entire 390-acre main campus,

plus the 25-acre medical center complex. This eco-friendly system saves \$40,000 a month or \$480,000 per year in utility costs.

The process includes water chillers, cooling towers, pumps and a vast subterranean network of pipes snaking throughout the campus. The three chiller units are turned on in the evening. A total of 214 eight-foot-tall tanks produce more than 2,900 tons of ice per hour. By mid-morning, the chillers are turned off, the ice begins to melt and chilled water is dispersed to cool every building on campus.

Over several years UA invested \$65 million to transform aging air conditioning plants while the campus was expanding by two million square feet, including new medical and scientific research facilities. The university's entire utility grid was upgraded, including steam and electrical generation as well as chilled water.

Today this is one of the most energy-efficient and environmentally friendly chilled water systems in the world. Corporations and other universities send staff here to learn how to implement similar large-scale systems. UA engineering students learn from this real-world application of sustainable practices.

- One of the most energy-efficient and environmentally friendly chilled water systems in the world
- Chiller units can produce more than 2,250 tons of ice per hour



Below-Grade Learning Center Features Grass Roof

One of the University of Arizona's most innovative structures is below ground level with a grass roof.



Passersby can walk on this turf on the mall in the middle of campus and look down on trees in the open-air central courtyard of the Manuel Pacheco Integrated Learning Center.

The structure that frames the courtyard and covered arcades substantially increase useable square footage, eliminating the need for heat, air conditioning or the maintenance associated with indoor space.

The extensive turf panel, irrigated with reclaimed water, provides excellent thermal mass and insulating qualities that help mitigate the extreme temperature swings experienced in the Sonoran desert.

Natural light is directed into the building's perimeter and interior spaces, utilizing tinted glass louvers and insulated skylights. The arcade's parabolic ceiling also reduces reliance on artificial lighting. Trellises with angled elements let in more sun in the winter, less in the summer.

CO2 monitoring software regulates the exchange of fresh air inside the building. Normally the heated or cooled air that's exchanged is vented out through the roof. Not so here. Small vents all around the building trickle that surplus air into the courtyard area, gently mitigating the outdoor temperature. The UA may be the first to introduce this technology.

This efficient, compact, easily maintained building includes 14 classrooms and a 300-computer information commons. Opened in 2001, the center was designed to help freshman transition successfully into the university environment, providing core classes, advisers, tutors and computer access at one location.

- Outdoor spaces cut indoor square footage, saving on heat, cooling and maintenance
- Extensive turf panel provides excellent thermal mass and insulating qualities



UA Generates One-Third of Its Electric Power

Using natural gas, the University of Arizona generates approximately one-third of its own electric power each year, substantially reducing its carbon footprint and utility costs.



Natural gas has a carbon-to-energy content roughly half that of coal.

Natural gas is used at the central utility plants to generate electricity for more than 11 million square feet of buildings across campus.

Since 2002, two gas-fired combustion turbines along with two heat-recovery steam generators have produced critically important power for research and medical facilities, plus everything from heat and hot water to lights, fans, elevators, computers and personal electronics.

Hot exhaust (otherwise wasted) from the two turbines is routed through heat-recovery boilers, making this a combined heat and power – or cogeneration – operation. The ability to recover this heat for practical use on campus is a highly efficient process.

By cogenerating its own electricity onsite, the UA needs to purchase less electricity generated by coal-burning power plants, which generate roughly twice the carbon emission per kilowatt hour than natural gas.

Production of electricity and steam comprise almost 70 percent of the total greenhouse gas emissions on the UA campus. Not surprising for a desert environment, the largest single consumer of electricity is the refrigeration equipment that drives the central campus cooling system – which is powered by another UA innovation known as the University Thermal Ice Storage Project (see page 14).

This cogeneration system began operating at the UA years before concerns over climate change led to the American College and University Presidents' Climate Commitment and the resulting Climate Action Plans designed to improve sustainability and reduce greenhouse gas emissions nationwide.

- UA uses natural gas to generate approximately one-third of its electric power each year
- Natural gas has a carbon-to-energy content roughly half that of coal



Student Challenge – Battle of the Utilities

Every fall students who live on campus gear up for the Battle of the Utilities to see who can conserve the most water and electricity. And save they do.



In one month, competing residence halls at the University of Arizona saved more than 18 millions of gallons of water. That's enough to fill 47 Olympic-size swimming pools eight feet deep – or to run a shower continuously for 28 years.

That same month, UA students reduced their total energy consumption by 21 percent – which equates to 20,000 barrels of oil. That translates to enough gasoline to drive a mid-sized sedan around the circumference of the earth more than eight times.

More than 6,000 students live on campus in 23 UA residence halls. The challenge has nuances. Some halls date to the 1940s and a few are brand new models of energy efficiency.

Eco-Reps in each hall lead the challenge – going door to door posting “lights out” notes or hosting board-game nights to cut back on TV or web-surfing time. They share facts like this: If every household in America switched out one incandescent light bulb for a compact fluorescent light bulb, it would reduce energy consumption as much as taking a million cars off the road.

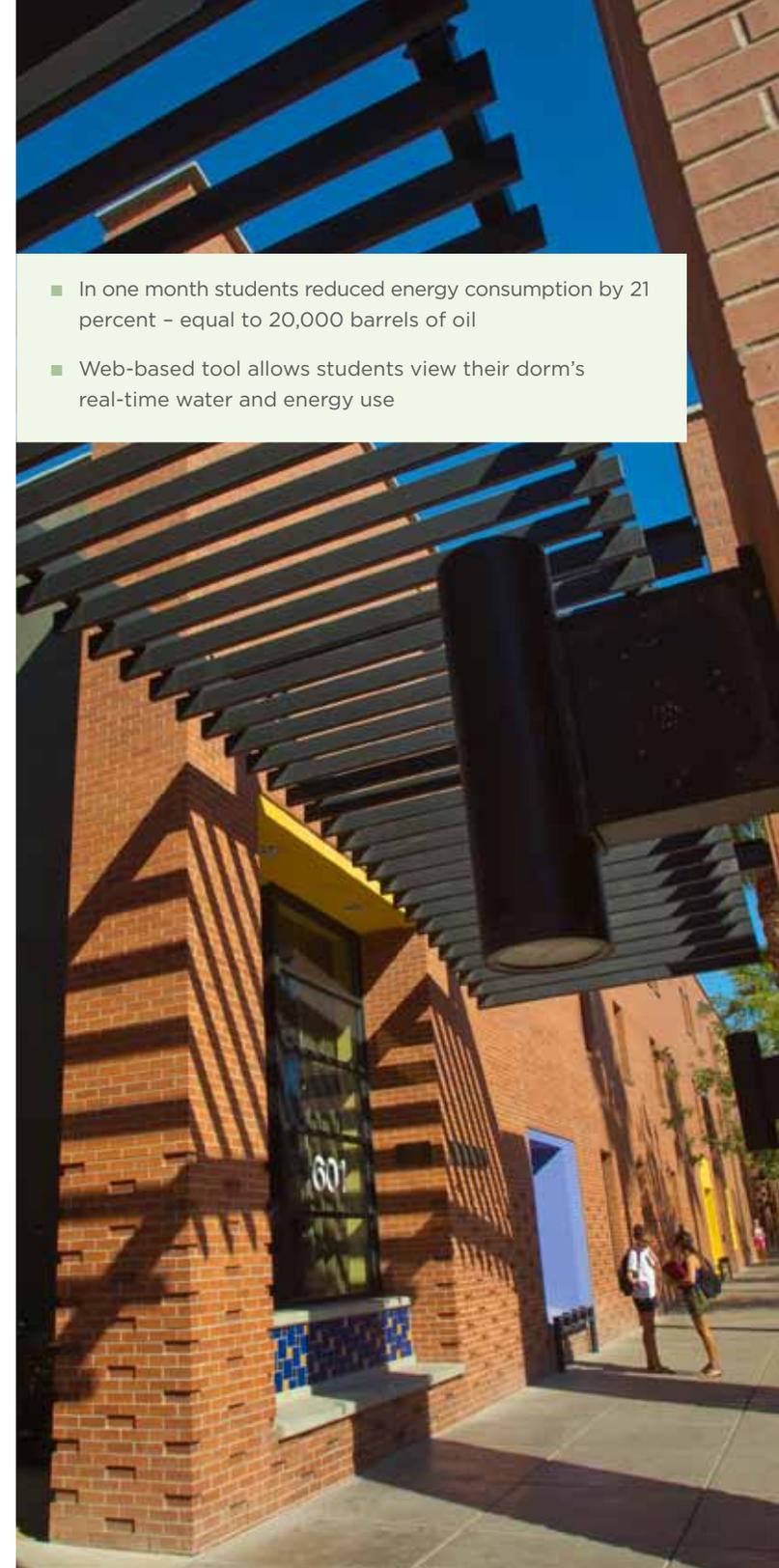
Highly competitive, students in one hall were so overzealous they unplugged too much – including drinking fountains and their refrigerator.

Eco-Reps this year used Building Dashboard, a web-based tool that lets them monitor their hall's water and energy use in real time. This new tool is now in 16 halls, with more to come.

Promoters of the challenge say that the month-long competition is just about enough time psychologically to pick up and keep a habit.

In early 2012 UA students also joined in a national challenge to reduce a gigawatt of electricity use, competing regionally against arch-rival Arizona State University.

- In one month students reduced energy consumption by 21 percent – equal to 20,000 barrels of oil
- Web-based tool allows students view their dorm's real-time water and energy use



What's the Benefit of 7,810 Trees?

Six students are setting out to locate and measure 7,810 trees on the University of Arizona campus.

That's about 1,300 trees per student.



Their job is to locate each tree in the arboretum inventory, measure its girth, record its proximity to buildings and use a software program called i-Tree to calculate the tree's height, respiration rate, age, shade value, carbon sequestration and other variables.

The goal is to assess the UA's urban forest that includes 522 distinct species of trees and quantify the ecological services that each provides - including its role in reducing greenhouse gases and energy consumption. A preliminary analysis using the i-Tree software in 2008 suggests that the arboretum sequesters more than 150 metric tons of CO₂ each year.

i-Tree is an urban forestry benefits-assessment tool, developed by a former UA professor. It's used in the United States and Canada, but rarely on a university campus.

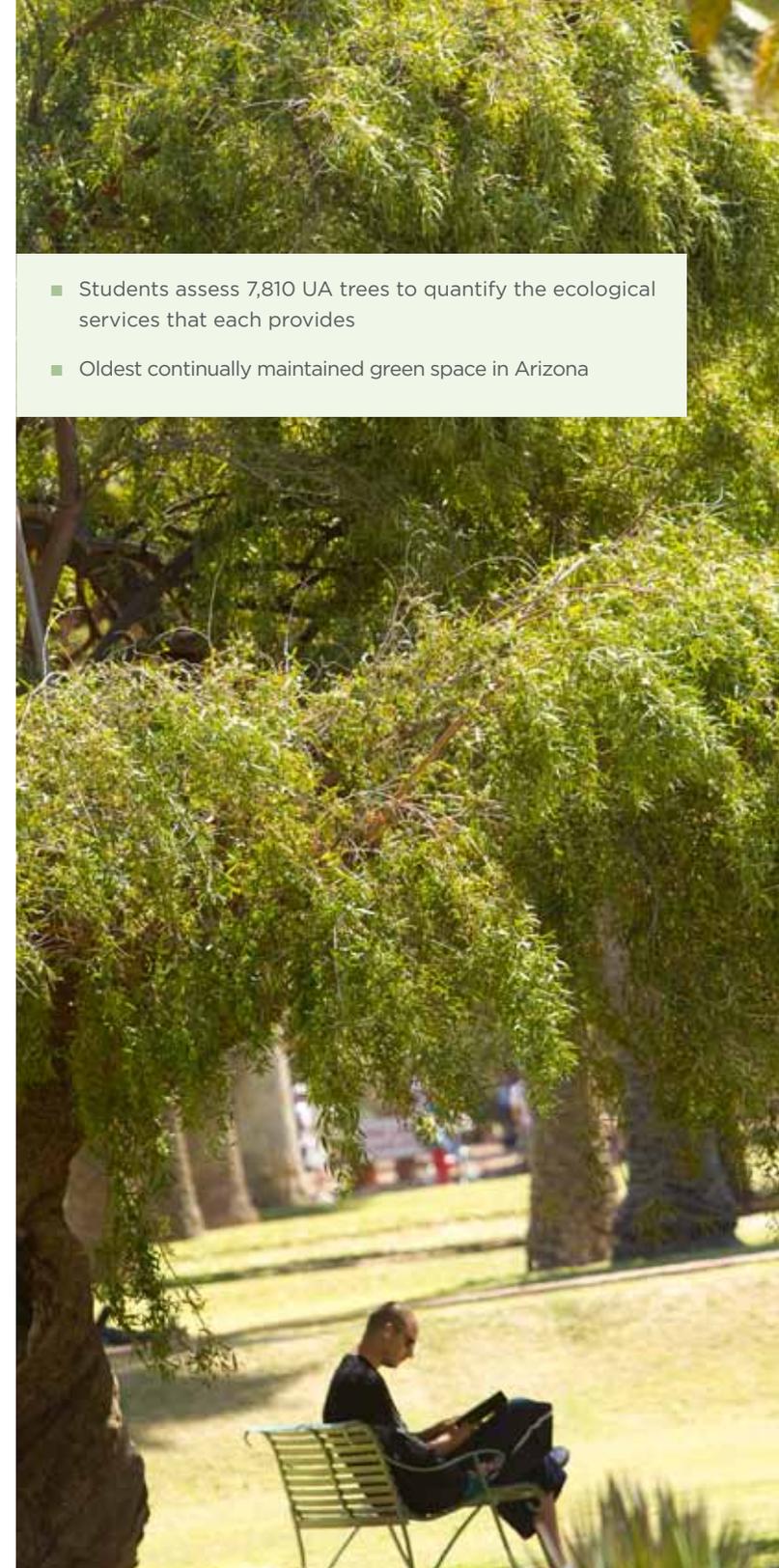
The UA arboretum is the oldest continually maintained green space in Arizona. This is a living laboratory of trees from arid regions around the world, where students and scholars study drought-resistant horticulture and arid-land ecosystems.

These UA plant science students are gaining practical experience as urban foresters and establishing an important new database for the university.

Trees improve air quality, mitigate the urban "heat island" effect and reduce energy consumption for heating and cooling. But what's the collective ecological benefit of 7,810 mature trees? What species provide the most value? Does the tree's impact fluctuate as it ages? Do conifers sequester more carbon than deciduous trees?

This study will contribute to science-based plant management strategies for the university, the local community and other arid regions.

- Students assess 7,810 UA trees to quantify the ecological services that each provides
- Oldest continually maintained green space in Arizona



The House Energy Doctor Is In

Students come to the University of Arizona from every continent to learn how to be a House Energy Doctor.



This program, unique in the world, offers hands-on training to learn how to use measurement tools and instruments to diagnose a building's energy health and develop a prescription for improving it.

On average, homeowners can make a few modifications and cut their energy bills by 60 percent.

The students measure every aspect of energy performance in a building – from the reflectivity of the roof to how landscaping

impacts the temperature of the building and the volume of air conditioning distributed through the registers. They inspect heating, cooling and water-heating systems and check for leaks around doors, windows, vents and electrical outlets using smoke sticks. Owners are surprised by how much air conditioning and heat they lose through these invisible leakages.

Over the past 10 years House Energy Doctor teams have diagnosed 65 residences, 12 commercial buildings, 120 builders' residential prototypes, two city libraries, one health center and four university buildings. After the energy audit on two of the UA buildings, recommendations were implemented and both attained the U.S. Environmental Protection Agency Energy Star certification, performing in the top 25 percent of similar facilities nationwide.

The House Energy Doctor is not a new novel "green" concept. In fact, a UA architecture professor launched this project 25 years ago. This education, research and outreach program has won awards from the U.S. Department of Energy and evolved to include interactive computer-based energy workshops for schools and universities in Southern Arizona and Mexico.

Recently the team also began assessing outdoor thermal comfort in urban spaces, utilizing software they developed, sophisticated tools, scale models and fish-eye lenses. The thermal performance of an outdoor space is predicted, evaluated and redesigned for comfort.

- Teaching how to diagnose a building's energy health and develop a prescription for improving it
- House Energy Doctor audit helped two UA residence halls earn EPA Energy Star certification

The UA is leading the country in graduating new a generation of more energy-conscious architects and other professionals who understand the principles and practices of sustainable design.



UA Students Living Green

Live green now. The University of Arizona shows students how.



At the two newest residence halls 75 percent of the hot water is generated by roof-mounted solar panels. Computer-operated awnings allow for optimal sunlight in the winter, while blocking it in the summer. Bathrooms feature low-flow showerheads, faucets and dual-flush toilets. Nearly 80 percent of the building materials were recycled. Both Likins Hall and Arbol de la Vida received LEED Platinum certification from the U.S. Green Building Council, the highest rating possible.

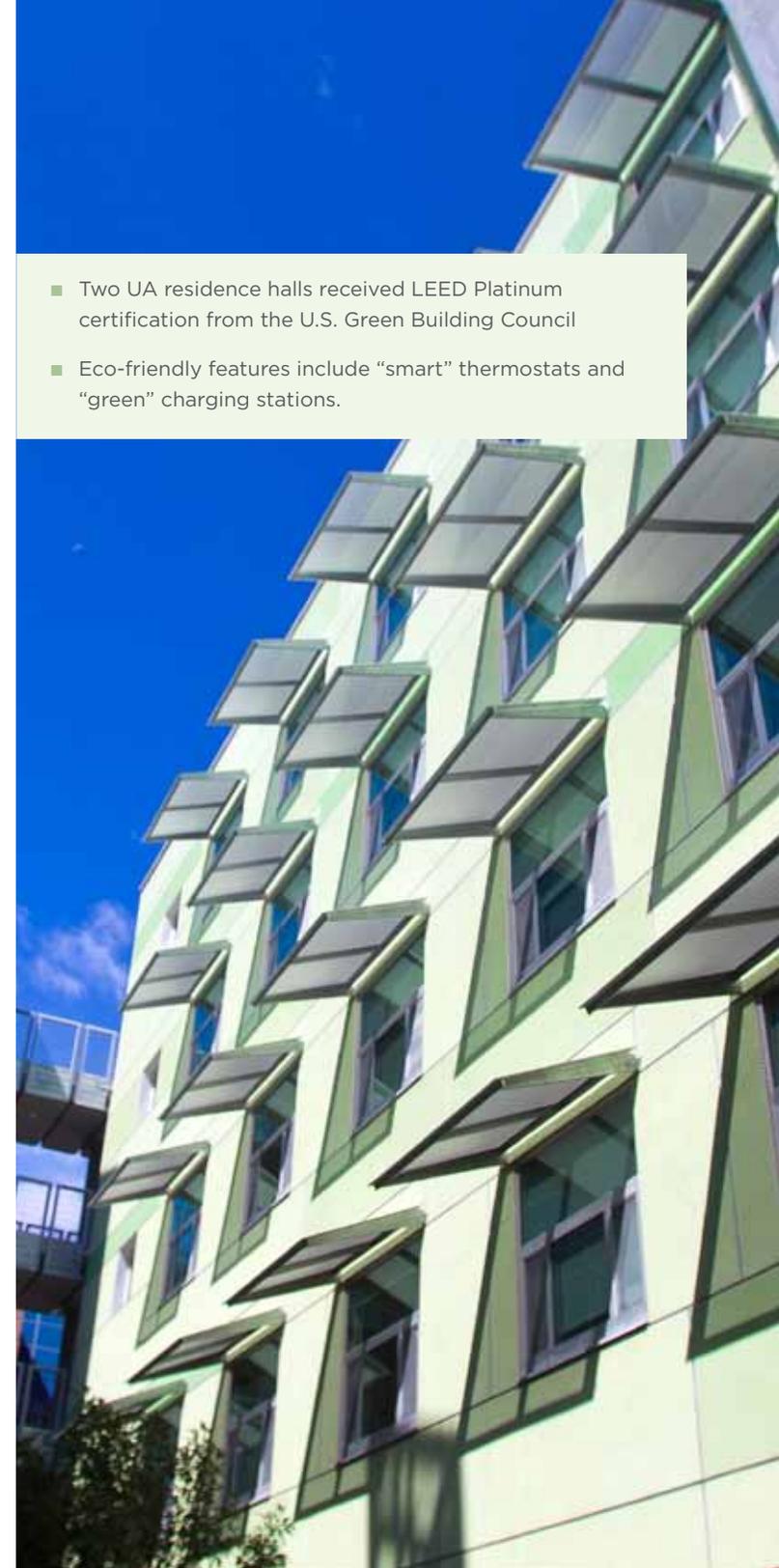


Two other UA residence halls were selected by the U.S. Environmental Protection Agency for ENERGY STAR certification. This signifies that the buildings perform in the top 25 percent of similar facilities nationally for energy efficiency and meet strict energy-efficiency performance levels set by the EPA. Arizona-Sonora and La Aldea Halls are the first residence halls in the Pac-12 conference to achieve this certification. Commercial buildings with ENERGY STAR certification use an average of 35 percent less energy than typical buildings and release 35 percent less carbon dioxide into the atmosphere.

UA students have daily hands-on experiences in sustainable living on the campus and in their residence halls. In their rooms, eco-friendly features range from LED light bulbs to “smart” thermostats and “green” charging stations that shut off power when the space is unoccupied. Competitions between residence halls challenge students to recycle more and use less energy. Kiosk displays and an interactive website allow them to see their impact by monitoring the hall’s real-time use of energy and water.

More than 6000 students live in the 23 residence halls on campus.

- Two UA residence halls received LEED Platinum certification from the U.S. Green Building Council
- Eco-friendly features include “smart” thermostats and “green” charging stations.



UA Rated Top-10 Solar University

The rooftops of a dozen buildings around the University of Arizona campus are already covered with about 2,500 photovoltaic solar panels, with more to come. But that's just a drop in the solar energy bucket compared to what's now in development - another 15,296 kilowatts at the UA Science & Technology Park.



This growing commitment to solar power makes the UA one of the top-10 campuses in the nation for total installed capacity and for planned installations, according to the Association for the Advancement of Sustainability in Higher Education.

This desert university has plenty of sun and big plans for harvesting it. The UA Tech Park

includes a 222-acre Solar Zone for developing, producing and studying utility-scale solar energy. In addition to the 4,428 kilowatts of solar panels in place, three more 5,000-kilowatt projects are in the works, along with one of the largest solar concentrating PV systems in the world. Energy produced will go to customers of Tucson Electric Power Co.

The University also maintains a Solar Photovoltaic Test Yard, the largest of only a dozen in the nation - with more than 600 photovoltaic modules from 20 different manufacturers. This also is the only solar test yard open to the public. Though owned by TEP, this project is entirely operated by UA faculty and students who work together to measure how weather, air temperatures, panel placement and the quality and direction of sunlight impact the energy yields and how individual systems hold up over time.

All data collected at the test yard is free and available online.

The university is a solar leader, a unique intersection between academic research, growing business interest and educating the public about a viable source of future power.



- UA Tech Park includes 222-acre Solar Zone for studying utility-scale solar energy
- Largest solar photovoltaic test yard in the nation operated by UA



Students Raise the Roof – with Solar Panels

University of Arizona students led a three-year effort to raise the money and install 44 photovoltaic panels on the roof of their residence hall.



The idea came from a faculty fellow in the Posada San Pedro residence hall but it was implemented by determined undergraduates who set out to do something that had never been done before. They made this solar-energy project a reality.

The estimated annual production of the 44 panels is 20,000 kilowatt hours of electricity produced by the sun, not a coal-burning power plant. This reduces greenhouse gas emissions by 14 metric tons.

Year one the students organized as the Solar Cats and researched the processes and costs of such a venture. The second year they involved more students and got down to the specifics of what was needed to install the photovoltaic panels on the residence hall roof. Then the students had to raise the money – \$94,000 – and get approvals to do a construction project on a UA-owned facility.

Funding came from the UA Student Services Fee, the UA Green Fund, which supports projects to make the UA a more environmentally sustainable institution, and UA Residence Life.

Finally, after three years of work on campus and with partners in the community, the panels were installed on the roof of their residence hall. The project became a hands-on solar research lab where students can access a system that monitors the building's energy production and usage over time.

Along the way these inspired change agents also volunteered to install solar panels on a local Tucson school.

- Student project installs 44 photovoltaic panels on residence hall roof
- Panels generate 20,000 kilowatt hours annually, reducing greenhouse gas emissions by 14 metric tons



Drilling Down the Details

LIGHTING THE WAY



It took six years to retrofit all lighting fixtures on campus with more energy-efficient fixtures and bulbs. This saves thousands of dollars a year in electricity and reduces the university's carbon footprint. Energy savings result from less energy for lighting and a lower cooling load in the buildings, while producing a better quality light.

VENTING



The UA installed more than 300 high-performance fume hoods in research laboratories, which maximizes occupant safety while saving \$700,000 in energy costs annually.

SHUTTING DOWN



By turning off the heating and cooling systems in more than 160 campus buildings during holidays, the UA cuts its utility costs and reduces greenhouse gas emissions. The UA started with about 80 buildings in outlying areas of the campus, then decided in 2007 to double the number of buildings throughout the campus. Some do need power 24/7 - including research labs and medical facilities. This is one of many ongoing demonstrations of the university's commitment to energy conservation, sustainability and preservation of the environment.



Next Steps

To Reduce Energy Use & Develop “Green” Energy Sources

Strategic Investment in Energy Efficiency

- The University of Arizona is one of 32 founding institutions of the Billion Dollar Green Challenge, and is setting up its “Green Revolving Fund” in 2012 with a goal of seeding this fund with at least \$1 million within four years. The fund will be used to invest in additional energy-efficiency upgrades and projects that lower operating expenses and have reasonable payback periods. The operational savings will be returned to the fund, then reinvested in additional projects. Energy audits are and will continue to be used to determine the most effective use of the fund. Over time the university will explore opportunities to continue growing the fund, including allowing alumni and others to contribute to UA sustainability goals.
- Only in its second year, the UA Green Fund has and will continue to provide grants to support innovative sustainability projects proposed by UA students and employees. The 10-student Green Fund Committee administers a fund of \$400,000 per year. In its first two years, the fund received more than 60 formal proposals requesting more than \$2 million.

Changing Energy-Use Behavior

- The UA Office of Sustainability will partner with several UA units to expand current outreach programs that engage 15,000 UA employees and 40,000 students to live more energy-efficient lives at school, work and at home.
- As part of a new university-wide budget model, the UA will explore establishing financial incentives for larger units that develop energy conservation programs and reduce energy use within their areas.
- Residence Life will continue to expand the involvement of approximately 6,500 students who live on campus – including 80 percent of UA freshman – competing in a Battle of the Utilities competition between residence halls that has led to significant energy savings over the past four years and establishes an important culture of conservation with first-year students.
- The UA will use its new sustainability purchasing policy to support department-level purchasing of the most energy-efficient electronic equipment possible.

Next Steps *(continued)*:

Reducing Energy Demand & Greening Our Energy Sources

Develop Additional Solar-Energy Production Capacity

- The UA is always evaluating opportunities for additional solar-energy production capacity both on- and off-campus – ranging from rooftop power-purchase agreements to utility-scale systems on larger UA properties around the state. The UA will continue to balance the desire to develop additional capacity with the costs that must be incurred.

Increase On-Campus Energy Production

- Even though regulated utilities in Arizona are required to increase the portion of renewable energy in their portfolio to 15 percent by 2025, the UA already uses natural gas for most on-campus energy production, which is about half as greenhouse-gas intensive as coal, the primary energy source from purchased electricity. The UA will explore ways to further utilize this lower-carbon fossil fuel as a transitional strategy toward the long-term goal of carbon neutrality.

Purchase Solar Energy Produced at UA Tech Park

- In partnership with Tucson Electric Power, the UA is developing one of the largest utility-scale solar energy production and evaluation facilities in the United States, with more than 13 megawatts of power-generating capacity by 2013. Currently all the power is provided to TEP customers. The UA will explore options to purchase energy generated at the Tech Park as part of the university's contract with TEP.



Curb Transportation Emissions

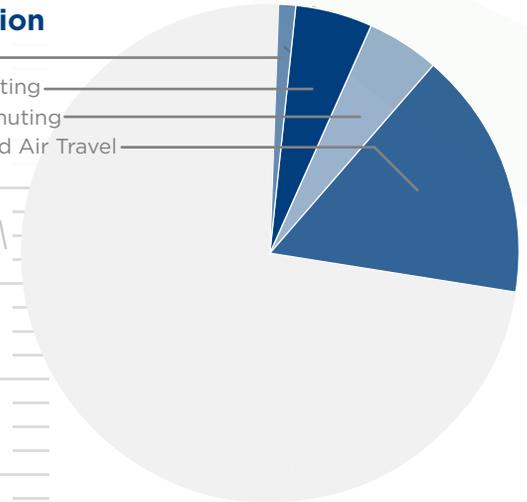
By not driving alone at least one day a week, members of the University of Arizona community have saved:

- **7,668,501 driving miles**
- **383,425 gallons of gasoline**
- **\$3.7 million**
- **219,100 pounds of pollution**

Source: 2007 PAG/ UA Travel Demand Survey

Transportation

Vehicle Fleet
Student Commuting
Employee Commuting
Directly Financed Air Travel





Change Your Habits. Change the Planet.

A Small Commitment Makes a Big Difference.

For more than a decade the University of Arizona has encouraged faculty, students, staff and visitors to join together to reduce transportation-related greenhouse gases and fuel consumption – even if it’s just one day a week.

This campus community includes nearly 55,000 students, faculty and staff, plus visitors. Of those, approximately 11,000 ride bicycles, 1,234 employees carpool and 2,600 ride the bus to campus.

A tagline used by the UA Parking and Transportation Services is “Change Your Habits. Change the Planet.” And it’s working.

According to the UA Travel Demand Survey, the university community has saved 7,668,501 driving miles, 383,425 gallons of gas, \$3.7 million and 219,100 pounds of pollution by carpooling at least one day a week.

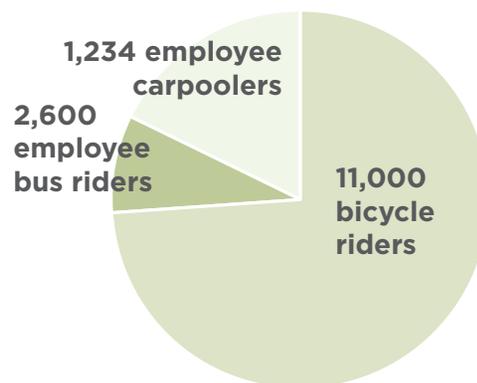
It’s not easy. Folks in the wide-open West like their cars, pickups and SUVs. The Tucson metro area spans roughly 600 square miles – with bus service, but no subway or light rail to serve the roughly one million residents. People are used to commuting long distances to the UA main campus in central Tucson. The daily roundtrip from Marana in the northwest or Vail in the southwest is 50 miles or more. That five-times-a-week commute produces greenhouse gas emissions of roughly 229 pounds of carbon dioxide every week.

It’s challenging to change habits, so the UA promotes a variety of transportation alternatives to further encourage members of the Tucson community to choose more sustainable travel modes. These include park-and-ride options throughout the metro area, carpooling connection assistance, carpool parking

lots, bus pass discounts, the free Cat Tran campus bus system, private student-apartment shuttle buses to and from campus, car-sharing and bicycle-sharing programs, secured bicycle parking, bike valet service and repair stations.

These alternative transportation programs help to significantly reduce greenhouse gas emissions and serve as a standard for others to follow. Every year since 2003, the UA has earned the national “Best Workplaces for Commuters” award. In 2011, the UA was recognized by the League of American Bicyclists as a silver-level bicycle-friendly university.

By offering a variety of options, the UA is impacting the decisions people make about how they travel. Once they try alternative transportation, many find they like the benefits of sharing carpool time with colleagues, reading or studying on the bus, or checking out a free bike and cycling across campus in the fresh air – while doing their part to reduce greenhouse gases in the atmosphere.



UA Campus Alternative Transportation Users

First in Nation

On Earth Day 2011, the University of Arizona became the first university in the nation to add an all-electric car to its car-sharing fleet. The Nissan Leaf is the first zero-emissions car in the UA's pool of



vehicles available on campus for students, faculty and staff. The UA partners with Connect by Hertz, a global car-sharing club, to provide this cost-effective alternative to owning and maintaining a personal vehicle.

An hourly rental fee covers all expenses, including gas, insurance and roadside assistance. The program quickly attracted more than 700 members who rent a car, and is perfect for alternative transportation users needing access to a vehicle for emergencies, to run errands or to explore Southern Arizona. Anyone 18 years or older who has a valid driver's license and a good driving record for the past 12 months can sign up.

The new zero-emissions all-electric car can be charged at any of the four charging stations on campus. Tucson is one of 11 cities taking part in an electric charging station development initiative called the EV Project.

This car-sharing program was introduced in 2009. The Nissan Leaf joined the UA car-sharing fleet of seven Toyota Prius hybrids, two Smart Cars, a Mini Cooper and two Ford Escape sport utility vehicles. Enrollment is free and Hertz waives the first-year membership and application fee.

The UA also was one of the first universities in the nation to add an all-electric Nissan Leaf to its "green" motor fleet, along with numerous vehicles that run on ethanol. The 2011 All Electric Nissan Leaf can be rented by those on university business. It has a range on one charge of approximately 100 miles and takes just eight hours to fully charge. The operating cost to charge the Leaf is approximately two cents a mile, depending on utility rates.

Sixty percent of the interior of the Leaf is made from recycled materials, including water bottles. The back of the Leaf has a small solar panel to help keep the 12-volt auxiliary battery charged. With more charging stations being installed throughout Tucson and surrounding areas, the reality of practical, all-electric vehicles for campus use is moving ahead.

- UA is the first university in the nation to add an all-electric car to its car-sharing fleet
- Tucson is one of only 11 cities taking part in the EV Project to develop electric charging stations



UA Rated Bicycle Friendly

On a typical day there are more than 11,000 bikes on the UA campus. The League of American Bicyclists, a national program that identifies colleges and universities that create exceptional environments where bicycling can thrive, rated the UA as a silver-level bicycle-friendly campus.



With 350 days of sunshine a year and more than 700 miles of designated bikeways, Tucson is one of the best places to ditch a car and hop on a bicycle. Tucson is ranked No. 9 on Bicycling magazine's 50 most bike-friendly cities in America and was ranked No. 1 by Outside magazine for road biking.

Innovative services make it easier to choose cycling as an alternative to gas-powered transportation.

The Employee Bike to Work program allows access to the campus recreation center where sweaty bike commuters can use locker rooms and showers at no charge.

Riders needing quick bicycle assistance can now fix a flat or make minor repairs at either of two fully equipped self-service bike repair stations on campus.

The Campus Bicycle Station is a one-stop shop for all bicycling needs – from maps and cycling information to quick bike fixes. This service is operated by the UA Parking and Transportation Services in conjunction with the Pima County Bicycle Ambassador Program. Most attendants are bicycle instructors certified through the League of American Bicyclists.

Cat Wheels is a bike-sharing initiative that provides a total of 55 single-speed cruisers at nine UA locations, including parking garages, the campus recreation center and the Bike Valet parking area. Bikes can be checked out for 24 hours at no charge with a valid UA CatCard.

The UA provides bike racks all around campus and discounts on sturdy U-locks. There also are bike lockers, enclosures and even a Bike Valet Program where cyclists can leave their bikes in a secure location with watchful volunteers.

- Tucson ranked #1 for road biking by Outside magazine
- Tucson ranked #9 on Bicycle magazine's 50 most bike-friendly cities in America
- 700 miles of designated bikeways
- UA campus rated silver-level bike-friendly campus by the League of American Bicyclists



Students Turn Cooking Oil Into Biofuel

University of Arizona students are learning to convert used cooking oil into biofuel that ultimately will fuel the campus motor fleet, reduce greenhouse gas emissions and boost their careers.



This innovative program began with a student-sponsored grease drive the day after Thanksgiving in 2005. Every year since, home cooks and restaurant owners have dropped leftover cooking grease at any of several locations around the metro area.

Grecycle Arizona – a local company founded by a UA graduate – converted waste that was once poured down the drain or dumped in a landfill into biodiesel fuel, which burns more cleanly and is easier to make than regular diesel.

About 3,300 pounds or 400 gallons of cooking oil converts into an equal amount of biodiesel.

Starting in 2012, students are producing the fuel themselves in a small pilot-scale facility at the UA Campus Agricultural Center, where they process the waste cooking oil from two busy campus student union facilities in 100-gallon batches.

Eventually their biodiesel will be used to power UA vehicles, blending their fuel with standard diesel and helping to reduce greenhouse gas emissions.

These students are learning how to run a biodiesel production plant to generate a product that can meet the standards set by the American Society of Testing and Materials. Students gain valuable hands-on experience in process engineering, quality assurance and control, logistics, biofuels and green chemistry before they enter the job market. This program is believed to be the only model of its kind on a university campus.

Chemically, the oil used for frying turkeys is not all that different from what powers the semis that hauled the turkeys to market. Both contain hydrocarbons, chain-like molecules made up of carbon and hydrogen. The conversion is a relatively straightforward and mild chemical process.

- Nearly pound-for-pound conversion from cooking oil to biodiesel
- UA students converting biodiesel in 100-gallon batches
- Biodiesel eventually gets blended with regular diesel to power UA vehicles

This collaborative project is funded in part by the UA Green Fund, financed by student fees to support projects that involve students and employees in making the UA a more environmentally sustainable institution.



Transportation Choices

CAT TRAN



The UA introduced the free campus-wide shuttle service, popularly known as the “Cat Tran,” in 1988 and has been contributing to reduced greenhouse gas emissions ever since.

The shuttles initially ran on regular diesel fuel, then biodiesel and today on ultra-low-sulfur diesel – which produces fewer emissions than any other biofuel on the market. This means the fleet has better mileage, lower fuel costs, and pumps fewer emissions into the environment.

The 30-passenger wheelchair accessible buses transport 3,500 riders a day. The shuttles make 58 stops on five different routes, connecting the main campus, medical center and downtown Tucson. The Cat Tran operates Monday through Friday from 6:00 a.m. to 6:00 p.m. with the UA Night Cat providing more limited service after hours.

CARPOOLING



The UA partners with the Pima Association of Governments to connect people who are interested in carpooling. The Sun Rideshare program provides a computer-generated “match list” with names, phone numbers and email addresses of other commuters who live and work nearby and are interested in joining a carpool.

The UA provides designated carpool parking lots and spaces in parking garages for those who carpool with three or more people, further encouraging carpooling and the sharing of parking expenses, and directly reducing commuting-related emissions.

Commuters in outlying areas can meet their carpool at Sun Rideshare’s Park and Ride lots throughout the metro area. For UA football games, any car with four or more people can park in Sixth Street, Tyndall, Main Gate or Highland Avenue garages free of charge.

U-PASS



The UA provides incentives for students, faculty and staff to ride the bus to and from campus through the Sun Tran U-Pass program.

Parking and Transportation Services subsidizes passes up to 40 percent, and UA affiliates can have unlimited access to the Sun Tran, including the twelve routes that lead to the university. In addition to the regular semester pass, express passes are available for both Sun Tran and Sun Express routes.



Next Steps

To Reduce Transportation-Related Emissions

These alternative transportation activities are just the foundation for what's yet to come.

Research shows that 40 percent of those who currently drive to the UA campus, and live within five miles of the university, drive alone. That is a huge opportunity to reduce greenhouse gas emissions further by encouraging more members of the campus community to get out of their cars and walk, bike, take the bus or carpool.

The UA is working with the Pima Association of Governments to study and improve bicycle and pedestrian conditions on and around the campus. Plans include analyzing bicycle and pedestrian flow, identifying choke points, and creating solutions to better manage traffic flow and reduce accident risk. These strategies will guide the UA and City of Tucson in implementing beneficial improvements and programs.

Developing strategies to offset and reduce the greenhouse gas impact of air travel to and from this top-research university proves to be yet another challenge. Air travel accounts for 15.43 percent of the UA carbon footprint – more than student, faculty and staff commuting combined.

The City of Tucson is developing a \$197 million all-electric modern streetcar project that will span four miles, connecting the UA main campus and medical center to downtown Tucson and the redevelopment area west of downtown. The streetcars are expected to ease traffic congestion and reduce emission levels on and around the university.

For more information on UA alternative transportation visit:
<http://parking.arizona.edu/sustainability>.

Next Steps *(continued)*:

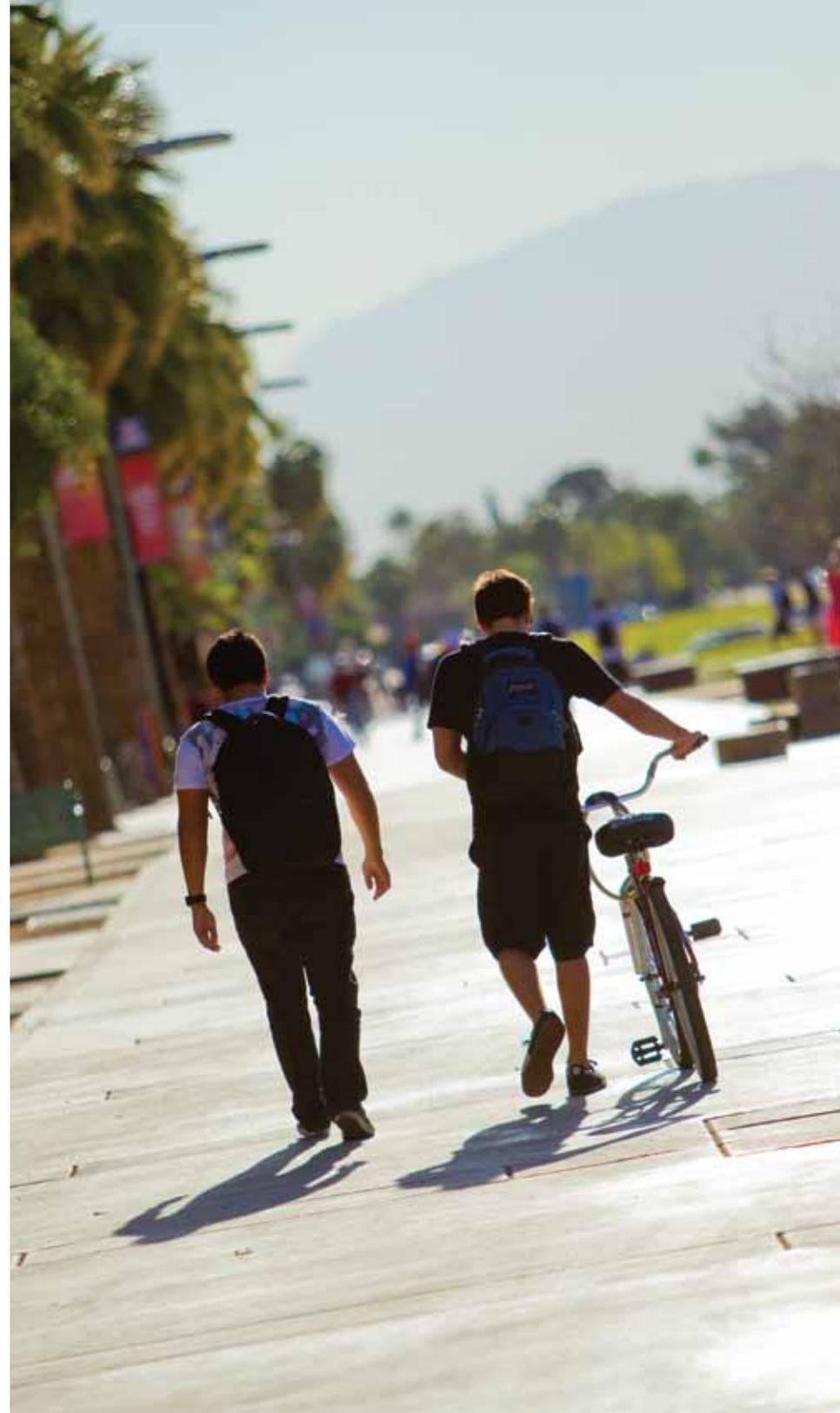
Reducing Transportation-Related Emissions

Offset Air Travel

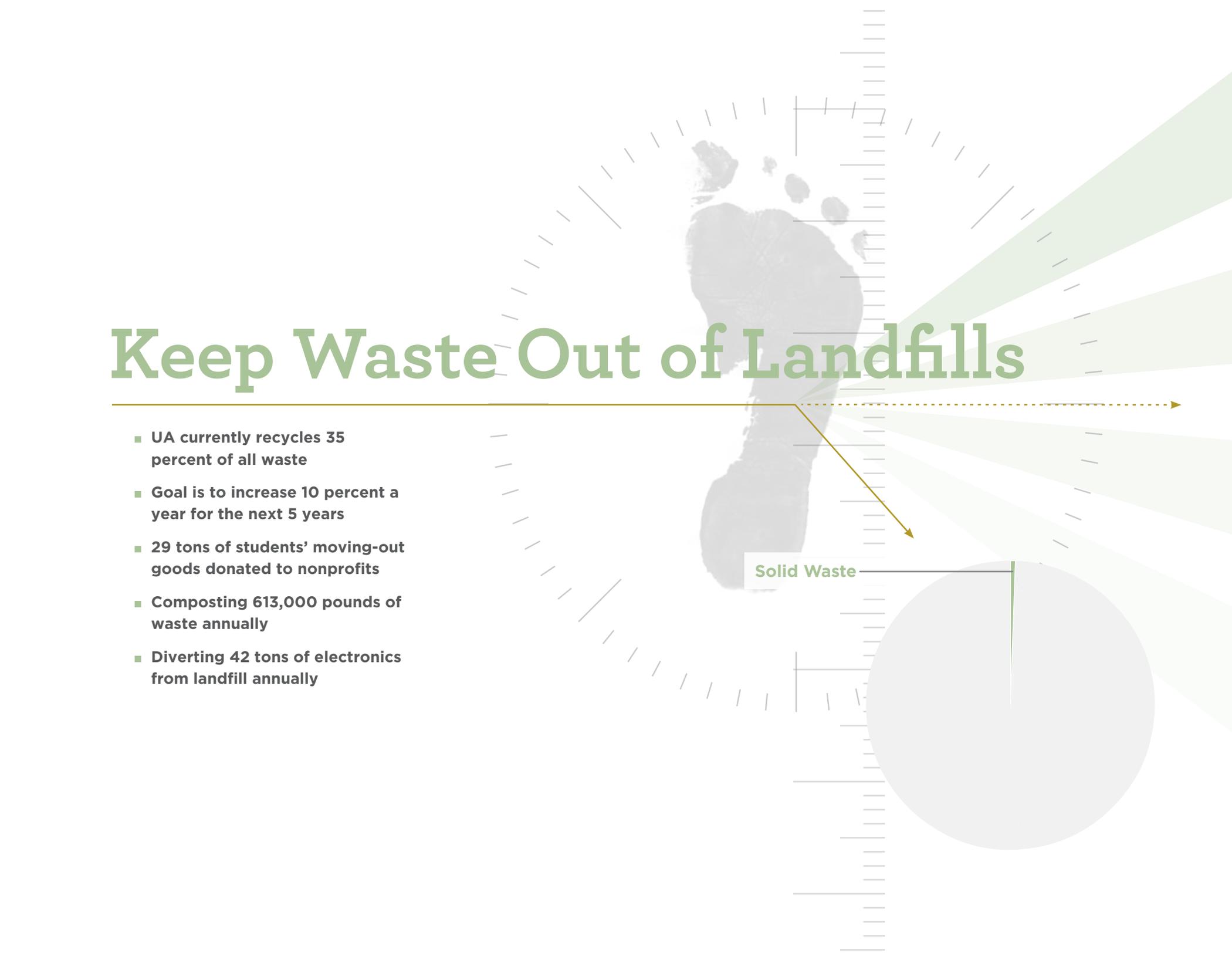
- The approximately 5 million passenger air miles travelled per year by University of Arizona faculty, staff and students make up more than 10 percent of the UA carbon footprint – and this only includes what is tracked through the UA financial system. Building on its innovative air-travel-emissions tracking system, the UA is working to develop a voluntary carbon-offset purchasing system that is integrated into the process of purchasing individual airline tickets using the UA financial system. The system would pool contributed funds and maximize purchasing power with a single request for proposal for purchasing offset credits in large quantities that in turn would be applied to the UA. This system would also allow the UA to consider the benefits of sourcing offsets from local or regional projects.

Encourage Greener Commuting Behavior of Students and Employees

- The university will continue to expand existing alternative-transportation programs that reduce single-passenger car commuting. While the UA benefits from an effective regional survey of employee commuting, the university also is working to improve the UA’s capacity to survey students on their commuting patterns. The university also expects that rising fuel prices and improving fuel efficiency will continue to reduce its commuting and UA-vehicle-related emissions.
- As the UA develops the carbon-offset program for air travel, it also may expand this as an option for employees and students to voluntarily offset emissions from their commuting.
- The UA is a partner in a modern street car project that planned for completion in 2013. This will connect the main campus and medical center with downtown Tucson. The street car will increase development within central Tucson that will offer UA students and employees additional housing options with shorter commutes.

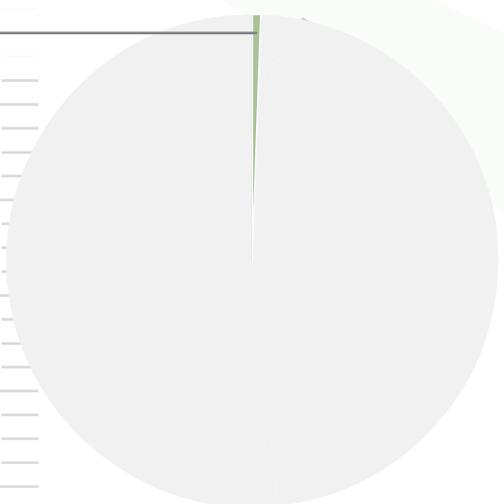


Keep Waste Out of Landfills



- UA currently recycles 35 percent of all waste
- Goal is to increase 10 percent a year for the next 5 years
- 29 tons of students' moving-out goods donated to nonprofits
- Composting 613,000 pounds of waste annually
- Diverting 42 tons of electronics from landfill annually

Solid Waste





Keep Waste Out of Landfills

Students Initiate Many Recycling Projects

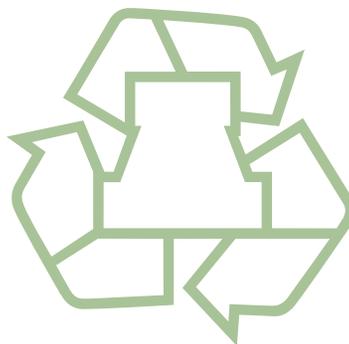
From construction pallets to animal bedding to banana peels, the University of Arizona is finding ways to chip away at its waste stream by implementing new and innovative recycling programs and – in the case of the banana peel – put waste to work.

Currently, the UA recycles 35 percent of all waste, up five percent from last year. The goal is to steadily increase the recycling rate for the entire university community by 10 percent each year for the next 5 years, further reducing the UA's carbon footprint.

The Facilities Management recycling and waste department supports long-term UA sustainability goals by working to facilitate and increase recycling efforts across the campus. The staff provides information, education and resources to encourage faculty, staff, students, vendors and visitors to recycle common materials like cardboard, paper, aluminum and plastic, as well as everything from toner cartridges and batteries to shipping pallets and landscape waste.

The point of separating waste streams according to material type is to lower the contamination rate of recyclable materials from non-recyclable materials, which ensures more waste is actually recycled and the UA recoups a higher value of return. By working with a diverse array of local business, the university has created innovative waste-diversion streams to tackle uncommon materials.

Collaboration across campus is key for recycling at UA. Many recycling programs are initiated by students and then supported campus wide. Students for Sustainability has initiated numerous recycling projects, including Compost Cats – an innovative compost collection and production service that has students across campus noticing where they put those banana peels.



One undergraduate student is working to document the location of every recycling bin across campus, both in outside common areas and indoor spaces, then entering the data onto a GIS map. Once complete, this data can make recycling easier by more strategically placing bins according to demand, and by mapping all stations to facilitate access. That way, after polishing off a soda, a student could use a smart phone or laptop to check the UA website and locate the nearest recycling drop spot.

For more information, visit:

<http://www.fm.arizona.edu/fm-dept/recyclewaste.html>.

Recycling in Residence

Living for the first time away from home, students have the opportunity to form habits they'll keep for life.

Roughly 6,000 students live on the UA campus, representing a significant slice of the university population – which means residence halls are in a unique position to help them foster lifelong habits in sustainability.



It begins with orientation, when students move into their dorms. Move-in and move-out days are especially heavy waste days, as students unload boxes and discard old hangers. University residence halls offer special programs to facilitate recycling and donation. On move-in days, there are corral areas set up outside each residence hall and graduate housing where students can deposit styrofoam packaging, cardboard boxes and other recyclable waste.

At the end of the school year, when many students don't want to pack boxes anew, thousands of lamps, microwaves and bicycles are cast aside. To keep usable items out of the landfill, at the end of every semester the Residence Life Sustainability Program partners with Tucson community nonprofit organizations to set up collection bins where students can donate unwanted items. In 2011, about 29 tons of material – from storage bins to TVs and furniture – were donated to the Salvation Army and Community Food Bank of Tucson.

Though bicycles are a popular mode of transportation around campus, as students pack up and move out, many leave their bikes behind. Beginning in 2011, with a pilot program between the UA and local non-profit organization BICAS – which stands for Bicycle Inter-Community Art and Salvage – these discarded bicycles can find a second life. Through the group accepts donations all year, for several days in May, they set up a donation center on the UA campus where students can bring unwanted or unneeded bicycles.

Yet as any student knows, a lot happens between move-in and move-out. That's why, throughout the year, residence life programs keep recycling at the forefront of student attention, where EcoReps in each dorm promote sustainability through more than 200 events and activities.

- UA ranks 21st in the nation for 2011 RecycleMania competition
- 29 tons of bicycles, microwaves, food and other goods recycled by students moving out of their dorms

In February, UA students join “green” thumbs across the nation for RecycleMania, an annual two-month competition among universities to reduce waste and increase recycling. In 2011, the UA ranked 21st among 363 peer campuses in the United States, collecting more than half a million pounds of recyclable materials over eight weeks. That's a major contribution to the nationwide total of 91 million pounds of recyclables collected and kept out of landfills. In terms of greenhouse gas reductions, it is the equivalent of taking 25,000 cars off the road for an entire year.



Compost Cats Collect, Compost Food Waste

An apple core is discarded in the Student Union. A few months later a flower blooms in a nearby garden bed, nourished by compost.

University of Arizona's Compost Cats are taking food waste from the Student Union, as well as local restaurants, and turning it into useable compost.



Monday through Friday, six part-time paid undergraduate students collect compostable food waste – like coffee grounds, fruit rinds and leftover bread – from Student Union Memorial Center and transport it to the compost site at the UA Agriculture Center. Students also collect compostable waste from 16 local businesses, including Whole Foods, Starbucks and the University Marriot, as well as clippings from campus landscaping projects.

Since January 2011, the Compost Cats have collected 414,000 pounds of green waste and 198,940 pounds of food waste. They

gather up to 15,000 pounds of greenery and 7,000 pounds of food waste each week. Compost is used at the UA Community Garden, another student-initiated project, and donated to the local nonprofit Native Seeds SEARCH.

Not only does re-directing food waste from the landfill provide carbon offsets, which are currently being calculated by UA students, composting the food also saves business owners money in the form of landfill fees and reduced waste transportation costs.

The food and green waste takes three to four months to actually turn into compost. During that time it is carefully monitored to maintain stable pH, temperature and adequate moisture. When the compost is ready, it is shifted through a new mechanized compost screener, sorting mulch compost from fine-grain compost and providing the consistent texture required for commercial compost.

The ultimate goal of the Compost Cats is commercializing the project so that is financially self-sustaining. With a bagging machine requested from the UA Green Fund, organizers plan to begin selling bulk and retail compost – Wildcat branded, of course – within the year. While they currently don't charge pick-up fees for any of the businesses they collect from, they are considering a monthly fee based on landfill fee savings and carbon emission credits.

Because composting requires more upstream separation than recycling, the Compost Cats also are working to educate students.

- Collecting 414,000 pounds of landscape waste and 198,940 pounds of food waste since January 2011
- Students plan to package and sell the compost – Wildcat branded of course

For three weeks in January, volunteer “compost coaches” stood by new composting bins in Student Union restaurants to educate students and others about what food they can and cannot put into the compost bins.

Photo by Samatha Munsey/Arizona Daily Wildcat



Pulling Our Cyber Weight

Computers, printers and other electronic devices contain hazardous elements like lead, cadmium and mercury. These toxins can leak into the ground when this e-waste is dumped in a landfill.



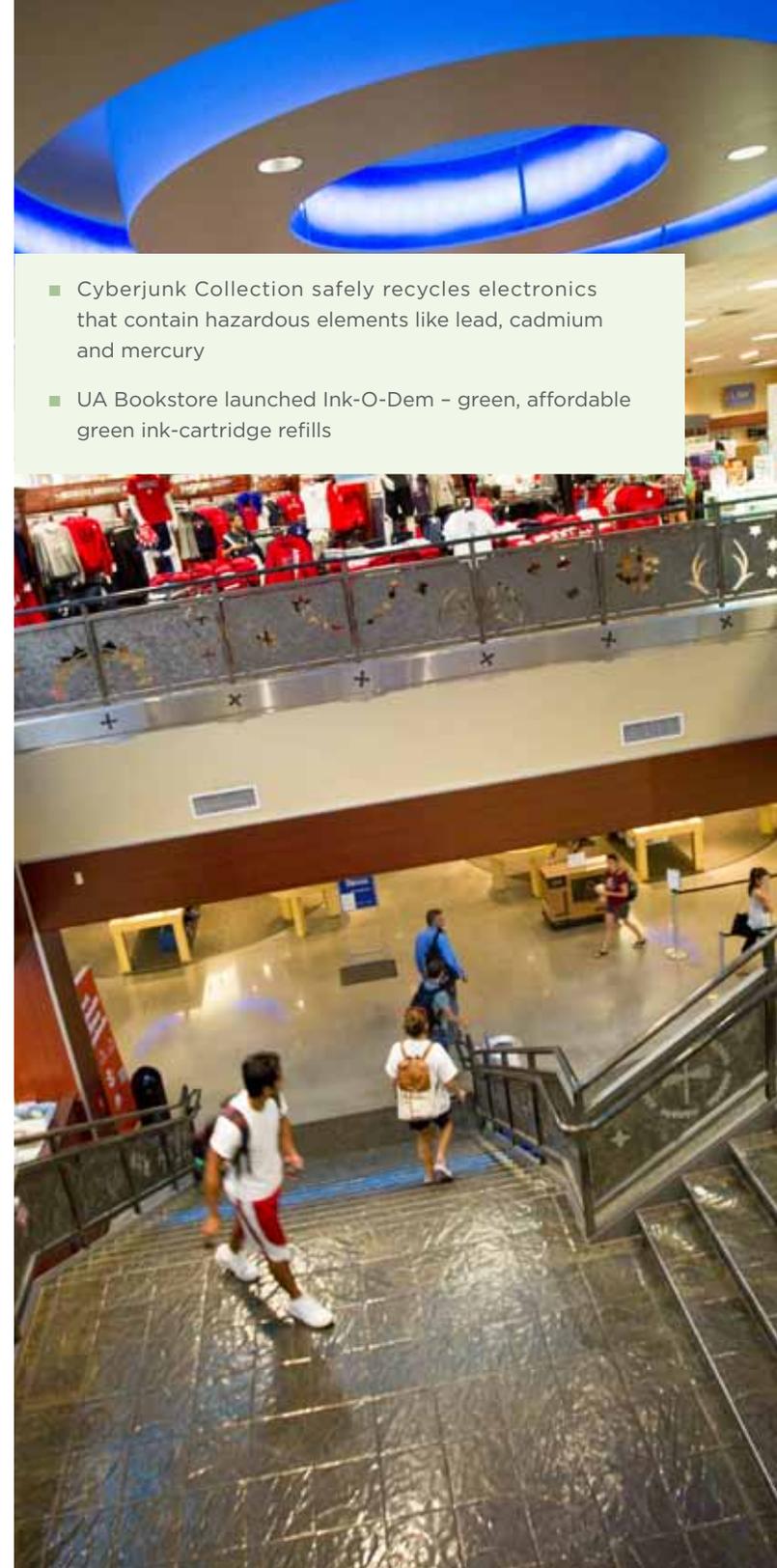
That's why the UA Bookstore and University Technology Services initiated a Cyberjunk Collection service. For four or five days every July, Cyberjunk sets up a collection center north of the bookstore, where students and community members can bring their old electronics and batteries to have them properly and safely recycled.

All items are stripped down to bare components and metals before they are loaded onto palettes and sent to a recycling plant in California. Once the material is recycled, the bookstore receives Certificates of Destruction stating that items were destroyed responsibly.

This program applies only to community e-waste, because of state regulations regarding the disposal of UA property. For the past five years, South Tucson Police Department, local school districts and other community organizations are able to recycle through the Cyberjunk collection program.

In 2011, the program responsibly disposed of 101 palettes of electronics, thus keeping 83,841 pounds of material – or 41.9 tons – out of the landfill.

Also in 2011, to diminish the amount of e-waste produced in the first place, the UA Bookstore launched an ink-cartridge refill program. Ink-O-Dem installed an ink-cartridge refilling system – making the UA the first university in Arizona to offer green, affordable ink refilling. Black cartridge refills cost \$9.99 and color refills are \$14.99.



- Cyberjunk Collection safely recycles electronics that contain hazardous elements like lead, cadmium and mercury
- UA Bookstore launched Ink-O-Dem – green, affordable green ink-cartridge refills

Innovative Waste Streams

With a campus community of nearly 40,000 students – plus faculty, staff and visitors – there’s a lot of diverse research and programming happening at the University of Arizona. That means there’s also a diverse array of waste being produced.

To increase the recycling rate on campus, member of the Facilities Management staff are leaving no stone—or block of styrofoam—turned.

For common materials, campus recycling is operated under a modified “single-stream” system, which simplifies the process on the user end. All types of paper, such as office paper, newspaper, or chipboard, plastic, including any #1 through #7 “non-film” plastics, and aluminum or tin cans can be deposited in virtually any recycling bin or box on campus. In December of 2011, FM began operating a separate waste-diversion stream for corrugated cardboard, and has since diverted 115 tons of cardboard.

Styrofoam is the bane of the recycling world. Often used in electronics packaging, Expanded Polystyrene (or EPS—the generic term for styrofoam) is light, large and valueless – making any transport cost required to get it to a recycling center a net loss. Fortunately the UA connected with SoyTuf coatings, a local manufacturing company that uses EPS to make a light-weight concrete block. The company picks up bales of EPS that FM sets aside, thus eliminating the material from the university’s waste stream.

Other unlikely contributors to campus recycling are the animal members of the UA community. Three animal care centers on campus were throwing out tons of biologically rich waste, such as corn cobs and aspen or birch shavings. Recognizing the opportunity, a representative from Animal Care approached Facilities Management and the Compost Cats about turning that waste into something useful. Now, the animal care centers are a regular stop on the Compost Cat’s daily pickup route and could contribute 70 tons a year of animal bedding to the composting operation.

Working with Tucson business Pallet Recyclers, Facilities Management has gathered and recycled over 1000 pallets – or 30 tons worth of waste – since the fall of 2011. Other recycling partners include CFK (Cartridges for Kids), a Waste Management recycling program that takes UA print and toner cartridges, and Armstrong, a building supply company that recycles old ceiling panels.

With new education initiatives underway that encourage everyone on campus to chip away at their waste streams, the UA is looking forward to a reduced waste footprint each year to come.

- Since December 2011 UA Facilities Management has recycled 115 tons of cardboard
- Working with Tucson business Pallet Recyclers, Facilities Management has gathered and recycled over 1000 pallets, or 30 tons worth of waste, since the fall of 2011



Green Spirit

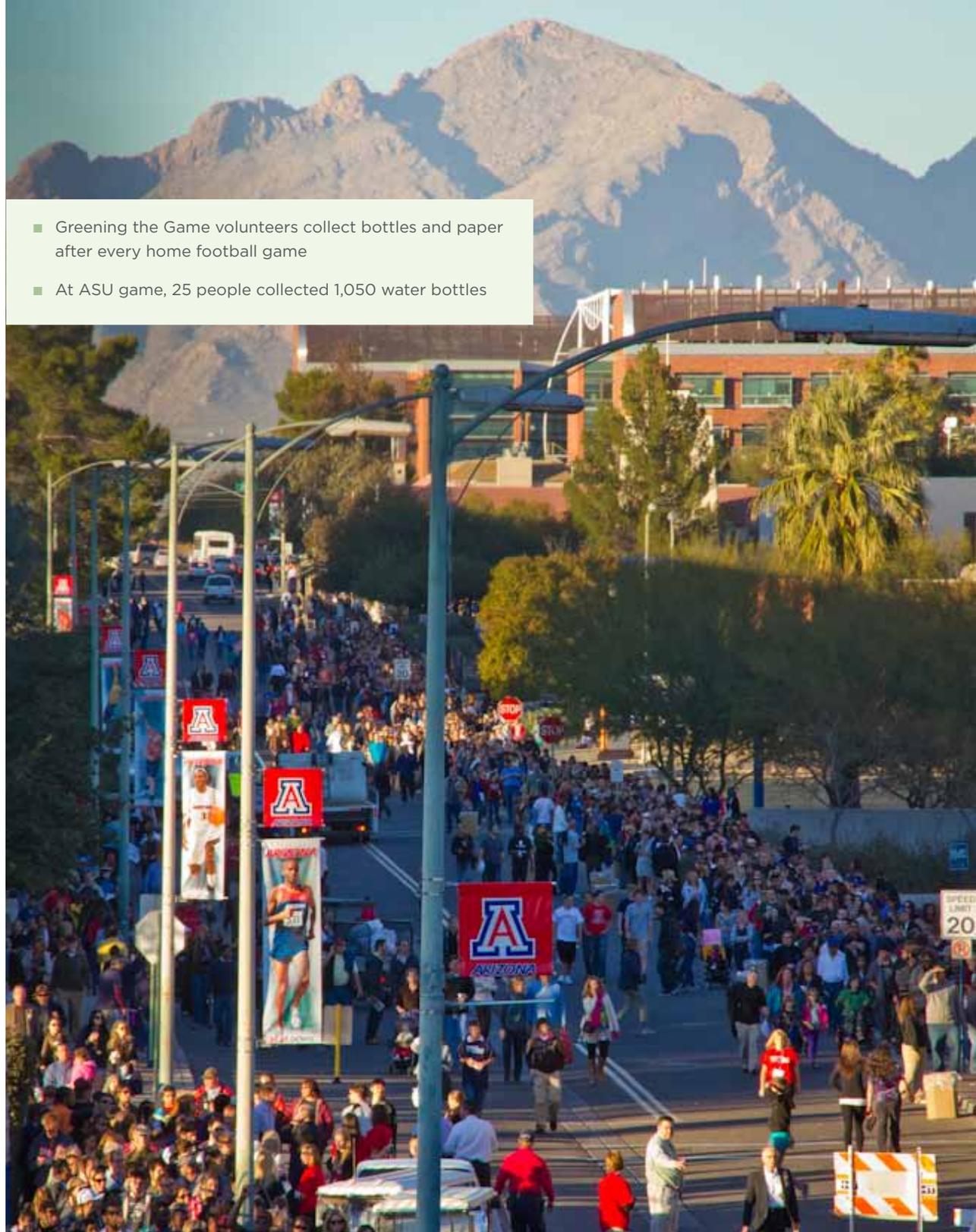
The wildcat colors may be cardinal and navy, but University of Arizona students are leading the way to make school spirit green.



Greening the Game, a project initiated by Students for Sustainability and supported by Facilities Management and the Athletics Department, is helping to make recycling easier at UA sporting events

After every home football game, project interns and volunteers spend an hour collecting water bottles and paper. Once the water bottles and pamphlets are collected in plastic bags, Waste Management picks up the bags and recycles them. After the Arizona State University game in the fall, 25 people collected approximately 1,050 water bottles.

- Greening the Game volunteers collect bottles and paper after every home football game
- At ASU game, 25 people collected 1,050 water bottles



Purchase “Green” Goods & Services

The University of Arizona is committed to stewardship of the environment and to reducing dependence on non-renewable energy. That’s why it buys green whenever feasible. Over the years many purchases were already eco-friendly and sustainable – but going forward green is a top priority for consideration along with price, availability and performance criteria.



The UA environmental purchasing strategy addresses these principles:

- Minimize consumption of non-replaceable natural resources
- Seek alternatives to products and processes that are detrimental to the environment
- Minimize waste from packaging and usage to eventual product disposal
- Maximize the reuse and recycling of materials.

Look for “Green Seal” cleaning products, efficient quiet “Green Label” vacuum cleaners, U.S. EPA ENERGY STAR electrical products, sustainably harvested wood certified by the Forest Stewardship Council and other industry-rated standards.

Vehicles that run on electricity biofuels or other alternatives to gasoline are preferred. Copiers and printers should be compatible with the use of recycled content and remanufactured products. Packaging is reusable, recyclable or compostable. Suppliers of everything from computers to carpets must have a take-back plan for reuse or environmentally safe recycling.

Heating, cooling, insulation and fire-suppression systems can no longer contain chlorofluorocarbon and halon. Paint, carpeting, adhesives, furniture and casework should have the highest recycled content and lowest amount of volatile organic compounds. Biodegradable, phosphate-free and citrus-based cleaning solvents are the norm. For road construction projects, recycled, reusable or reground materials are selected whenever practical.

The university supports purchasing goods and services from those manufacturers and vendors who share a commitment to the environment. From food wrappers and light bulbs to LEED-certified construction projects, UA purchasing policies are designed to do the most good for the resources expended.

Greening Bathrooms

With more than 1,000 restrooms on campus, the UA purchases only paper towels and toilet paper made from 80 percent recycled fibers. The UA also switched to a mild bio-degradable foam soap that meets sanitation standards and is green-certified. Hundreds of standard flushing urinals were replaced with waterless urinals, saving millions of gallons of water each year.



Next Steps

To Reduce Emissions from Solid Waste

Reduce Purchase/Acquisition of Non-Recyclable Materials

- In addition to the new sustainability purchasing policy, the University of Arizona will provide resources for department-level purchasing that leads to less non-recyclable material being acquired by the UA.

Increase Diversion of Materials from Waste Stream

- The UA continues to expand its ability to divert from the waste stream by finding on- and off-campus uses for materials. By working with partners, the UA will continue to reduce what is thrown away by finding partners and markets for materials that the UA cannot recycle but are nonetheless valuable to others.
- The student-run Compost Cats program continues to identify waste streams at the university that can be incorporated into their process of creating ready-to-use compost at the UA Campus Agriculture Center a few miles north of the main campus. The UA will continue to support this effort as a critical strategy for reducing landfill greenhouse-gas emissions and for generating a valuable soil amendment for the UA and Tucson community.
- The university is investing in more and more effective recycling bins inside and outside of buildings that offer increased options for recycling.
- The UA is continuing to improve its recycling outreach strategy with enhanced signage, a mobile website and a phone app to ensure that UA students, employees and visitors can easily determine what can be recycled and where.



Play It Forward

Taking More Steps to Reduce the UA's Carbon Footprint

University of Arizona is a leader in climate change research – providing information and insights that influence policies and actions worldwide, as well as implementing strategies and actions to further reduce its own carbon footprint in the arid Southwest. The UA leads by example and trains the next generation in sustainability science and solutions.

Science uncovered the earth's evolving climate changes – from ancient times to the present and projections for the future. And it will be science that provides more opportunities to lighten our collective carbon footprint. The goal of carbon neutrality may well take decades and will require major new technological breakthroughs.

That's one of the motivations behind the founding of the American College and University Presidents' Climate Change Commitment. A key goal of the ACUPCC is to promote the research and educational efforts of higher education to equip society to re-stabilize the earth's climate. The mission is to accelerate progress towards climate neutrality and sustainability by empowering the higher education sector to educate students, create solutions and provide leadership-by-example for the rest of society.

Across the nation, college and university presidents and chancellors are partners in this commitment. They believe that exerting leadership in addressing climate disruption is an integral part of the mission of higher education. Their actions will stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni, business and local communities.

This is a long-term commitment. The UA will continue to lead by example in reducing its carbon footprint and continue to improve its ability to track greenhouse gas emissions, report comprehensively on all steps being taken to reduce them and share proven innovations. The UA will remain a global leader while creating learning experiences for students who see carbon management as an increasingly important professional skillset. Sustainable actions today and tomorrow can impact the quality of lives and the health of the planet.





Learn more about our environmental initiatives,
visit <http://sustainability.arizona.edu>.