

2017

Campus Sustainability Report

Prepared by Chad Carwein, ECU Sustainability Manager

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LETTER FROM THE AVC FOR CAMPUS OPERATIONS



Sustainability and efforts to 'go green' have not only captured the efforts of corporations and businesses around the world, it also has caught the attention of higher education institutions. East Carolina University has recognized the importance of sustainability and chosen to participate in the Sustainability Tracking, Assessment and Rating System (STARS). Established by the Association for the Advancement of Sustainability in Higher Education (AASHE), STARS is a voluntary, self-reporting framework for colleges and universities to gauge progress toward sustainability and be recognized for their leadership. Created by the higher education community, STARS helps ECU set and meet our sustainability goals while promoting information-sharing among our campus community.

In 2009, the UNC System adopted a Sustainability Policy, which set a goal of carbon neutrality by 2050 and established "sustainability" as a core value of institutional operations, planning, capital construction, and purchasing practices. This policy enabled UNC institutions to create sustainability programs and provide staff as well as financial support for sustainable development initiatives on campus. While ECU has had a fledgling program promoting sustainability on campus, other institutions such as Appalachian State University, NC State University, and UNC Chapel Hill already had mature programs in place.

ECU expanded our sustainability movement in the spring of 2016 by hiring Chad Carwein as the first University Sustainability Manager. I am proud to announce that, after months of data collection and reporting, East Carolina University has earned 41 points and our first-ever STARS Bronze Rating. Our submission was close to the 45 points needed for a STARS Silver Rating and, since the rating is valid for three years, I'm confident that we will make enough progress to secure a STARS Gold Rating by the time our next submission is due. Now that this information has been made public, I invite you to review our <u>STARS Report</u> and share this exciting news campus wide.



We can now highlight our achievement when connecting with prospective students and their parents to illustrate ECU's commitment to campus sustainability. The value of this achievement cannot be overstated, especially with regard to potential recruitment opportunities. In 2016, the Princeton Review's Annual Hopes and Worries Survey found that over 60% of prospective students and their family's believed that an institution's commitment to environmental stewardship would contribute to their application and attendance decisions [#14]. By completing this STARS Report and submitting our data to other reporting frameworks, ECU will also be included in Sierra Club's Cool Schools list and the Princeton Review's Guide to Green Colleges, to be published in the fall. Thank you to everyone who worked toward accomplishing this milestone and continuing to advance campus sustainability.

LETTER FROM THE UNIVERSITY SUSTAINABILITY MANAGER

Hello, my name is Chad Carwein and I am the Sustainability Manager for East Carolina University. In fact, I'm very proud to say that I am the first person to hold this position at ECU. I started the job barely over a year ago in March 2016 and my how the time has flown! Just in this first year, we've accomplished so much. I say "we" because everything to do with sustainability is and *must be* a team effort. One person simply cannot make an entire campus sustainable on their own. Reducing greenhouse gas (GHG) emissions and fostering a culture of sustainability at a large institution like ECU requires collaboration and I view my role as providing leadership and vision to these efforts.

Prior to my time with ECU, I was the Sustainability Program Specialist at UNC Greensboro for two and a half years. In 2009, I received my Bachelor of Arts (BA) in Psychology with a Spanish Minor from the University of Kentucky, where I also interned with the Lexington-Fayette Urban County Government's Department of Environmental Quality. In 2012, I earned dual Masters Degrees in Public Affairs (MPA) and Environmental Science (MSES) with concentrations in Sustainability, Environmental Policy, and Natural Resource Management from Indiana University's School of Public and Environmental Affairs (SPEA).

In my role at ECU, I have the privilege of working with students, staff, and faculty to improve sustainability on both the Main Campus and the Health Sciences Campus. Beyond campus, I have also worked with various community groups to build partnerships and improve environmental stewardship within the City of Greenville and surrounding areas of Pitt County and Eastern North Carolina. One of the first things I did on the job was to get both of my offices certified as Safe Zones, which is a program offered through the LGBT Resource Office. That is important to mention because most people do not realize that sustainability involves more than the environment and economy – it also takes into account social equity.

Some other big projects that I've worked on during this first year include updating the <u>sustain.ecu.edu</u> website, establishing social media accounts to improve engagement opportunities, hosting several events (both on and off campus) to increase awareness, and much more! Many of the programs and figures included in this report were already happening before I arrived to the University; however, there is always room for improvement and that is exactly what I intend to do over the next several years, but I need help! So, if you are reading this document, then thank you very much because *sustainability is journey – not a destination*, but understanding where we are is the first step to get where we want to go!







WATER MANAGEMENT

ECU takes water conservation extremely seriously and has worked quickly to make water conservation a priority on all campuses. Recent droughts in the area have brought into clear focus the need to conserve water, and in response, ECU is addressing the issue in a variety of ways.

GOAL

• Reduction in indoor potable water consumption of 20% and a reduction of outdoor potable water use of 50%.

PROGRESS

• 50% reduction in potable water consumption per square foot since 2003.

Extensive rain water harvesting, aggressive efficiency upgrades, leak detection, and smart irrigation controls account for the decrease in water consumption.

STRATEGIES

NON-POTABLE WATER MANAGEMENT

Reclaimed Water

The photo in the lower right corner of this page is of the water reclamation system at Coastal Studies Institute. Water is captured from the roof of the facility then piped down through a filtration system. Once the water has been treated, it is transferred into four 12,000 gallon underground storage tanks. Finally, the water in the tanks is connected to the indoor plumbing system and used to flush toilets and urinals.





Year	Water Cost Avoided	Square Foot Cost (\$ / kGal)	Water Intensity (Gal/GSF)	Water Intensity Change
2002-03	-	\$5.12	47.12	-
2003-04	\$1,790	\$4.87	47.04	0%
2004-05	\$258,795	\$5.66	38.52	-18%
2005-06	\$239,129	\$5.44	38.99	-17%
2006-07	\$555,511	\$5.67	31.57	-33%
2007-08	\$649,600	\$5.74	30.25	-36%
2008-09	\$816,313	\$6.45	27.70	-41%
2009-10	\$746,882	\$6.64	29.64	-37%
2010-11	\$771,136	\$7.07	30.39	-35%
2011-12	\$994,505	\$8.05	28.18	-40%
2012-13	\$1,109,705	\$8.20	27.14	-42%
2013-14	\$1,158,509	\$8.20	26.25	-44%
2014-15	\$1,468,629	\$9.05	23.45	-50%

Table 2: \$8.8M in cost avoidance since FY2002-03 and 50% reduction in water intensity.



STORMWATER MANAGEMENT

Control Measures

Over 20 stormwater control measures capture, slow, and/or filter campus runoff. Traditional measures include ponds, wetlands, underground storage, bioretention, and sand filters. More innovate control measures include cisterns and permeable pavement.

Ponds

Retention ponds such as Lake Laupus on Health Sciences Campus and others located behind Croatan Dining Hall and at the North Recreational Complex also aid in stormwater management. In addition to aquatic plants that filter runoff, the water is also held in place to ease pressure on the city system then used for irrigation. Monetary savings are estimated to be thousands of dollars in lieu of treated water.

Cisterns

As a major consumer of water on campus, the ECU Grounds Department has installed several rainwater cisterns, both above and below ground, to collect and use rain water for landscape irrigation. In this picture, rain water is captured from the roof via the gutters and piped to the cistern through downspouts. Other systems are located underground and either collect rain from building roofs or by diverting stormwater from parking lots.

Permeable Pavement

A permeable pavement system will allow rainwater to infiltrate the soils and recharge aquifers. The use of pervious paving is among the Best Management Practices (BMP) recommended by the EPA and other agencies for the management of storm water runoff on a regional and local basis. Permeable pavers eliminates the need for retention ponds, bioswales, and other storm water devices, and provides more efficient land use. By allowing water to soak through and infiltrate, permeable pavement reduces storm water flow and pollutant loads.



Education

The ECU Grounds Department worked with the Sound Rivers Association to include signage at three grant funded Best Management Practices (BMP) projects installed on campus in 2015/16. These educational signs will add an academic/teaching component to the BMP projects.







Smart Irrigation

When irrigation is necessary, ECU uses an advanced Irrigation Control (IQ) system equipped with a weather station that will calculate the evapotranspiration (ET) rate for a day. The irrigation system is then able to deliver the precise amount of water needed to the landscape, effectively eliminating over watering.

The IQ system is currently operating efficiently at the Smith-Williams Center, Blount Intramural Fields, North





Recreational Complex, and the brand new Student Center on Health Sciences Campus. Planning for future expansion of the IQ system on campus is underway. This system will allow the University to save a thousands of gallons of water by running multiple zones at one time. In addition, the system will identify leaks and shut off the water supply at the break while the system is running, which will prevent wasted water and possible safety concerns with a blowout. This will certainly help our cause when we have another drought and the State wants us to cease all watering.

Native Landscaping

The grounds department has also begun using more native and drought tolerant vegetation on campus, which allows the university to irrigate far less than it previously did. These plants require less water, less mowing, and fewer chemicals to survive, which is also beneficial to the environment.

Indoor Plumbing Fixtures

ECU Facilities Services has worked to reduce water usage in campus buildings through traditional water-saving initiatives, such as installing low-flow faucets, toilets, and shower heads across campus. For example, over 20 academic and administrative buildings have been completely upgraded with lowflow fixtures. In addition, West End Dining, Dowdy-Ficklen Stadium, Clark-LeClair Stadium, and CRW facilities now have low-flow fixtures. Nearly all the dorms have also upgraded to low-flow shower heads and, in the Health Sciences Building alone, ECU has replaced 137 toilet valves with 2-flush type.

Trayless Dining Program

Did you know that Dining Services has been trayless since 2007? By dining trayless, you have helped positively impact the waste stream. Dining trayless minimizes food waste, conserves energy and water, and reduces the amount of cleaning chemicals entering the sanitary sewer.

DEAR TRAY. I'm sorry. I don't want to hurt you, but I think we need to Our relationship is dysfunctional - I use you, you make me do things I regret (like wasting twice as much food as trayless diners). You're so high-maintenance - it takes you more than half a gallon of water just to get ready before a meal. We should just end this now, before we both get hurt. It's not me -- it's you.

GOODBYE

CLIMATE CHANGE MITIGATION

Eastern North Carolina, with its long coastline and many low-lying areas ways, is particularly vulnerable to the unpredictable effects of climate change. As a result, ECU is implementing strategies to reduce its greenhouse gas (GHG) emissions and the impacts of climate change on and off campus.

GOAL

• Climate neutrality by 2050.

PROGRESS

 Scopes 1 and 2 reduced CO2e by 1.2% per square foot since 2011.

STRATEGIES

Greenhouse Gas Inventory Building Energy Use **Energy Conservation Measures** Green Development Transportation Materials Management Waste Reduction and Recycling Policy and Engagement

GREENHOUSE GAS INVENTORY

Understanding current greenhouse gas (GHG) emissions is a necessary step towards developing goals for lowering future GHG emissions and strategies to combat global climate change. There have been several changes in campus infrastructure over the years, with a potential to change source distribution and total amount of GHG emissions.

Since the previous inventory completed in Calendar Year 2011 only accounted for Scopes 1 and 2 of emission sources, it is difficult to draw a comparison in terms of the overall distribution of GHG emissions. However, when comparing gross area of total building space and the emissions from just the first two scopes, the previous inventory concluded that ECU produces roughly 12.4 kg CO2e per square foot and the current inventory found a reduction of 0.15 kg CO2e per gross square foot of building space. This amounts to an overall reduction of 1.2% since 2011. Of course, this is partly owed to the fact that total building space increased by 9.4% from 6,220,312 gross square feet in Calendar Year 2011 to 6,804,178 gross square feet in Fiscal Year 2016.

MODULE	Summary								
WORKSHEET	Overview of Annual Emissions								
UNIVERSITY	East Carolina University								
Select Year>	2016	Energy Consumption	CO2	CH,	N_2O	eCO ₂			
		MMBtu	kg	kg	kg	Metric Tonnes			
Scope 1	Co-gen Electricity	-	-	-	-	-			
	Co-gen Steam	-	-	-	-	-			
	Other On-Campus Stationary	455,583.1	24,492,815.9	2,237.6	51.0	24,564.0			
	Direct Transportation	75,049.3	5,041,349.4	545.4	208.7	5,117.2			
	Refrigerants & Chemicals	-	-	-	-	416.4			
	Agriculture	-	-	-	9,299.7	2,771.3			
Scope 2	Purchased Electricity	446,857.1	63,827,098.8	1,240.4	773.6	64,088.6			
	Purchased Steam / Chilled Water	-	-	-	-				
Scope 3	Faculty / Staff Commuting	103,556.6	7,389,108.9	1,554.8	519.9	7,582.9			
	Student Commuting	180,400.4	12,872,171.8	2,708.5	905.6	13,209.8			
	Directly Financed Air Travel	49,494.0	9,652,821.5	95.7	110.0	9,688.0			
	Other Directly Financed Travel	5,164.0	368,467.6	77.5	25.9	378.1			
	Study Abroad Air Travel	-	-	-	-	-			
	Student Travel to/from Home (OPTIONAL)	-	-	-	-	-			
	Solid Waste	-	(976.8)	337,652.0	-	8,440.3			
	Wastewater	-	-	28,904.9	201.1	782.6			
	Paper	-	-	-	-	263.0			
	Scope 2 T&D Losses	27,619.3	3,945,014.7	76.7	47.8	3,961.2			
Offsets	Additional								
	Non-Additional					-			
Totals	Scope 1	530,632.4	29,534,165.3	2,783.0	9,559.5	32,868.9			
	Scope 2	446,857.1	63,827,098.8	1,240.4	773.6	64,088.6			
	Scope 3	366,234.3	34,226,607.7	371,070.1	1,810.3	44,305.9			
	All Scopes	1,343,723.9	127,587,871.7	375,093.5	12,143.4	141,263.4			
	All Offsets					-			
					Net	141 042 4			
					Emissions:	141,263.4			

GHG Profile

The largest contributor to the GHG emissions profile of ECU still remains to be Scope 2, Purchased Electricity, which accounts for about half of all the University's footprint. Scope 1, emissions sources including On-Campus Stationary, Direct Transportation, Refrigerants, and Agricultural combined for a little more than 23% of total GHG emissions. Attributing nearly one third of the total GHG emissions, Scope 3 sources include Commuting, Directly Finance Travel, Solid Waste, Wastewater, Paper and Scope 2 T&D Losses. Taking all three scopes into account, the 2016 GHG Inventory Report finds that ECU produced a total of 141,263 MT CO2e.



BUILDING ENERGY USE

In Fiscal Year 2016, there were 2,377 Heating Degree Days(HDD) and 1,948 Cooling Degree Days (CDD), both of which factor into our annual energy consumption. As a result, ECU purchased 923,166 MMBtu of electricity from the Greenville Utilities Commission. In addition, ECU used 380,526 MMBtu of natural gas for the district steam and hot water supply. Energy consumed from other sources comprised the remaining 8,516 MMBtu of our total building energy use that amounted to 1,312,208 MMBtu. Take a look at the charts and graphs below to see the historical trends in energy use by ECU.



Year	Energy Cost Avoided	Energy Cost (\$/ GSF)	Energy Cost (\$ /MMBtu)	Energy Intensity (Btu/GSF)	Energy Intensity Change
2002-03	-	\$2.13	\$12.50	170,724	-
2003-04	-\$1,130,619	\$2.33	\$12.32	189,287	11%
2004-05	-\$140,266	\$2.47	\$14.29	172,569	1%
2005-06	-\$615,896	\$2.96	\$16.66	177,567	4%
2006-07	\$1,368,244	\$2.56	\$16.30	157,404	-8%
2007-08	\$3,239,093	\$2.44	\$17.14	142,573	-16%
2008-09	\$3,561,260	\$2.72	\$19.16	142,207	-17%
2009-10	\$1,081,982	\$2.86	\$17.71	161,238	-6%
2010-11	\$2,869,386	\$2.61	\$17.84	146,059	-14%
2011-12	\$2,899,179	\$2.56	\$17.58	145,433	-15%
2012-13	\$3,405,994	\$2.42	\$17.15	141,416	-17%
2013-14	\$3,357,400	\$2.43	\$17.13	141,752	-17%
2014-15	\$3,846,835	\$2.51	\$17.97	139,480	-18%

Table 1: \$21M in cost avoidance since FY2002-03 and 18% reduction in energy intensity.

ECU Annual Energy Consumption

ENERGY CONSERVATION MEASURES

Starting in 2013, ECU participated in a lighting performance contract with several other institutions in the UNC System. The project replaced 30,000 fixtures and was paid for through an innovative financial agreement that utilizes cost savings from the more efficient Light Emitting Diode (LED) light fixtures to pay for the installation. This project is estimated to have a seven-year payback period.





Brody School of Medicine Gross Anatomy Lab (before and after LED replacements installed).

Schneider Power Monitoring Expert

This energy monitoring system is utilized at ECU to monitor real-time electrical energy consumption at most buildings on campus as well as the Dental School's Service Learning Centers located across the state. Our goal is to utilize the dashboard feature of PME to stream real-time graphics to individual building monitors located in central lobby areas so that building occupants can reduce consumption.



Lucid Building Energy Dashboard

Campus Living utilizes this system for monitoring energy consumption in the residence halls. Twice per year residence halls on campus use the Lucid Dashboard to host the Watt Watch Energy Challenge, in which dorms compete against one another to see who can reduce energy the most over a month-long period. The winning dorm is awarded with a party sponsored by Campus Living.



Eastern North Carolina's warm and humid climate requires year-round space conditioning to provide comfortable working environments for students, faculty and staff as well as to protect campus buildings. Therefore, ECU has recently upgraded and optimized all three central chiller plants, allowing for higher efficiency operation of these facilities.

HVAC Upgrades

Understandably, Joyner Library is one of the most heavily used buildings on campus. Due to its longer operating hours and the need to maintain archival storage standards of temperature and humidity, energy consumption is high. This year, ECU is upgrading much of the HVAC, optimizing its chiller plant and replacing outdated pneumatic controls. When complete, the efficiency will be greatly enhanced.

Dedicated Heat Recovery Chiller

At ECU's West Research Campus, the main facility is heated with propane-fired gas boilers. In 2015, the building's aging chillers were replaced with a more efficient chiller along with a separate heat exchanger which extracts "waste" heat from the water returning to the chiller and uses it to preheat the boiler water. This has resulted in a 70% reduction in propane use.

Solar Film Installations

Three of our older facilities with single-pane windows have had thermal film installed. This has resulted in reducing - by more than 90% - the infrared radiation passing through the glass. With the reduced heat load, the air conditioning works less – saving energy – and the aesthetics of the buildings are also improved.

Solar Umbrella Charging Stations

Two Zon Powersol Umbrellas have been installed. One is located outside of Jones Residence Hall and the other can be found in the East Carolina Heart Institute Atrium. These umbrellas have solar panels on top that power the charging station near the table top. These devices demonstrate the capabilities of solar power and allow up to three mobile devices to charge simultaneously. The intelligent USB charging ports sense when a device is charged and the LED display indicates power stored and available.









GREEN DEVELOPMENT

The 2007 NC Senate Bill 668 requires reduction in the amount of energy, water and other resources consumed by the State government in their buildings and facilities. These standards apply to all new buildings owned by the State as well as the University of North Carolina system, which are larger than 20,000 square feet. Applicable projects must be designed, constructed and certified to exceed the energy efficiency requirements of ASHRAE 90.1-2204 by 30 percent for new buildings and 20 percent for major renovations.



ECU Green Buildings:

- 1. Croatan Dining Hall LEED Silver (2010)
- Ross Hall (first 3 floors) LEED Gold (2012)
- 3. Coastal Studies Institute - LEED Gold (2014)
- Gateway Residence Hall Designed to meet LEED Silver standards (2014) 4.
- HSC Student Union Designed to meet LEED Silver standards (2017) 5.



TRANSPORTATION

Commuting can be a significant contributor to greenhouse gas emissions; however, it is difficult to assess without traffic data or a commuter survey. Generally, several factors influence commuter habits, such as distance between destinations, road infrastructure, traffic patterns, parking availability, public transportation access and reliability, and others. At ECU, access to public transportation, biking infrastructure, student housing, parking capacity, and other factors account for commuting modal splits. Student and employee commuter travel in FY 2016 accounted for 283,597 MMBtu, which translates into 20,793 MT CO2e (14.7% of total emissions).



ECU Transit

ECU's own transit system, one of the top 10 largest passenger carrying fleets in North Carolina, transports over 2.5 million riders annually. ECU Transit operates during the academic year, including both summer sessions, to serve both the main and medical campuses. It's fare free; all you need to ride is your 1 Card. The ECU Mobile app has a program called NextBus, which allows commuters to track bus locations real-time and plan their trips around daily routines. Even if ECU buses can't get you where you need to go, try Greenville Area Transit (GREAT). Discount passes are available at the Central Ticket Office inside the Mendenhall Student Center.

Alternative Fuel Vehicles

ECU's fleet has a total of 483 vehicles, which includes: 2 plug-in hybrid vehicles, 36 electric vehicles, and 2 transit buses powered by Compressed Natural Gas (CNG). In fact, ECU Transit has plans to replace diesel buses with CNG buses as needed, which will reduce emissions by 25% per bus replaced.

EV Charging Stations

In collaboration with the Greenville Utilities Commission, ECU applied for and received a grant from Duke Energy to install two Electric Vehicle (EV) charging stations on campus. One is located in the parking lot at the bottom of College Hill Drive and the other is located on Health Sciences Campus in the lot where North and East Campus Loop intersect. The Parking and Transportation Office has designated three parking spaces for each duel charging station, but the users have a 4-hour time limit.

Zimride

Zimride is a ride-sharing network that helps members of the ECU community find, post, and coordinate carpooling alternatives to individual transportation needs. Zimride provides a central location for finding out about memberposted ride needs and offers, and helps get individuals connected for a mutually beneficial ride arrangement. Membership registration is not required, but you do have to login using your ECU PirateID and passphrase, which means you will be safely connecting with members of the ECU community, giving you the most efficient and relevant ride options.









Zipcar

Enterprise CarShare is perfect for students, faculty and staff that do not have a car on campus. Members pay an affordable hourly rate, which includes gas and insurance, to save money on gas, lower the wear and tear on their own vehicles, and/or for the luxury of driving a brand new hybrid or fuel-efficient car! Together with ECU Parking, Enterprise CarShare continues to help students, faculty and staff reduce the congestion, fuel consumption and vehicle emissions for a



cleaner, greener campus! The Enterprise CarShare vehicles include 2 brand new fuel-efficient vehicles One is located in the Mamie Jenkins parking lot, next to the Old Cafeteria Building. The other one is located in the first space in the parking lot in front of Aycock Residence Hall on College Hill.

Bike Programs

In addition to the hundreds of bike racks, three bike repair stations, and indoor shower facilities for cyclists located on both campuses, ECU Parking and Transportation Services has also offered a Pirate Bikes rental program since 2009. Providing bike amenities and services like this helped ECU qualify for Bicycle Friendly University status in 2014. This program recognizes institutions of higher education for promoting and providing a more bikeable campus for students, staff and visitors. The BFU program evaluates applicants' efforts to promote bicycling in five primary areas: engineering, encouragement, education, enforcement and evaluation/planning, known as the Five E's.



...live healthy



WASTE REDUCTION AND RECYCLING

Recycling

ECU utilizes a dual-stream recycling system inside buildings and a single-stream recycling system in outdoor areas on campus. The table below highlights material weights from fiscal year 2016:

Materials Recycled	1,135 tons	
Materials Composted	0.0 tons	
Materials Recovered and Reused	33 tons	
Materials Donated or Sold	59 tons	
Materials Sent to Landfill	2,724 tons	
Percentage of Materials Diverted	31.0%	



Move-Out Programs

In collaboration with Off-Campus Housing and Campus Living, Recycling Services has hosted the Pirates Treasure Give N' Go Donation Drive for the past few years. Collection boxes are setup in residence hall lobbies to collect clothes and small appliances, which are picked up by Goodwill for charitable purposes. In 17 student apartment complexes around town, large bins are placed near trash and recycling dumpsters in order to divert reusable items like furniture and electronics, which are picked up by the local Habitat for Humanity Re-Store.

Fryer Oil Recycling Program

100% of used cooking oil is recycled by dining services and collected by a local third party vendor for reuse.

Electronics Recycling

64.7 tons of monitors, computers, printers, copiers, and televisions were recycled by PowerHouse recycling.

RecycleMania

RecycleMania is a friendly competition and benchmarking tool for college and university recycling programs to promote waste reduction activities to their campus communities. Over an 8-week period each spring, colleges across North America report the amount of recycling and trash collected each week and are in turn ranked in various categories based on who recycles the most on a per capita basis, as well as which schools have the best recycling rate as a percentage of total waste and which schools generate the least amount of combined trash and recycling. Positive results were reflected in an upwards progression in the final RecycleMania rankings in numerous categories. From 2014-2016, our ranking in the Bottles and Cans category improved from 81st to 49th place, from 106th to 67th in the Paper category, and from 115th to 69th in the Cardboard category.

Bottle Filling Stations

Over 80 bottle refill stations have been installed across both campuses including residence halls, academic and administrative buildings as well as athletic and grounds facilities. As of last count taken in the summer 2016, over 2.47 million bottles had been refilled and that amounts to more than 1.8 million plastic bottles kept out of the landfill.









MATERIALS MANAGEMENT

Paper

In fiscal year 2016, ECU's total expenditures on office paper amounted to \$132,000. Of those expenditures, 99% or \$131,072 was on office paper with 30% post-consumer recycled content.



Computers

In fiscal year 2016, ECU's total expenditures on desktop and laptop computers, displays, thin clients, tablets, TVs, etc. amounted to \$4,595,828. Of those expenditures, 80% or \$3,676,663 was on Electronic Product Environmental Assessment Tool (EPEAT) Gold registered products.



Cleaning Supplies

In fiscal year 2016, ECU's total expenditures on cleaning products amounted to \$193,000 and nearly 25% of those products were Green Seal certified. In addition, total expenditures on janitorial paper products amounted to \$185,000 and 100% or those products were certified by the Forest Stewardship Council (FSC) or Green Seal. In total, over 60% of expenditures on cleaning and janitorial paper products were certified by a third party.

Oak Hall NuHorizon Eco-Friendly Gowns

Made from 23 recycled plastic bottles each. In 2015-16 academic year, 4,440 bachelor's degrees conferred, which amounts to 102,120 plastic bottles kept out of landfills from ECU graduates.



Prior to the 2016 football season, ECU entered into a contract with Adidas for all athletic apparel. Adidas has a long history of corporate sustainability, which is deeply rooted in the company's core belief that sport has the power to change lives. Their sustainability strategy takes holistic approach that follows the entire lifecycle of sport with focus on products including water, materials, and energy as well as people through empowerment, health and inspiring action.



OAK HALL CAP & GOWN Our Firm Belief In Sustainabilit



POLICY & ENGAGEMENT

Fume Hood Decommissioning

The energy required to operate one standard fume hood costs ECU an estimated \$7,000 per year! In fact, the energy required to condition and then move the air through the ductwork in one hood can be three- to four- times the amount to operate an entire residence for a year. Heating, Ventilation and Air Conditioning (HVAC) controls in laboratory facilities are programmed to provide a safe number of air changes per hour (ACH) when fume hoods are operated in an area. For these reasons, ECU is launching a new program for when ventilation equipment is out of service for maintenance or there is no research planned for the near future, the ACH must remain the same until the sashes are securely closed and equipment is decommissioned. Once that is accomplished, HVAC personnel can then reduce the number of air changes per hour in the workspace – greatly reducing the operating costs of the affected portion of the building. When it is determined a decommissioned hood is needed for upcoming research, Campus Operations will cover the cost for EH&S to retest the equipment and – upon successful test results – will re-commission the equipment for use and Facilities Services HVAC will adjust the Building Automation System accordingly to provide safe ventilation flows throughout the lab.

Appalachian Energy Summit

Last summer marked the 5th annual Appalachian Energy Summit Appalachian Energy Summit held at Appalachian State University in APPALACHIAN STATE UNIVERSITY Boone, NC. Over the years, the event has expanded to include not only public schools within the UNC System, but also private institutions, community colleges, and other major universities in surrounding southeastern states. Attendees from ECU serve as representatives on the following working groups: Academic Integration, Campus-Based Energy Efficiency, Finance and Regulatory Opportunities, High-Performance Campus Design, Transportation Opportunities, Student Leadership and Engagement, and Zero Waste / Waste Reduction. We look forward to attending the 6th annual summit this summer and continuing progress toward reducing and stabilizing the university's average annual energy expenditures, equaling \$1,000 per student, as well as focusing on initiatives that will cumulatively save the university system \$1 billion over 20 years.

Watt Watch Energy Challenge

Similar to Campus Conservation Nationals (CCN). ECU has hosted a Watt Watch Energy Challenge in the residence halls on Main Campus for the past two years. Typically, this competition challenges dorm residents to work together to reduce electricity consumption and mitigate the impacts of climate change. In recent years, the competitions have resulted in 6-9% energy reductions and over \$80,000 in avoided energy costs for participating dorms!



FOOD AND WELLNESS

ECU Campus Dining and Aramark Higher Education have many programs in place to reduce the negative environmental impacts associated with campus food supplies. In addition, the University offers several wellness programs not only to students, but to faculty and staff as well.

DINING AND CATERING SERVICES

In collaboration with Aramark Higher Education, ECU Campus Dining works to continually develop and implement sustainable solutions for the University. We've taken important steps to advance our sourcing practices in a responsible and ethical way. To drive measureable change, we have established the following focus areas and commitments to make our campus more environmentally conscious

Local Purchasing: Did you know Dining Services sources local produce grown within 250 miles and from community-based producers, growers and distributors whenever possible? The list changes throughout the year depending on seasonality and availability.

Recycling: Dining Services partners with campus to recycle plastics from all dining locations across campus. We are committed to minimizing our environmental footprint. Look for signs in our locations for information on where to put your recyclables.

Recycled Content Paper: We use 100% recycled content paper in all dining locations on campus.

Green Cleaning: All dining locations are committed to using daily green cleaning products in our operations to reduce the need for chemical based cleaning products and provide a healthy and safe learning environment.

Energy & Water Conservation: We train our employees each semester on common energy and water conservation practices in order to conserve precious natural resources.

Humanely-Raised: Purchase humanely-raised animal proteins including cage-free shell eggs by 2015, cage-free liquid eggs by 2020, broiler chickens by 2024 and group housed pork by 2017, as detailed in Aramark's Animal Welfare Principles and Policy.

Sustainable Seafood: Purchase 100% sustainable seafood by 2018 including fresh, frozen and shelfstable seafood products for both wild-caught and farm-raised seafood, as detailed in Aramark's Sustainable Seafood Principles and Policy.

In addition to supporting and adhering to our responsible sourcing principles and policies, all of the suppliers, vendors and distributors must abide by Aramark's Supplier Code of Conduct, which covers standards around environmental compliance, labor, safety standards and more. This standard applies to authorized suppliers of goods and services to Aramark locations managed in North America.



ECU Dining Services contracts with Aramark for food service on campus. Here is what they have to say about their Green Thread programs and policies:

"At Aramark Higher Education, we have a deep respect for and commitment to protecting and improving the environment. We work to reduce our environmental footprint while delivering exceptional operational results. We also offer expertise and practical solutions to our campus partners to help them reduce their environmental impacts. We develop and implement longterm environmental stewardship programs and policies within the areas of sustainable food; green buildings; waste stream management; responsible procurement; energy and water conservation; and transportation. We call these programs and policies Green Thread as they weave throughout our business operations every day!"

Vegan and Vegetarian Options

ECU Dining Services offers a vegan entrée on our main service line at lunch and dinner at both dining halls every day of the week. These dishes often contain rice, beans, soy, hummus and pita, or an ancient grain variety. At breakfast they have added firm tofu to the omelet station (also offered all day). Other typical protein offerings throughout the day include beans variety, soy milk, peanut butter, and some nuts. We also have a robust salad bar at both residential dining halls. At West End Dining Hall we offer an Asian hibachi station that has rice and tofu as well. Both dining halls serve vegan friendly cereals such as Rice Krispies and Corn Pops.

Food Donations

Weekly protein donations are collected by student volunteers and taken to the Campus Kitchen where donations are sorted and delivered to the following local meal providers: Ronald McDonald House, Joy's Soup Kitchen, Operation Sunshine, and Little Willy's Center.



Community Supported Agriculture

There multiple entities around Pitt County that offer students, staff, and faculty to participate in community supported agriculture operations. Commonly referred to as a CSA model, community supported agriculutre is a system that connects the producer and consumers within the food system more closely by allowing the consumer to subscribe to the harvest of a certain farm or group of farms.

Local Farmer's Markets

The Leroy James Farmer's Market (previously known as the Pitt County Farmer's Market) is located at 4560 County Home Road in Greenville, NC and its hours of operation are 8am to 1pm on Tuesdays, Thursdays, and Saturdays as well as 8am to 3pm on Fridays. From July 2015 through June 2016, there were approximately 60,000 customers purchasing fresh produce, meats, baked goods, honey, jams, pickles, plants, and crafts from over 40 vendors in and around Pitt County.



Umbrella Market

The Uptown Greenville Umbrella Market offers a variety of locally-produced foods, handmade local arts, and music on the Five Points Plaza at Evans and Fifth Streets in Uptown Greenville. Conveniently located near campus, the market is open from 5-8pm on Wednesdays weekly May through August.

Greenville Community Garden

The Greenville Community Garden is located just off the Greenville Greenway by the Tar River. It was founded by the University Sustainability Manager and two other local residents. All produce harvested is donated to local food banks and other community groups that battle hunger. After the first year of production, the garden was flooded by Hurricane Matthew in the fall of 2016. Since the soil was likely contaminated, the group decided to grow their plants in hay bales this year. The garden is doing great and there are now plans for a major expansion by the end of summer.





WELLNESS PROGRAMS

Employees

Campus Recreation and Wellness offers Student Affairs employees an 8 week wellness institute that focuses on the 8 dimensions of wellness to encourage a healthy lifestyle and personal well-being. The 8 dimensions of wellness include: physical, occupational, spiritual, environmental, financial, social, intellectual, and emotional. ECU also has a Wellness Committee that envisions the creation of a transformational collaborative approach to facilitate a culture of wellness for ECU faculty and staff. In addition, the Department of Human Resources offers an Employee Resources Program (ERP) which assists employees with personal problems that may adversely affect their job performance. The program seeks to restore individual health and productivity, improve efficiency, and retain experienced employees. Dependents of eligible employees are also covered.

Students

Campus Recreation and Wellness (CRW) offers a wide variety of wellness programs and services to students. The Wellness Passport Program is a partnership between the Wellness Office, COAD 1000 and Kinesiology 1000 courses, as well as programmers from across campus that exposes students to the 8 dimensions of wellness model through a wide range of approved programing to promote overall well-being and self-care. The Sustainability Film and Discussion Series screenings all qualified as Wellness Passport Premier events because they are larger-scale educational programs that typically feature a guest speaker and draw large crowds.

Other services offered to students:

- Student Health Services
- Victims Advocacy Services
- Healthy Lifestyle Coaching
- Student Recreation Center
- Free Body Mass Index Assessment •
- Fitness Programming and Services
- Counseling Programs and Services ٠
- Collegiate Recovery Community Services

















RESEARCH, EDUCATION, AND CURRICULUM

Course work, degree programs, field research, and experiential learning activities lead to improved understanding of and advancement of sustainability. ECU has 391 faculty members (20%) engaged in sustainability research, which represent 46 out of 66 academic departments.

COURSE INVENTORY





- Sustainable Tourism (MS)
- Environmental Health (BS)
- Environmental Health (MS)
- Applied Atmospheric Science (BS)
- Coastal Resources Management (PhD)
- Development & Environmental Planning (Grad Certificate)
- Hydrogeology and Environmental Geology (Grad Certificate)

VOLUNTEER AND SERVICE LEARNING

Service has always been at the heart of East Carolina University. This commitment is demonstrated by the fact that 7,000 students were engaged in community service, volunteering over 32,500 hours in 2016. In addition, the Sustainability Manager partnered with the Office of Leadership and Civic Engagement so that four service-learning students could earn their required hours to help launch the Green Office Program, which certified three offices representing over 60 faculty and staff. It is also important to note that every full-time employee (staff or faculty) has available 24 hours per year of paid time-off for approved Community Service Leave.



WEST RESEARCH CAMPUS:

The ECU West Research Campus provides a unique resource for research and education in ecology and biodiversity close to the ECU main campuses. Formerly a Voice of America Site, the WRC covers almost 600 acres northwest of Greenville, NC. Much of the site is a poorly drained mineral flat with typical wetland soils. Prescribed burns are used to maintain an open savanna-like habitat. The site supports diverse plant community, including a number of carnivorous and rare fire-dependent plant species.

The site is used by a number of research programs in biology, including Dr. Chalcraft's work on community ecology of temporary ponds. It is also used by a number of graduate and undergraduate courses in ecology, field botany, field zoology, ornithology, wetland and ecosystem ecology.

A long-term educational ecological research experiment, funded by the National Science Foundation, was initiated at the WRC in the spring of 2002. This project was designed to provide opportunities for undergraduate and graduate training in ecological research. Each summer, undergraduate students sample the vegetation and contribute to an accumulating long-term data set. In recent years, graduate students have received funding to develop another aspect of the project to explore the effects of treatments on herbivore communities.

COASTAL STUDIES INSTITUTE

In partnership with East Carolina University, UNC Chapel Hill, North Carolina State University, UNC Wilmington and Elizabeth City State University, the UNC Coastal Studies Institute (UNC-CSI) serves as a true demonstration of innovation in research and education. The LEED Gold certified campus is located on Roanoke Island in the Outer Banks with a unique multi-campus partnership to fulfill the university's mission to undertake research, offer educational opportunities, provide community outreach programs, and enhance communication among those concerned with the unique history, culture, and environment of the maritime counties.



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Continuing Education

Courses Focused On

Sustainability





The campus spans 213 acres of marshes, scrub wetlands, forested wetlands, and sound ecosystems. While the institute emphasizes northeastern North Carolina in its outreach and educational programs, its scope also encompasses all of the eastern coast of the United States and the mid-Atlantic.

Research at UNC-CSI covers a broad range of pressing environmental concerns faced by coastal North Carolina and the delicate ecosystems that are present. By bringing together skilled professionals, scientists, academics, and locals to the North Carolina coast, UNC-CSI can provide unbiased research to decision makers of the area, resource managers, and the public.

CENTER FOR SUSTAINABILITY



The Center was originally established as a Center for Sustainable Tourism in the mid 1990's, and relocated to East Carolina University in the fall of 2007. In the fall of 2013, the Center expanded it role to include natural resources and the built environment. Today, the Center is focused on research and outreach within North Carolina, but also has applications throughout the world. The Center currently partners with numerous industries due to the multi-dimensional nature of sustainability. Faculty and staff within the Center have expertise in a wide variety of areas from engineering to recreational studies. Today, through ongoing efforts to establish partnerships and cooperation with varied stakeholders the Center is working hard to prepare for a brighter tomorrow.

The mission for the Center for Sustainability is to increase opportunities for sustainable innovation through research, education and leadership development. This will be accomplished through cooperative partnerships with various industries in North Carolina and the broader global community. Research and projects developed through the center will address the three pillars of sustainability: people, planet and profit.

AFFORDABILITY AND DIVERSITY

ECU welcomes all people to be part of our living, working, and learning community. The University grows in strength as we diversify our students, staff, and faculty. Creating a more diverse and inclusive campus environment benefits and enriches all members of the campus community.

AFFORDABILITY

ECU offers several programs to prospective students from low-income backgrounds, which include targeted outreach, scholarships, guidance and preparation assistance for families of prospective students, as well as other policies and programs to minimize cost of attendance.

- 32% of students graduate with no interest-bearing loan debt ٠
- 46% is the graduation / success rate for low-income students ٠
- 60.8% of entering students are from low-income backgrounds •
- 47.2% of need was met for students who were awarded need-based aid
- 210 out of 725 scholarships offered by donors require a need for financial aid.

DIVERSITY

Student Diversity Resources:

- LGBT Resource Office supports under-represented groups of students on campus
- ٠

Employee Diversity Resources:

- Project: ECYou assesses diversity and equity through the Campus Climate Survey
- ٠
- •

HUB Program

According to the University's Guide to Materials Management & Purchasing, a vendor may be classified as a Historically Underutilized Business (HUB) vendor if their business is minorityowned, female-owned, a disabled business enterprise, or a non-profit workshop for the blind or severely disabled. Departments are encouraged to solicit competition from small and historically underutilized businesses when making any purchase.

Campus Multifaith Alliance – promote values, faith development, and service to others Ledonia Wright Cultural Center – provides student diversity and social justice experiences

Safe Zone Training – LGBT training and certification program for university employees Office for Equity & Diversity – promotes a diverse, respectful and inclusive environment BSOM Office of Diversity Affairs – enhance awareness and knowledge of diversity at Brody

ENGAGEMENT

On and off-campus, outreach and engagement are central tenets of the ECU Sustainability Program. Extra-curricular activities and community-based projects focus on creating positive change and enhancing the quality of life for all people of Eastern North Carolina.

ENVIRONMENT COMMITTEE

The University Environment Committee (UEC) is comprised of seven elected faculty members as well as several ex-officio members representing the following units on campus: Chancellor's Office, Provost's Office, Vice Chancellor for Health Sciences, Vice Chancellor for Administration and Finance, Vice Chancellor for Student Life, Faculty Senate, and Student Government Association. The Committee is responsible for the following duties:

- Policies to preserve, improve and advance the University's physical environment
- Recommendations to mitigate the loss of habitat that has been displaced on campus
- Reviews effects of development projects on water quality and quantity, runoff, and community
- Promotes sustainability, including energy and resource conservation, curriculum and research

SUSTAINABILITY COMMITTEE

The ECU Sustainability Committee will serve as a resource and offer guidance to assure that the university community is engaged, responsible, and environmentally literate in the campus-wide development of a fully articulated vision for sustainability in research, curriculum, campus operations, and community. Our environmental stewardship will build on existing initiatives and strengths that align with the university strategic plan, as well as foster regional sustainability. If you would like to join the Sustainability Committee or have an idea to make campus more sustainable, you can come to one our meetings or email us at <u>sustain@ecu.edu</u>. Subcommittees include the following:

- Students
- Integration
- Administration
- Communications
- **Climate Change Mitigation**
- Design and Construction
- **Operations and Maintenance**
- Recycling and Waste Management
- Environmentally Preferable Purchasing

STUDENT ORGANIZATIONS

ECO Pirates

Our goal is to create a more sustainable campus that is healthy for the environment and the students. We do this by working with organizations on and off campus to better ECU and Greenville.

ReLeaf Greenville

ReLeaf Greenville is a branch of ReLeaf, Inc. that was established in 1990 to plant, promote, and protect the urban forest. Other goals include the following: reduce the disappearance of trees along streets, increase the use of trees in parking areas, increase the use of trees in development landscaping, and educate the ECU campus community about the value of trees.

USGBC Student Chapter

The ECU USGBC Student Chapter is an organization whose members are interested in sustainable construction and green building projects based on the LEED Rating System. Membership provides workshops for students to attain the credentials of LEED-GA (Green Associate).

COMMUNITY PARTNERSHIPS

FROGGS

The Friends of Greenville Greenways (FROGGS), Inc. and the City of Greenville North Carolina are dedicated to building a comprehensive Greenway system that elevates the quality of life in Greenville. By encouraging new businesses to aid in the production of usable and viable opportunities within environmentally sensitive areas and open spaces, we will not only increase Greenville's appeal as a tourist destination in Eastern North Carolina, but foster a thriving, familyfriendly community!









Love A Sea Turtle

What began as a third grade school field trip in 2005 to the Karen Beasley Sea Turtle Rescue and Rehabilitation Center has evolved into a passion and fun journey of discovery. Love A Sea Turtle is dedicated to marine and ocean conservation awareness by engaging students in leadership development and environmental stewardship, inspiring others to get involved in year-round service projects and conservation activities, and providing nature-based summer programs for under-served youth.

Keep Greenville Beautiful

Keep Greenville Beautiful is a non-profit environmental organization that aims to enhance the City through clean-up events, educational activities, beautification projects, and improving local waste handling practices. The University Sustainability Manager and the ECU Recycling Coordinator partner with Keep Greenville Beautiful in many of their cleanup events and outreach activities.

Sierra Club Cypress Group

The Cypress Group of the North Carolina Chapter includes 19 counties in Eastern and Northeastern Coastal North Carolina, making it the largest Group in the State geographically.

Rebuilding Together Pitt County

Rebuilding Together Pitt County strengthens the lives of our most vulnerable communities by providing low-income homeowners, including the elderly, people living with disabilities, veterans, and multi-generational families with critical home repairs, accessibility modifications and energy-efficient upgrades.

Sound Rivers Association

Sound Rivers is a private nonprofit organization that guards the health and natural beauty of the Neuse and Tar-Pamlico River Basins. We partner with concerned citizens to monitor, protect, restore and preserve the watersheds covering 23% of North Carolina's land mass. Our goal to provide clean water to our communities for consumption, recreation, nature preservation and agricultural use.



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BEAUTIFUL

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City of Greenville Bicycle and Pedestrian Commission

The Mission of the City of Greenville Bicycle and Pedestrian Commission is to advance Greenville as a bicycle and pedestrian friendly community, to encourage bicycling and walking among its citizens and visitors, and to provide advice and recommendations to the Greenville City Council on guestions related to bicycle and pedestrian issues. The University Sustainability Manager was appointed by the Mayor of Greenville to serve as a voting member on this Commission. To date, the Sustainability Manager has attended monthly meetings of this Commission as well as assisted in conducting a bicycle and pedestrian survey and setting goals for the Commission's activities in 2017.

City of Greenville Environmental Advisory Commission

The Mission of the City of Greenville Environmental Advisory Commission is to recommend matters of environmental concern and serve as technical advisor to the Greenville City Council. The University Sustainability Manager serves as a non-voting representative of East Carolina University on this Commission. To date, the Sustainability Manager has been very active with this group, presenting findings from the Greenhouse Gas (GHG) Inventory and assisting with planning and promoting a Clean Energy Symposium for the City of Greenville.

CAMPUS EVENTS

Sustainability Symposium

The Sustainability Symposium engaged community individuals, university faculty and staff, regional industries, and agencies interested in sustainability, with a primary focus on Agriculture and Food Systems (food, water, and energy). This symposium presented thoughtprovoking examples of sustainability ideas, analyses and practices. The event promoted approaches that adopt and implement inclusive views of the key dimensions of sustainability (environmental, economic and social) to address present and future needs. The goal of the event was to catalyze and stimulate discussion on how sustainability can be integrated into research and industry practices, especially those that will benefit eastern North Carolina.

Sustainability Film and Discussion Series

SustainECU and the ECU Green Library Group hosted the first annual Sustainability Film & Discussion Series in academic year 2016-17. This program intended to lend a voice to environmental sustainability and climate change issues affecting our community and the world. The series screened monthly documentary films ranging in topics from consumerism to waste, agriculture to water, and transportation to energy.



The program was supported in part by ECU Facilities Services and Campus Recreation & Wellness. Local sponsorships were provided by FROGGS, Sierra Club, and Keep Greenville Beautiful. The monthly events were free and open to the public at 7:00 PM in the Jenkins Fine Arts Center Auditorium and the following films were screened: Cowspiracy, Dirt! The Movie, Shored Up, Living Downstream, and Tapped. After each film screening, an ECU faculty member or representative from an organization with subject matter expertise would lead a 30-minute discussion on the topic of the film.

Earth Week Activities

In collaboration with several ECU students and campus departments, SustainECU celebrated Earth Day in April 2016 and 2017 with a week full of events and activities on campus. We started a couple of weeks before Earth Day this year by offering paper shredding and electronics recycling at the annual employee appreciation picnic on Health Sciences Campus. To kick-off the week of Earth Day, we hosted a hammock hangout and film screening of Tapped on Wednesday evening. Friday was a beautiful day for our Earth Day Festival on Main Campus where we had several fun, hands-on activities (like a tree planting and the bike blender pictured below) as well as representatives from numerous eco-friendly organizations. We wrapped up the week of events with a Community Day of Service on actual Earth Day – Saturday, April 22nd. All in all, it was a great experience for everyone who joined us!







Climate Change and Health Symposium

The Brody School of Medicine, Department of Public Health and SustainECU teamed up with national, regional and local experts to raise awareness of the health impacts of climate change in the region. Objectives of this event included the following:

- 1. To raise awareness among healthcare professionals and students on the effects of climate change on human health
- 2. To increase the understanding of the relationship between climate change and human health impacts in eastern North Carolina
- 3. To stimulate synergy, share ideas, engage faculty and students through an interactive, poster presentation session.

OUTREACH INITITIATIVES

Guest Lectures

The University Sustainability Manager offered a "Guest Lecture On-Call" service to faculty in the fall 2016 and spring 2017 semesters. Overall, more than 950 students were reached in over a dozen classes.

Shut the Sash Campaign

When a fume hood sash is left open, a large volume of air is constantly exhausted from the building, wasting massive amounts of energy. A single fume hood can use as much energy as 3-4 residential homes. On an annual basis, using a 6foot VAV fume hood at 10% full open for experiment set up, 25% at 18 inch working opening and keeping the sash closed 65% of the time would save approximately \$6,000 every year compared to a constant, fully open hood. The trivial cost to install the sash stickers is dwarfed by the operating cost reductions due to the decrease in airflow in VAV fume hood systems. The safety benefits gained by good sash operating procedures are realized in both CAV and VAV laboratories.





