# Table of Contents

**Environmental and Energy Initiative**
- Planet Blue Operations Teams
- Building Standards
- Renewable Energy

**Sustainability on Campus**
- Education Programs
- Research Accomplishments
- Student Accolades
- Campus Outreach and Engagement

**Environmental Indicators**
- Energy Use
- Emissions
- Water Use
- Land Use
- Solid Waste

Peony Gardens in Arboretum (front cover)
Rudbeckia beds at Rackham (inside front cover)
Greetings from Planet Blue!

This past year has been extremely active for the University of Michigan on the sustainability front. President Mary Sue Coleman launched a new university-wide commitment to environmental sustainability and responsible living with the formation of the Environmental Sustainability Executive Council, appointment of a Special Counsel to the President for Sustainability, and creation of the Office of Campus Sustainability.

“Planet Blue: the Sustainable Difference” encompasses education, research, and operations efforts throughout the university, and seeks to establish the campus as a living-learning laboratory. Taking the Planet Blue identity to a new level enables the university community to realize the Sustainable Difference.

Through a partnership between the Graham Environmental Sustainability Institute and the Office of Campus Sustainability, the Campus Sustainability Integrated Assessment is setting the stage for future operational sustainability goals and related initiatives on campus. During the past year, hundreds of ideas designed to reduce our environmental impact were identified and researched. The second phase of the project is now focused on the ideas that have significant potential and most closely align with institutional priorities. The ultimate result will be a set of “stretch goals” designed to drive sustainability in campus operations into the future.

The mission of the university is to serve the people of Michigan and the world through preeminence in creating, communicating, preserving, and applying knowledge, art, and academic values, and in developing leaders and citizens who will challenge the present and enrich the future. Our sustainability efforts squarely align with this mission. The 2010 Annual Sustainability Report highlights data collected for the July 1 through June 30 fiscal calendar years, 2004–2010, for the University of Michigan Ann Arbor Campus. We hope you find this report to be of value and invite you to help the university in our efforts to protect the environment and foster sustainability on local-to-global scales. Whether faculty, staff, student, alumni, or campus partner, we must all take responsibility for our impact on the planet. By working together we can reduce those impacts and help steer society on the path toward a sustainable future.

Terrance Alexander, PE, CIH
Executive Director
Office of Campus Sustainability

Donald Scavia, PhD
Special Counsel to the President on Sustainability
Professor and Director, Graham Institute

For more information please visit www.ocs.umich.edu
Planet Blue Operations Teams:

Planet Blue Operations Teams provide a two-pronged approach to helping make existing buildings greener at the university-recommissioning building systems to improve performance and efficiency, and engaging occupants in greener operations. At the conclusion of fiscal year 2010, Planet Blue Teams had actively engaged 68 university buildings. Energy conservation measures and behavior changes are saving an average of 12% in energy use, representing $3.5 million in energy avoidance costs, and more than 13,000 metric tons (MT) of CO$_2$ emissions annually. As more buildings are engaged in the process, leading up to approximately 120 buildings in total, we are confident the savings will continue to grow.

The five pilot buildings completed in FY 2008—Chemistry, Fleming Administration, Institute for Social Research, Rackham, and Space Research—are now firmly established examples of the potential energy reduction ability of the Planet Blue Operations Teams.

FY2010 Annual Sustainability Summary of the Planet Blue Pilot Buildings:

- Energy cost avoidance: $780,000
- Net energy reduction: 13%
- Steam reduction: 18%
- Electrical reduction: 2%
- Energy reduction is equal to that required to power, heat, and cool 460 average US households.
- Emissions reduction of 2,800 MT CO$_2$ is equivalent to removing 560 automobiles from the road.
Thirty buildings were completed in FY2009 including Haven Hall, the 300,000 square-foot Electrical Engineering and Computer Science Building, and the 97-year old Hill Auditorium.

FY2010 Annual Sustainability Summary of the FY2009 Planet Blue Buildings:

• Energy cost avoidance: $2,400,000
• Net energy reduction: 13%
• Steam reduction: 17%
• Electrical reduction: 6%
• Energy reduction is equal to that required to power, heat, and cool 1,300 average US households.
• Emissions reduction of 9,800 MTCO$_2$ is equivalent to removing 2,000 automobiles from the road.

West Hall open house teams ready to greet students, faculty, and staff from the building and begin forming partnerships.

Sustainability Report Cards are being prepared and distributed for each completed Planet Blue Building twice a year to assist in educating and motivating the occupants.

www.planetblue.umich.edu
Building Standards:

Where Planet Blue Operations Teams work with existing facilities, the Architecture Engineering and Construction (AEC) department works to incorporate sustainability into new construction on campus. The University of Michigan adheres to one of the most rigorous construction standards among higher education institutions in the nation.

- This past year, the university adopted the US Green Building Council’s LEEDv2009 Silver certification as its standard for new non-clinical construction projects exceeding $10 million in construction value.

- The University of Michigan exceeds ASHRAE 90.1-2007 energy efficiency standards by 30%.

University buildings with LEED certification now include the Dana Building, home to the School of Natural Resources and Environment (SNRE), and the Stephen M. Ross School of Business. Mott Children’s and Von Voigtlander Women’s Hospitals Replacement Project, the new Law School academic building, the Institute for Social Research addition, and the Phoenix Memorial Laboratory Renovation are currently on track for LEED certification.

“Aiding this standard demonstrates our deep commitment to sustainable campus operations, complementing our educational and research programs in this area. We must practice what we preach.” Mary Sue Coleman, President University of Michigan

AEC Sustainability Master Plan

The AEC Sustainability Master Plan is the blueprint that communicates the methodology employed to assist architects and engineers with building design and construction sustainability at the university and to incorporate the LEED policy now in place. The Master Plan divides sustainability into various categories, summarizing the tactics and policies that will be employed for each category.

For more information please visit the Master Plan website

www.aec bf.umich.edu/sustainability/index.html
Renewable energy sources help reduce our dependence on fossil fuels. The university is building a portfolio of renewable sources both on campus and through partnership with our energy provider.

**ON CAMPUS**
The university has a 33kW photovoltaic array located on the roof of the Dana Building. The array supplies approximately 42MWh of electricity annually, and provides public awareness and student research opportunities.

In 2008, a solar-powered water heater was installed at the Central Power Plant to pre-heat domestic water. In FY2010 the collector produced 110 million BTUs of energy.

The university operates one of the largest alternative energy vehicle fleets among universities in the United States, with 545 vehicles running on E-85, 96 vehicles using B-20, 14 gas-electric hybrids, and three full electric vehicles. Renewable energy sources comprise 16% of the total transportation energy. The fleet is continuously updated with new alternative energy models as they become available.

**THROUGH PARTNERSHIPS**
A significant advancement concerning renewable energy was the university’s partnership with DTE Energy to purchase the output from two 2.5 MW wind turbines. The 9,000 MWh of electricity provided by the turbines represents 1.8% of the electricity purchased by the university in FY2010. The turbines are part of the Heritage Sustainable Energy wind farm located near Cadillac, Michigan. The project created 100 construction jobs and four full-time jobs on site.
Education Programs:

The university offers nearly 400 sustainability-focused courses and programs across multiple academic disciplines in our 19 schools and colleges, all of which are featured in a searchable database available on the Sustainability website. This extensive course offering meets the increasing demand for sustainability content from our students, evidenced by the explosive growth in educational programs this past year.

• The Program in the Environment through the College of Literature, Science and the Arts offers both major and minor programs for undergraduate students, with a peak enrollment of 511 students the past year.

• The Department of Atmospheric, Oceanic and Space Sciences launched an undergraduate Climate Impact Engineering concentration designed to teach an understanding of the relationship between, and the impact of, changing climate and Earth systems.

• The Graham Institute launched a Sustainability Scholars Program, allowing 25 exceptional undergraduate students from across campus to pursue a 10-credit series of sustainability-focused courses and earn a special transcript notation.

• The master’s programs at the School of Natural Resources and Environment explore a range of sustainability issues—from landscape architecture, to environmental justice, to sustainable systems. Record enrollments of 403 students were reached in 2010.

• The College of Engineering Energy Systems Master’s Program, offering both degree and certificate options, boasted a record enrollment of 170 students.

• Celebrating its 15th year, the dual-degree (MBA/MS) program offered through the Erb Institute for Global Sustainable Enterprise reached a record enrollment of 121 students.
With nearly 400 faculty members focused on sustainability-related research, the university continues to be a leader in finding solutions to complex sustainability issues.

- The World Bank’s “World Development Report 2010: Development and Climate Change” was co-directed by the Dean of SNRE and co-authored by a second university faculty member. The international report explored how policy change can help people cope with risks, how land and water management must adapt to protect a threatened natural environment while feeding an expanding population, and how energy systems will need to transform.

- The White House named the university one of 46 “Energy Frontier Research Centers.” This five-year, $19.5 million research grant from the Department of Energy focuses on collaborative research to generate breakthrough alternative energy technologies. The university center will study the potential for complex nanoscale materials to convert solar energy and heat to electricity.

- Four university professors co-authored the National Academy of Sciences “America’s Climate Choices” report, which examined the serious and sweeping issues associated with global climate change, including the science and technology challenges involved, and provided advice on actions and strategies to respond.

- In partnership with Michigan State University and the Ohio State University, the Graham Institute received a five-year, $4.2 million grant from the National Oceanic and Atmospheric Administration to create the Great Lakes Regional Integrated Sciences and Assessments Center (GLISA). GLISA focuses on the watersheds of Lake Huron and Lake Erie, concentrating on agriculture, watershed management, and natural resources-based recreation and tourism.
The Student Sustainability Initiative (SSI) coordinates efforts across several dozen sustainability-oriented student groups on campus. The SSI’s top priorities were to help the university establish an Office of Campus Sustainability and adopt LEED Silver certification as the green building standard for new construction. Both of these goals were accomplished and President Coleman specifically thanked the SSI for “pushing us to do more.” For their work, SSI won the 2009–10 Student Entrepreneurship Award from Oikos International—a global student organization focused on sustainable economics and management.

A student team from the Ross School of Business launched “Wello,” a social venture that manufactures and distributes 20-gallon drums that move four to five times the amount of water possible using traditional methods. Designed to help people in the developing world, the “WaterWheel” provides water for irrigation, personal hygiene, and household cleanliness, as well as people’s daily consumption needs. In recognition of their work, the Wello team was the university’s 2010 winner of the Dow Sustainability Innovation Challenge prize.

A team of university grad students launched a start-up called “Enertia,” which is developing technology to harness vibrations and generate electricity to power small electronics; replacing batteries. In recognition of their efforts, Enertia was named the 2010 winner of the University/DTE Clean Energy Prize, an annual entrepreneurship competition.

Through the innovative Better Living Using Engineering Lab program (BLUElab), university students traveled to areas in Nicaragua that rely heavily on burning wood for cooking. During the trip, BLUElab students learned about biodigester technologies to reduce fine particulates which threaten human health. After installing a biodigester on site, the students developed a new conceptual design for digesters specifically for rural areas of Nicaragua and comparable communities in the developing world.
Campus Outreach and Engagement:

The Graham Institute and Office of Campus Sustainability have been leading an Integrated Assessment (IA) to help solidify the university as a global leader for sustainable campus operations. This project uses the university campus as a “living laboratory” for making meaningful sustainability improvements. Completed in the summer of 2010, the first phase of the IA focused on seven topic areas: Buildings, Energy, Land & Water, Food, Transportation, Purchasing & Recycling, and Culture. Led by faculty and staffed by students, seven analysis teams conducted literature reviews, benchmarked peers, and evaluated university practices—working with operations personnel to gain institutional perspectives. Phase 2 analyses continue, with an integrated report scheduled for March 2011. It is expected the final report will include three to five stretch goals and an extensive list of ideas to help achieve the goals, defining a 10–20 years roadmap for university operational sustainability efforts.

In May, 179 faculty members from 18 university schools and colleges came together to participate in the 2010 Provost’s Seminar on Teaching. This workshop, “Dialogues on Teaching Sustainability,” explored opportunities to integrate sustainability throughout the university curriculum. Work groups are processing the outcomes from these discussions in an effort to recommend strategies for innovations in sustainability education.

With strong support from President Coleman, the university obtained “Observer Status” with the United Nations Framework Convention on Climate Change (UNFCCC) in the fall of 2009. This effort allowed a 43-member university delegation to travel to Copenhagen to participate in the 15th UNFCCC Climate Change Conference, with university students blogging in real time to share their experiences on this important global event.

To celebrate the 40th Anniversary of Earth Day, the university offered activities throughout the month of March. The signature event was a sustainability “Teach-In”—a collaborative effort of multiple university units that brought together panels of faculty experts with campus stakeholders to discuss critical sustainability issues, such as climate, livable communities, freshwater, and food and health.
Energy Use:

The university is home to more than 80,000 students, faculty, and staff; is comprised of almost 34 million square-feet of building space, and operates 1,077 vehicles. The university experiences a continual increase in the demand for energy across campus in an effort to keep up with the growth in research as well as increasing use of personal technology. We face continuing growth in building space and campus population as we meet the university’s mission of education, research, and health care. As part of this ongoing challenge, the university has established a series of energy conservation initiatives to reduce energy usage and control costs, including the Planet Blue Operations Teams and the adoption of the LEED Silver/ASHRAE +30% building standards.

TOTAL ENERGY DEMAND

Total university energy demand, defined as the sum of building and transportation energy demand, increased 6.1% from 6,500 billion BTUs in FY2009 to 6,900 billion in FY2010, representing a 4.2% increase over the FY2004 baseline. The good news is that despite the 8.3% square footage growth and 1.7% population increase, when normalized for population and building area the total energy use actually decreased 3.7% from 2.6 in FY2009 to 2.5 BTUs/person/ft² in FY2010. This represents an overall 22% decrease from FY2004.

An energy use increase was anticipated with the acquisition of the 174-acre, 2-million-square-foot brownfield redevelopment renamed the North Campus Research Complex (NCRC). Energy use at NCRC was approximately 400 billion BTUs—nearly identical to the university-wide increase for the year. Reuse of the vacant buildings at NCRC represents an uncalculated energy savings over demolition and new construction.

![University of Michigan Total Energy Use](chart)
BUILDING ENERGY DEMAND

Building energy demand is fed by on-campus production from the Central Power Plant and through purchased electricity and natural gas. Operations in the 384 buildings surveyed for this report consumed more than 6,800 billion BTUs of energy during FY2010, a 6.3% increase from FY2009 and a 4.3% increase from FY2004. Normalized for population and building area, building energy measured 2.5 BTUs/person/ft², down 22% from FY2004.

TRANSPORTATION ENERGY USE

The university owns and operates a fleet of 1,077 vehicles to move faculty, students, and staff across the 3,000 plus acres of campus. In FY2010 the fleet consumed 800,000 gallons of fuel; equivalent to 100 billion BTUs of energy, representing a decrease of 7.7% from FY2009. The campus bus fleet transported over 6.5 million passengers this past year. The combined ridership on the campus bus fleet and through M-Ride—the University-Ann Arbor Transportation Authority (AATA) partnership program—has increased annually and this past year approached 9 million riders.
The University of Michigan is committed to reducing its greenhouse gas (GHGs) emissions through energy conservation, the use of renewable energy where available, providing alternative transportation means, and other actions.

Total GHG emissions for the university, represented by those generated on site as well as indirect through purchased energy increased 14% from 590,000 metric tons in FY2009 to 670,000 metric tons in FY2010; a 20% increase from the FY04 baseline.

When normalized for population growth, FY2010 emissions increased 12% from FY2009 and 7.9% from FY2004. When normalized to building square footage, the increase in FY2010 from FY2009 was 4.8%; a 0.6% decrease from FY2004.

Our GHG contribution is split between on-campus and purchased sources. The generation of GHGs on campus, through powering university buildings and vehicles, increased by 11,000 MTCO$_2$e in FY2010. This represents a 3.9% increase from FY2009, but is still 4.9% below FY2004 levels. The university’s indirect GHG emissions due to purchased energy increased 22% between FY2009 and FY2010, representing a 46% increase from the FY2004 baseline.
As the university campus continues to grow in both size and scope, the ability to increase on-campus energy production at the energy efficient co-generation plant cannot keep up with demand. Therefore, additional energy is purchased from the grid, increasing overall GHG contribution.

Ride sharing reduces the number of cars on campus.
The university water needs are supplied by the City of Ann Arbor, with approximately 80% provided by the Huron River. The 3 million gallons of water diverted daily from the Huron River for use by the university represents approximately 1% of the total river volume. Through water conservation and a comprehensive storm water management program, the university is actively reducing its impact on the Huron River Watershed.

Water use decreased 3.0% from 1.24 billion gallons in FY2009 to 1.21 billion gallons in FY2010. This represents the lowest total water use recorded in the last seven years—1.9% below FY2004 levels.

When normalized to growth in population, water use reductions become even more pronounced. FY2010 water use was 41 gallons/person/day, down 4.7% from FY2009 and down 11% from FY2004.
The university uses comprehensive planning to select and put into practice strategies to meet existing needs while safeguarding resources for the future. Requirements for research, teaching, and living space are balanced with open space preservation, convenient transportation options, and enhancement of community pride. Total facility space at the university has increased more than **5.7 million square feet** (20%) from FY2004 to FY2010. Campus population has increased **11%** during this same period.

In FY2010 the university purchased the 174-acre brownfield development renamed the North Campus Research Complex (NCRC). NCRC consists of 28 buildings (nearly 2 million square feet), 80 acres of green space, and more than 2,500 parking spaces. NCRC is ideal for the university’s growing research activities in health care, biomedical sciences, and other disciplines. Using the existing buildings results in a lower impact on the environment than new construction. NCRC is adjacent to the existing North Campus, allowing seamless integration to bus routes and commuter parking options, which ensures new employees easy integration into the campus community. The additional new space resulted in a decrease in building efficiency which will be reversed as more faculty and staff occupy NCRC.

### University of Michigan Land Use

<table>
<thead>
<tr>
<th>Acres</th>
<th>Natural Green Space</th>
<th>Maintained Green Space</th>
<th>Impervious to Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,900</td>
<td>730</td>
<td>580</td>
</tr>
</tbody>
</table>

Source: U-M Grounds Services

### University of Michigan Building Efficiency as measured in Building Area vs. Campus Population

<table>
<thead>
<tr>
<th>Year</th>
<th>Campus Population</th>
<th>Building Area (ft²)</th>
<th>Building Efficiency (ft² per person)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>72,700</td>
<td>28,300,000</td>
<td>389</td>
</tr>
<tr>
<td>2005</td>
<td>73,800</td>
<td>28,500,000</td>
<td>386</td>
</tr>
<tr>
<td>2006</td>
<td>75,100</td>
<td>28,600,000</td>
<td>381</td>
</tr>
<tr>
<td>2007</td>
<td>76,200</td>
<td>30,700,000</td>
<td>403</td>
</tr>
<tr>
<td>2008</td>
<td>78,100</td>
<td>31,200,000</td>
<td>399</td>
</tr>
<tr>
<td>2009</td>
<td>79,200</td>
<td>31,400,000</td>
<td>397</td>
</tr>
<tr>
<td>2010</td>
<td>80,500</td>
<td>34,000,000</td>
<td>422</td>
</tr>
</tbody>
</table>

Source: Utilities and Plant Engineering
Whether disposing of short-lived products such as packaging or food waste, reuse of unwanted supplies and equipment, or the demolition and removal of a 100-year-old building, solid waste management is a major factor in the university's commitment to sustainability.

The university generated 16,000 tons of solid waste in FY2010. This waste is equivalent to 410 pounds per person, or 1.1 pounds/person/day. This is an improvement over the FY2009 rate of 430 pounds per person, but still an increase of 7.4% compared to the 380 pounds/person generated in FY2004.

### REDUCE:

The most efficient method to limit waste production is to eliminate the delivery of superfluous material. The university's Green Purchasing initiative promotes practices that reduce paper and packaging waste, such as online ordering, $50 minimum ordering, and a four day/week delivery schedule. Paper purchases for the university decreased from 610,000 reams in FY2009 to 590,000 in FY2010.
REUSE:
The university has many reuse programs for office, laboratory, and computing equipment through the Property Disposition Office. Nearly $2 million worth of equipment was resold last year. Waste Management Services collects gently used office supplies and makes them available to faculty and staff free of charge. The Student Move Out program diverted 9.9 tons from the landfill to local charities in FY2010. The Office of Occupational Safety and Environmental Health’s Chemical Redistribution Program provides a forum where campus units may obtain donated chemicals.

RECYCLE:
The university achieved a 33% recycling rate this past year. The annual Recycling Champions Building Competition awarded the Alumni Center for the highest recycling rate, 56%, Palmer Commons for most improved recycling rate, 200%, and the Chemistry Building for greatest waste reduction, 56%. The recycling program at Michigan Stadium diverted 29 tons of waste in the 2009 season and is the largest of any football stadium in the country. The Office of Campus Sustainability teams with Apple Computer each spring to offer an electronic waste recycling event to the general public.

SINGLE STREAM RECYCLING:
The university switched to a single stream recycling system where paper and container recyclables no longer need to be separated and the type of recyclables accepted was expanded. Dumpsters were relabeled throughout campus to reflect the program changes, and the single stream system is expected to yield increases in both participation and overall recycling rates.