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2010

THE BIG TEN SUSTAINABILITY REPORT

Best Practices, Trends & Challenges

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Executive Summary

The Big Ten Conference is at the national forefront of academics, research, and athletics, but our efforts in sustainability have yet to gain the same reputation. There is already quite a bit of competition among these schools, and while it is easy to compare one school to the next within these categories, there is no resource to examine the specific sustainability efforts at each school. Our goal in creating a Big Ten Sustainability Report is to inform the eleven schools of each other's progress and provide each university with a friendly incentive to become more sustainable. We have compiled our extensive research and analysis of the initiatives, programs, and statistics of each school into one report, with the hope that we can encourage the Big Ten schools to continue to improve their efforts in sustainability. Our research fell into six categories for each school: administration, buildings, energy, transportation, recycling, and food.

Administration

Campus leadership is integral to the development and expansion of sustainability at the Big Ten schools. We found that all of the schools besides Northwestern University and the University of Wisconsin have offices of campus sustainability. We examined which schools offered sustainable residence halls (about half), incorporated sustainability in their orientations (about two-thirds), and offered sustainability oriented campus-wide competitions (about half). Overall, the Big Ten schools are doing very well in administration and need to focus more on integrating sustainability into their curriculum.

LEED Buildings

In order to gauge the sustainability efforts put into buildings across the Big Ten Conference, we compared each school's current Leadership in Energy and Environmental Design (LEED) policies and practices. Every school in the Big Ten, except for the University of Michigan, had a LEED requirement for new projects exceeding a set budget unique to the school. The University of Wisconsin and University of Minnesota have set themselves apart as leaders in this category. Both schools follow a LEED Silver standard for all new projects: The University of Wisconsin in the process of putting four new Gold and one Silver certified buildings on campus, and the University of Minnesota recently opened the first LEED certified football stadium. These standards are both a symbol of these institutions' commitment to sustainability as well as a service to those who will use the buildings.

Energy

Of the Big Ten schools, seven have adopted some form of energy goal, three are members of the American College and University Presidents Climate Commitment, three are members of the Chicago Climate Exchange, whereas four universities have no formal goal. The most ambitious goal is at the University of Wisconsin to reduce energy use 20% per gross square foot by 2012. Penn State has the lowest energy consumption when weighted for building space, partly due to their three rigorous energy conservation programs aimed toward improving building energy efficiency. Iowa had the lowest amount of greenhouse gas emissions and has invested in an oat hull biomass fuel

generation program, providing them with 3% of their total energy consumption and preventing the release of a significant amount of greenhouse gases. Northwestern and Penn State emerged as leaders in terms of renewable energy, both purchasing 20% of their total electric energy use from renewable sources.

Transportation

Our team analyzed two aspects of sustainable transportation initiatives on Big Ten campuses: (1) environmentally friendly vehicles in motor fleets and (2) transportation methods for students and employees. The University of Wisconsin had the highest proportion of environmentally friendly vehicles, at over 60%, followed by the University of Michigan and Iowa with over 50%. The largest proportion of university individuals using modes of sustainable transportation was at the University of Wisconsin (nearly 80%), and Northwestern University (roughly 75%). Sustainable transportation initiatives while important, must be coupled with urban planning techniques to minimize the use of vehicles.

Recycling

Besides having regular recycling programs, we found that there were a few that stood out among the Big Ten schools, such as a program to reuse construction materials at Penn State University and projects to reuse furniture at the University of Iowa. Michigan State University and Indiana University have programs to give students reusable water bottles, thus reducing overall plastic waste. While recycling efforts were well established in most schools, there is still much room for improvement.

Food & Food Waste

There are many different ways in which universities can make their food systems more sustainable. Within the Big Ten Conference, six of the eleven schools have a tray-less dining system installed in at least one dining hall. Only five of the eleven schools have a food composting system, three of which include post-consumer food waste. There is a wide range in the percentage of the schools' annual food budgets spent on local foods, ranging from <1% to about 30%. Overall, much less was spent on organic food purchases than local food purchases. The University of Minnesota and the University of Illinois stood out as leaders across the board within the food and food waste category.

Conclusion

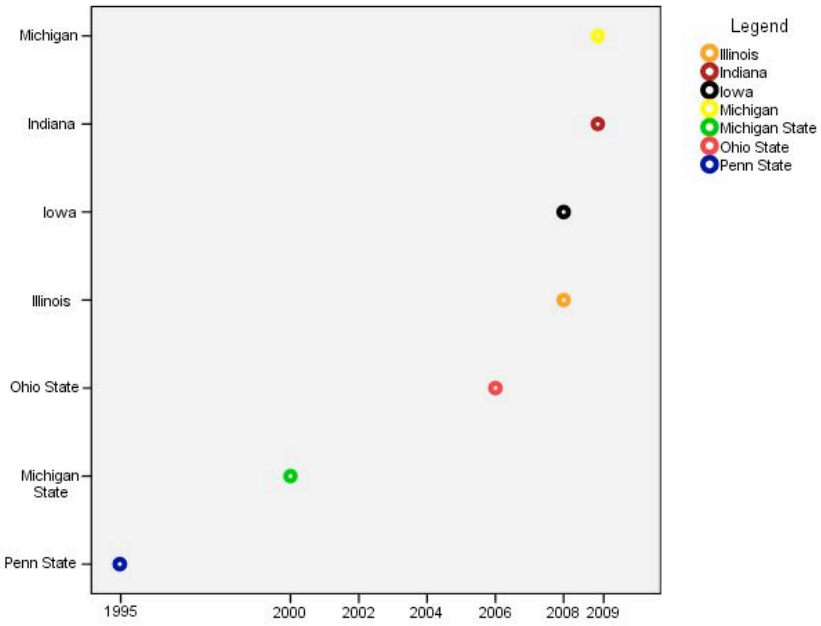
The Big Ten Sustainability Report can be used as a resource in the exchange of statistics and data regarding administration, energy, buildings, transportation, and food. This report serves to enhance collaboration between programs and ideas to promote friendly competition and to accelerate sustainability initiatives in the Big Ten Conference. Each category had a different combination of leaders, allowing for collaboration and the establishment of best practices within the Big Ten. This report enables schools to track their progress relative to other Big Ten schools and learn from their improvements and best practices. Specifically, the University of Michigan could implement a LEED Building Standards, increase local food purchases, and create a bike share program. The Big Ten Conference has the potential to be a leader in sustainability across the nation and judging by the findings in this report, they are on their way to achieving this goal.

Administration

Sustainability has become such an important issue in our world today that achieving a fundamental understanding of the problems we face is essential for every member of our generation. It is the charge of higher education to develop a consciousness about sustainability systems. Changing the systematic structures of institutions of higher education is the most effective way to develop higher consciousness about sustainability amongst young people.

Policies, Institutions and Staff

In institutions of higher educations, the leaders of the university are incredibly influential in moving sustainability initiatives forward. All of the Big Ten schools other than Northwestern, Minnesota, Purdue and Minnesota have established offices of campus sustainability. Furthermore, all of the Big Ten schools have advisory councils that report to either the university president or other high level administrators such as provosts and vice presidents. All schools other than Michigan State and Purdue have sustainability policies. The Big Ten schools average nine full time staff employed to address issues of sustainability, ranging from sixteen at MSU and two at Iowa.



Timeline 1: **Offices of sustainability by year of establishment**[1]

Certificates, Awards and Special Programs

Many schools have innovative sustainability initiatives in the area of education. Iowa, for example offers a Certificate of Sustainability.[2] Indiana offers several sustainability programs including an area certificate in sustainability as well as special designation for sustainability-related courses. At Indiana, there are also two sustainability teaching awards —the Sustainability Course Development Fellowship and the Sustainability and Environmental Literacy Leadership Award.[3] The Office of Campus Sustainability at Michigan offers a Sustainability Scholars Program for undergraduates.[4]

Campus Life and Student Programs

Student programs play a large role changing student behavior and making campus life more sustainable. All schools other than Iowa include sustainability in their freshman orientations. Residence halls are also play an integral role in shaping the sustainable lifestyles of students. Indiana, Michigan State, Northwestern, Iowa and Penn State all offer their students the opportunity to live in sustainability focused on-campus housing. Sustainability competitions offer a fun opportunity for students live sustainably by working together to reduce waste, energy use etc. Illinois and Michigan both offer two sustainability competitions, and Indiana, Northwestern, Penn State, Purdue and Wisconsin each offer one sustainability competition.

Administration Overview

When trying to infuse sustainability in institutes of higher education, we must consider the many different factors and stakeholders that drive institutional change. Student interest and demand alone cannot drive the systematic changes we need to make. We must engage faculty, administration and external stakeholders in order to achieve the paradigm shift that needs to take place in education.

LEED Buildings

Evaluating green buildings on campus is an important factor when analyzing a school's sustainable practices. According to the EPA, buildings account for 68% of total electricity consumption, 12% of total water consumption, 38% of carbon emissions, and 39% of total energy consumption[5]. Building 'green' is the practice of creating a building environmentally friendly whether it is through design, construction, or operation. In order to quantify what counts as green and what doesn't, the *U.S. Green Building Council* created the *Leadership in Energy and Environmental Design* or LEED rating system. The system rates buildings on a number of factors including water efficiency, energy efficiency, materials, resources, indoor air quality, innovation, and more. The more points a building receives in any of these areas the higher certification it achieves. The certification levels are Platinum, Gold, Silver and Certified. Many schools already have already adopted policies for new buildings and renovations to be at least LEED Silver certified when completed[6]. The schools in the Big Ten will be assessed on the amount of LEED certified buildings exist on campus and the standard they use when building or renovating.

Table 1. **LEED Standards at Big Ten Schools**

University	Enrollment (Undergraduate as of Fall 2009)	Affiliation	Current LEED Standard
Illinois	31,209[7]	Public	Yes, Silver
Indiana	32,490[8]	Public	Yes, Silver
Iowa	20,574[9]	Public	Yes, Silver
Michigan	26,208[10]	Public	No
Michigan State	Estimated 36,400[11]	Public	Yes, Certified
Minnesota	29,978[12]	Public	Yes, Silver
Northwestern	8,397[13]	Private	Yes, Certified
Ohio State	41,348[14]	Public	Yes, Silver
Penn State	38,630[15]	Public	Yes, Certified
Purdue	31,145[16]	Public	Yes, Silver
Wisconsin	28,690[17]	Public	Yes, Silver

The University of Illinois has a *Campus Master Plan* for all building designs and construction on campus states that all new building, renovations, or major projects will meet a LEED silver rating regardless of whether the university decides to pursue certification. The campus has around 130 buildings on campus, two of which actually have LEED certifications: The Business Instructional Facility (BIF) and the 2009 solar decathlon house. The BIF building is one of only 15 platinum certified buildings in Illinois and the first business facility platinum certified at any public university in the world[18]. The 2009 solar decathlon house is a solar run building entered by the University of Illinois into the Solar Decathlon competition which is sponsored by the *U.S Department of Energy's* (DOE's) *Office of Energy Efficiency and Renewable Energy* in partnership with its *National Renewable Energy Laboratory* (NREL). In 2009, the building was put up against 20 other buildings made by other schools and ranked on architecture, market viability, engineering, lighting design, communications, comfort zone, hot water, appliances, home entertainment, and net metering[19]. In addition to these projects, the Ikenberry Commons is under construction and expects to receive a Silver certification. Ikenberry is just the first of a major plan to replace all residence halls on campus[20].

Much of the University of Indiana's focus has been on sustainable buildings on campus. Progress has been made for their built environments by attempting to LEED certify at least 11 of their buildings that are in different stages of progress. The school has also been working to include LEED experts as a part of the University of Indiana staff. There hasn't been a new policy implemented by the university to put a minimum certification on each new building; however a mandate was put forth by the governor of Indiana to call for an equivalent of at least silver certifications for new state projects, including all new IU buildings[21].

The University of Iowa holds a buildings policy that any major project or renovation must meet at least a LEED silver certification[22], that is, any building or addition that is more than 20,000 square feet or any renovation that will cost more than 50% of the facility's replacement value. There are currently seven projects underway to receive a LEED certification. The school also made it their goal to double the amount of LEED accredited staff on campus and actually was able to hire more than triple than what they had the year before making the goal[23].

The University of Michigan recognizes the benefits of becoming sustainable and the concepts that LEED rates. All of their new projects have been attempting LEED certification. However, the university does not have a policy for new projects having a mandatory certification. All projects over $5,000,000 are subject to a review of a LEED accredited person[24]. The State of Michigan instead follows *the American Society of Heating, Refrigerating and Air-Conditioning Engineers* (ASHRAE) Standard 90.1 1999, which is more focused on energy conservation[25]. The university made a goal to exceed all ASHRAE standards by 30% more energy conservation[26]. Still, this is no substitute for a LEED standard. Current LEED certified buildings on campus are the Dana building (Gold) and the Stephen M. Ross School of Business (Silver). The Mott Hospital and

Women's Hospital, and a new building at the Law School are two projects still underway seeking to receive Silver certifications[27].

Michigan State University has implemented the minimum LEED certification for every new project. The campus recently received their first LEED certification for their chemistry building addition. The $18 million addition received a silver rating for their 15,000 square foot addition[28]. Since then, six projects (on and off campus) have been under review for receiving LEED certifications: Secchia Center, MSU Surplus Store and Recycling Center, Kellogg Biological Station dairy barn, Brody Hall, Life Science, and Eli and Edythe Broad Art Museum[29].

The University of Minnesota opened up the first LEED certified football stadium in the country. The TCF Bank stadium received a silver certification when opening[30]. The only policy the school follows when constructing a new project or renovation is the standard set by the State of Minnesota. The state set a standard for all public buildings to be at least the equivalent of a silver LEED certification[31]. This would mean the University of Minnesota would have to comply with this standard. To date, no other LEED certified buildings exist on campus.

Northwestern University has implemented a LEED policy for all new buildings stating that they are at least LEED certifiable but their goal is to meet silver ranking and above[32]. Two LEED buildings already exist on campus. The Wieboldt School of Continuing Studies received a gold LEED certification in 2007 and the Ford Motor Company Engineering Design Center received silver LEED certification in 2006. In addition, the Silverman Hall, Harris Hall and Searle Student Health buildings are projects in progress and awaiting LEED certification.

Ohio State University has one of the strongest sustainable building policies in the Big Ten. Ohio State University compiled the Interim Green Build and Energy Policy in order to comply with the Ohio House Bill 251 which states all on- and off- campus buildings must reduce energy consumptions at least 20% by 2014. In order to meet this goal, the school made a list of goals and rules for all new projects:

1. Every classroom and administrative building construction project will achieve energy efficiency that is 25% above ASHRAE 90.1 2004 standards.

2. Every dorm construction project will achieve energy efficiency that is 30% above ASHRAE 90.1 2004 standards.

3. Every athletics and recreation construction project will achieve energy efficiency that is 20% above ASHRAE 90.1 2004 standards.

4. Every lab construction project will achieve energy efficiency that is 20% above ASHRAE 90.1 2004 standards.

5. Every hospital and medical construction project will achieve energy efficiency that is 20% above ASHRAE 90.1 2004 standards.

6. All other building types will achieve energy efficiency that is a minimum of 20% above ASHRAE 90.1 2004 standards.[33]

For all other applicable building improvements, renovation, or alteration projects, such projects must exceed ASHRAE 90.1 2004 by 15%. In addition, the school also made a policy that all new projects that have a budget of $4 million or more must meet silver LEED certifications[34]. So far, the buckeyes have only one LEED certified building: the Ohio 4-H Center[35].

Pennsylvania State University has a policy to have any new projects with a budget of $2 million or more has to be LEED certified. They implement a custom LEED policy to their buildings as well. The policy breaks up each section in the LEED point system and gives the point a rank, either Mandatory, Minimal effort or No effort, for each building. The rank descriptions are as follows:

> "Mandatory- Compliance will be required.
> Significant effort- The design professional must show clear evidence that a serious attempt to achieve this credit has been made. If compliance is not achieved, reason for this failure must be shown by the design professional and accepted by the University. Assessment of credits classified in this group will require careful consideration of factors such as first cost vs. life-cycle cost, maintenance, operational issues, and aesthetic issues.
> Minimal effort-The design professional will investigate the possibility of accomplishing this credit. If circumstances are such that broad University policies or the project's programmatic requirements make a credit achievable, the design professional will provide the necessary documentation; however, no additional effort or resources will be dedicated towards it.
> No effort- We will not pursue this credit and documentation will not be required."[36]

In addition to this policy, the campus has five LEED certified buildings. One Gold certified building (School of Arts and Landscape Architecture), two Silver certified buildings (Forest Resources and Student Health Services (pending)), and two Certified (Medlar Field at Lubrano Park and Lewis Katz Building (pending)).

Purdue University does not have any LEED certified buildings on campus but the state of Indiana has passed a requirement that all new public projects with a budget of $1 million or more, including university buildings, must be equivalent to a Silver LEED certification or more[37]. They are currently working on the Roger B. Gatewood Wing addition to the Mechanical Engineering Building, which would be the first LEED project to be achieved at Purdue and is seeking a Gold certification[38].

Like many schools in the Big Ten, the University of Wisconsin-Madison has committed to a minimum Silver LEED certification for all new project or renovations[39]. They are quickly becoming a leader by having some of the strongest LEED practices in the Big Ten. Wisconsin is underway with five new projects set to open between summer 2010 and summer 2012: The UWSMPH Faculty Office Building (Silver), Wisconsin Institute for Discovery (Gold), School of Education (Gold), the new South Campus Union (Gold) and the School of Human Ecology (Gold)[40].

Energy & Climate

Institutions of higher education collectively spend over $14 billion annually on energy [41]. The emissions produced from generating such a massive amount of energy easily make energy use one of the top components of any university's ecological footprint. Luckily, with improving technology and increasing environmental awareness, there is much potential for improvements in energy use and efficiency. Many educational institutions have already taken steps toward making improvements, though some have taken a clear lead in tackling energy issues.

To compare the Big Ten schools' efforts regarding energy and climate, our team decided to look into five categories: energy consumption, greenhouse gas emissions, formal commitments to energy related issues, renewable energy initiatives, and campus awareness programs. These categories allow for analysis of the energy use and emissions profile of a university, the success of current initiatives, what the university is aiming to achieve in upcoming years, and future plans to further reduce energy use and GHG emissions. The comparisons will highlight universities that have made large strides with regards to energy programs and will enable other schools to learn from their practices, encouraging benchmarking and further improvements.

Formal Commitments to Energy and GHG Reduction

Formally adopting reduction goals should not be the only factor used to analyze how sustainable a university is, but a formal commitment serves as an indicator of a campus's dedication to the issue and its intent to achieve reductions. By setting a goal and a date for its completion, universities create a tangible target that will encourage improved practices and aggressive actions toward efficiency. Additionally, signing a formal commitment signals the importance of sustainability and energy to the community as well as other institutions. This allows universities to use their prominent role to encourage sustainable practices within businesses, surrounding communities, and individual lifestyles.

Several Big Ten members have set ambitious reduction goals. Five universities are aiming to reduce energy use or greenhouse gas emissions 15% or more by 2012-2015. Three universities are part of the American College and University Presidents' Climate Commitment (ACUPCC), which requires a plan for climate neutrality as well as taking additional actions to reduce greenhouse gases. And three colleges are members of the Chicago Climate Exchange (CCX), which requires the institutions to reduce greenhouse gas emissions 6% by 2010, with a baseline of 1998-2001 average levels.

Table 2. **Formal Goals adopted by Big Ten Schools**

College	Formal Energy and GHG Goals (Baseline year in parenthesis)	Progress
Illinois	1. Cut fuel consumption and emissions 10% by 2010 20% by 2014 (FY 2007) [42] 2. ACUPCC (CAP due May 2010)[43]	Reached goal of 10% by 2010[44]
Indiana	None	
Iowa	1. Reduce energy consumption 10% by 2010 2. Increase renewable energy consumption to 15% of total use by 2010[45] (2003) 3. CCX[46]	Renewable energy consumption is currently 10.95%[47]. Reduced emission 46,800 tons more than required for CCX[5]
Michigan	None	5.2% reduction in GHG emissions p.c. from 08-09[48]
Michigan State	1. Reduce GHG emissions 15% by 2015 2. Reduce energy consumption 15% by 2015 (2006)[49] 3. CCX	4% reduction in energy consumption per capita compared to FY 2009
Minnesota	1. Reduce energy use 5% by 2010 (2008) 2. ACUPCC (CAP due May 2010) [50] 3. CCX [51]	2.5% reduction in energy use[44]
Northwestern	None	
Ohio State	1. Reduce energy use 20% by 2014 (2004) [52] 2. ACUPCC (CAP due September 2010) [43]	
Penn State	1. Reduce GHG emissions 17.5% by 2012 (2006)[53]	8% reduction in GHG emissions by 2008[44]
Purdue	None	
Wisconsin	1. Reduce energy use per GSF 20% by 2012[54]	

Energy Consumption

Energy consumption was difficult to compare between schools, as each school records their data differently and does not always consider the same inputs in their measurements. For example, data for Wisconsin and Purdue, which was taken from *Greenreportcard.org,* generally took into consideration consumption from on site combustion, but did not account for purchased electricity. Additionally, total energy use

is not the most accurate measure for comparative purposes, as the universities differ in size and activity. Naturally, larger schools like Michigan and Michigan State had higher overall energy consumption, both exceeding over 6,000,000 mmbtu total. Purdue, on the other hand, has a much smaller campus and has energy consumption of less than half of Michigan and Michigan State.

To address this discrepancy, our team normalized for student population as well as total building area (Figure 2). When weighting energy consumption by building space, we found that Michigan State had the highest level of energy use while Penn State had the lowest level. Weighting energy consumption for student population put Purdue at the top with the lowest level, with Penn State a close second and Michigan with the highest level of energy use per student.

Pennsylvania State University stands out as one of the leaders in energy conservation, with low energy consumption rates in both the total and weighted figures. This can be attributed to several factors including campus outreach programs, energy challenges, and PSU's three rigorous energy conservation programs: the Energy Savings Program, Energy Conservation Measures, and the Continuous Commissioning program, which are all aimed toward reducing energy use through retrofitting and recommissioning campus buildings. PSU's $40 million investment into these programs has seen a $4.5 million annual payback through energy savings and a 7.5% reduction in electricity consumption since 2005, despite building space increasing over 1 million square feet[55].

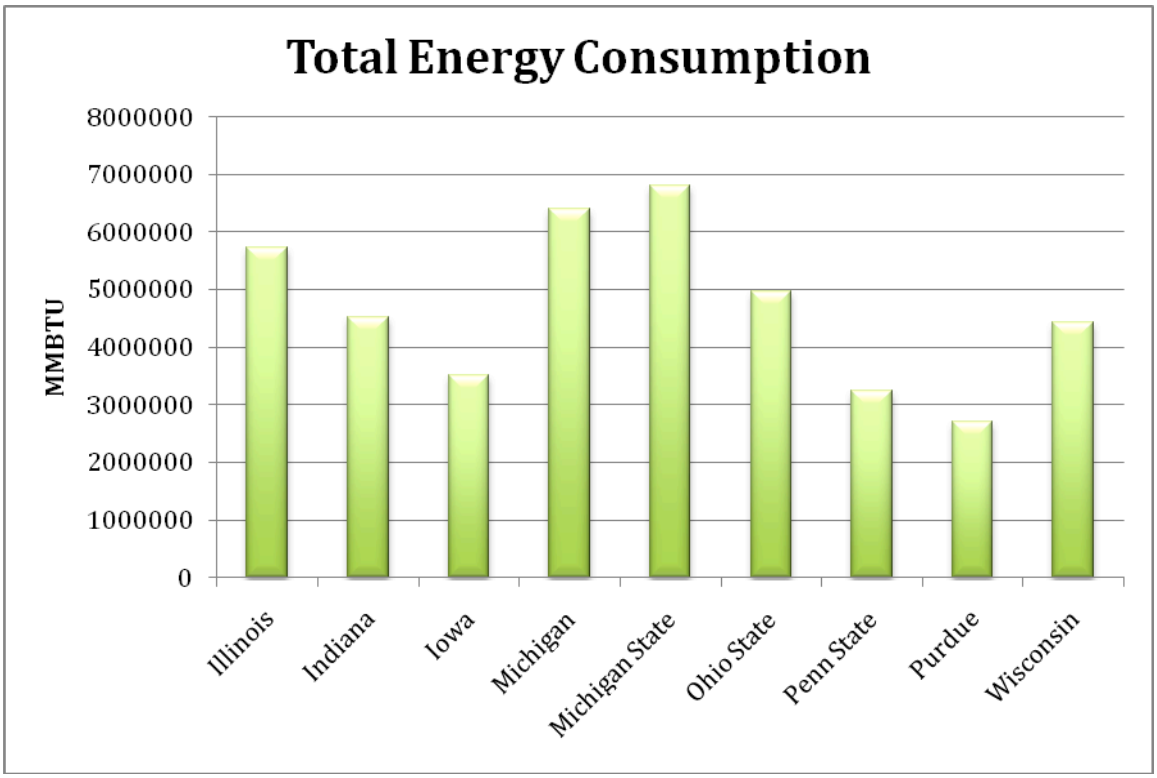


Figure 1. **Total Energy Consumption (mmBTU) in Big Ten Schools**

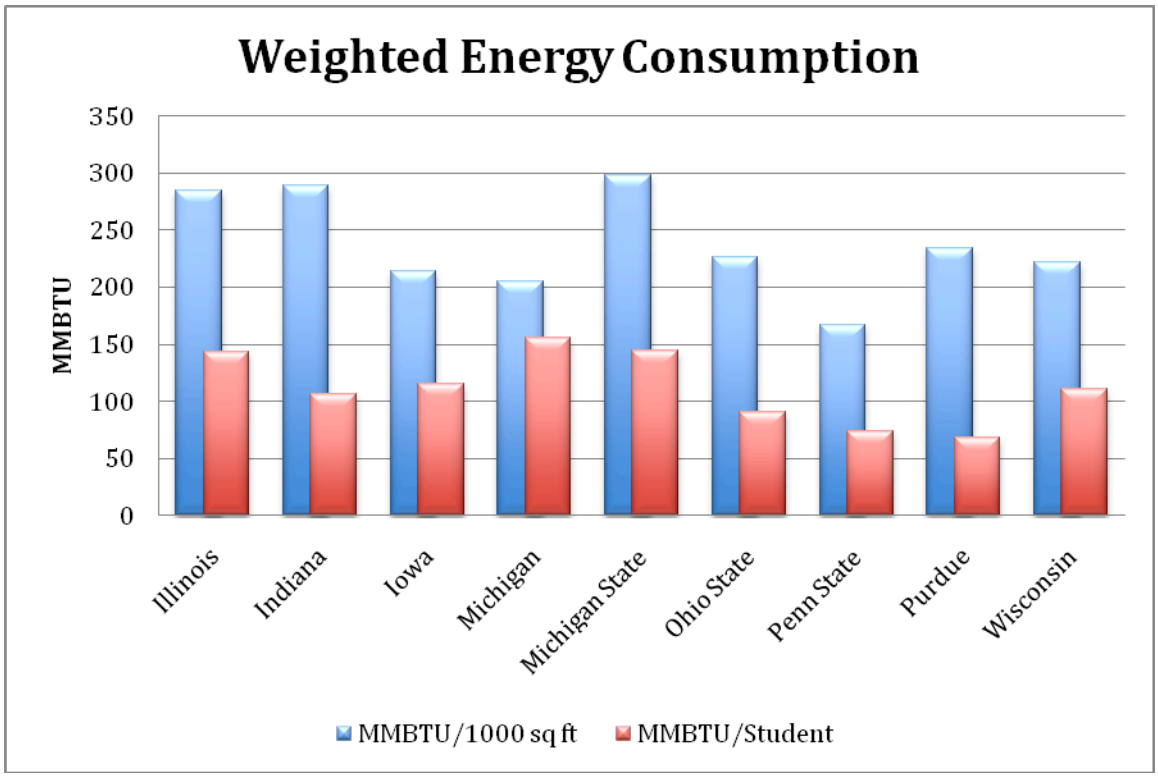


Figure 2. **Weighted Energy Consumption (mmBTU) in Big Ten Schools**

Greenhouse Gas Emissions

Again, our team decided to weight greenhouse gas emissions by total building space and per student in order to better compare the universities. The University of Iowa takes a clear lead in low amounts of greenhouse gas emissions, in total and weighted comparisons. Success may be contributed partly to their investment in oat hulls a source of biomass fuel for on-site energy generation, which has earned Iowa the Governor's Iowa Environmental Excellence Award and the Effective and Innovative Practices Award. The use of oat hulls, which are a byproduct of the cereal making process, not only saves a considerable amount of money, but also reduces the amount of GHG emissions significantly compared to coal generation since the process of burning biomass results in no new CO2 emissions. Within the 5-year period from 2003 to 2007, the use of oat hulls enabled the University to avoid 103,185 tons of coal burned, which is approximately equal to the amount of coal consumed by the University in a year. The biomass project has also reduced CO2 emissions by 254,000 tons within the same 5-year period, equivalent to taking 1,200 passenger cars off the road each year[46]. As of 2007, Iowa's renewable energy use represented almost 11% of total energy consumption[47].

Interestingly, though the University of Michigan had the highest amount of energy per student, the university also had the 2nd lowest level of energy use per 1000 square feet, suggesting that Michigan has a large amount of building space per student. This may be due to the inclusion of the University Hospitals in the building space report.

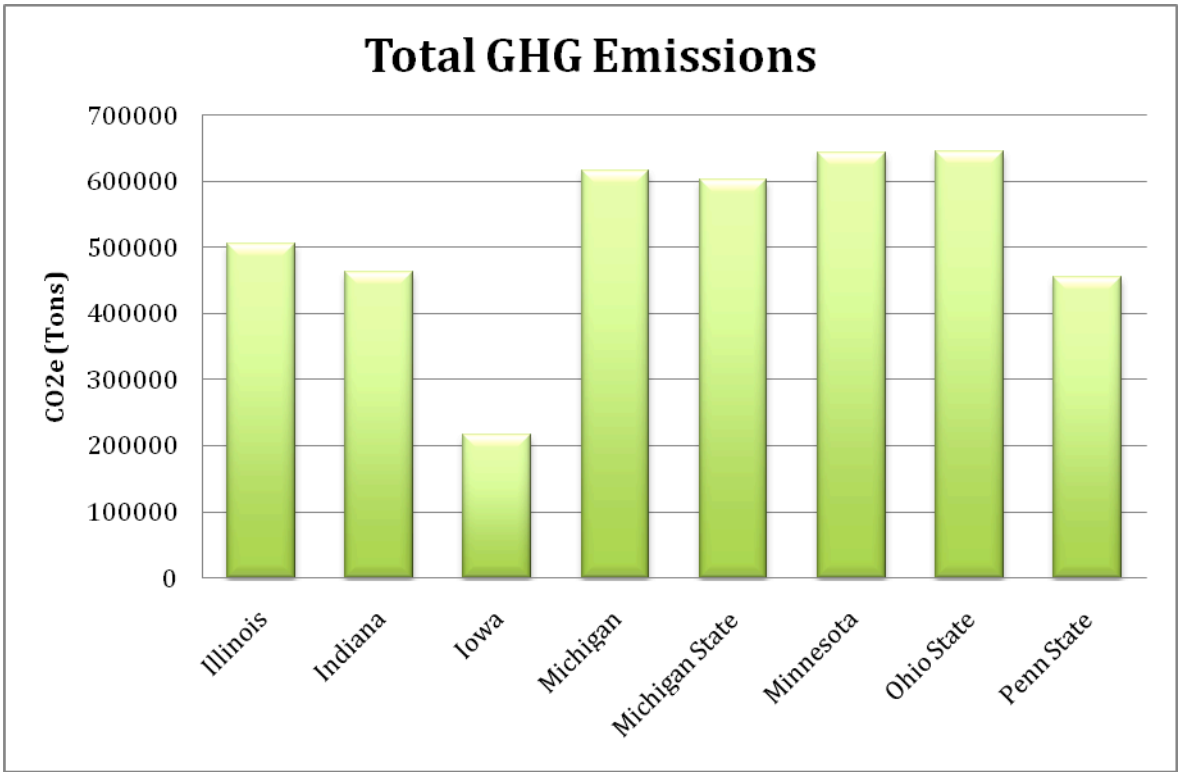


Figure 3. **Total Greenhouse Gas Emissions (Tons) in Big Ten Schools. FY 2008**

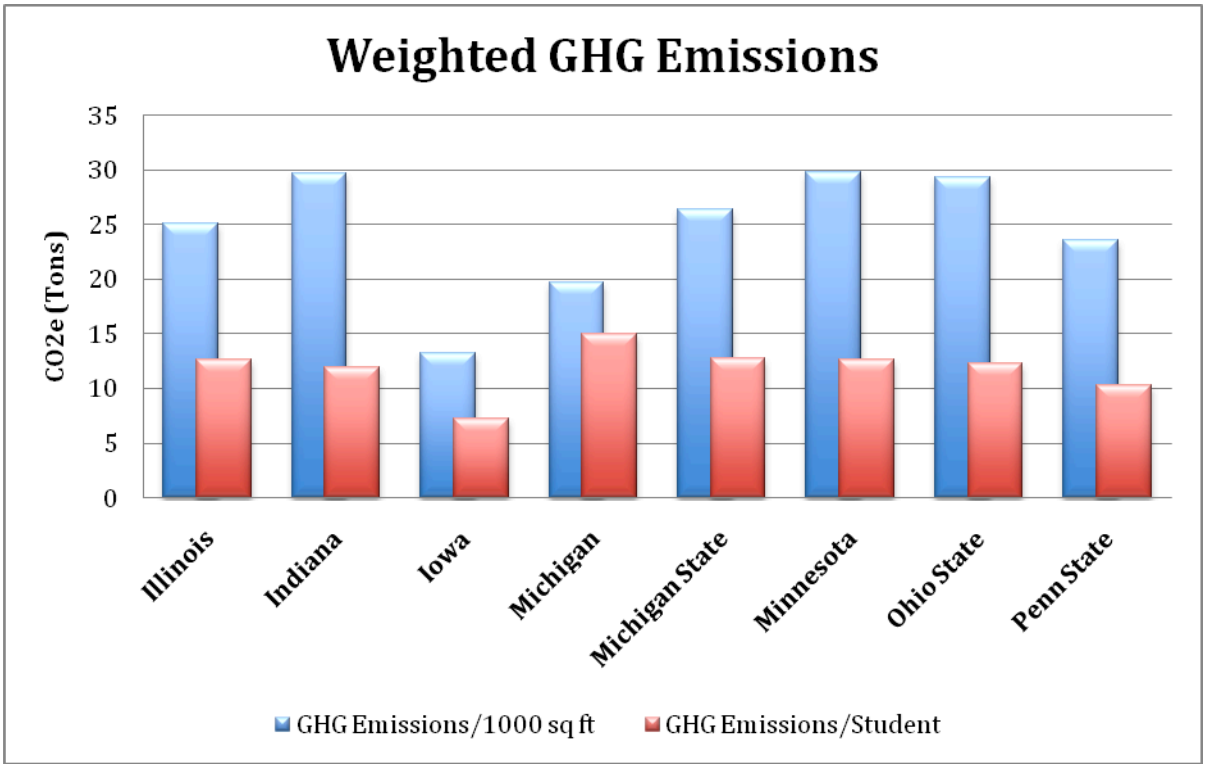


Figure 4. **Weighted Greenhouse Gas Emissions (Tons) in Big Ten Schools. FY 2008**

Renewable Energy Initiatives

Supporting renewable energy is an important step for universities and colleges to take to contribute to the local economy as well as to encourage sustainability and alternative energy options. Given the current state, the finite amount of resources on Earth will not be able to support future demand for energy needs. Investing in renewable energy provides a source of energy that is lower impact and more sustainable than traditional energy sources. Wind power, solar power, and biofuels, among others, provide clean power options that will allow low impact growth and development. Additionally, investing in renewable energy funnels money into the domestic economy, boosting employment and economic growth.

Northwestern, Ohio State, and Penn State rank in the top 20 schools within the EPA's Green Power Partnership for total green power usage. Both Penn State and Northwestern purchase 20% of their total electricity use from renewable sources. For their successful oat hull project, Iowa is ranked 15th compared to all entities for on-site generation of renewable energy.

Table 3. **Renewable Energy Initiatives at Big Ten Schools**

College	Renewable Energy Purchase (P) & Generation (G)/year	% of Total Electric Energy Use	EPA Green Power Partnership Rank[56] [57]
Illinois	321, 451 kWh (P)	0.07%[44]	
Indiana	460,800 kWh (P)	0.17%[44]	
Iowa	9,000,000 kWh (G)	3%[56]	15th in Top 20 On-site Generation
Michigan	600,000 kWh (P)	<1% [44]	
Michigan State	N/A	<1% [44]	
Minnesota	25,000 tons (G)	4%[44]	
Northwestern	40,000,000 kWh (P)	20%[57]	9th in Top 20 College & University Green Power Usage
Ohio State	18,000,000 kWh (P)	3%[57]	17th in Top 20 College & University Green Power Usage
Penn State	83,600,000 kWh (P)	20%[57] 6%[44] (Co-Gen)	3rd in Top 20 College & University Green Power Usage
Purdue	N/A	<1%[44]	
Wisconsin	40,000,000 kWh (P)	10%[54]	

Raising Awareness

Sustainability cannot be achieved through changes in infrastructure and operations alone. Personal behaviors and values must be changed as well, so as to target the root of energy usage. Colleges and universities have a unique opportunity to address personal behaviors and beliefs, as the community created plays a large role in how students mature and view society. By implementing programs that encourage conservation behavior, institutions of higher education are fostering individuals that are more environmentally aware and more conscious of their actions and impacts.

Table 4. **Awareness Programs at Big Ten Schools**

College	Energy Awareness Programs	Details
Illinois	Energy Liason Program	Each department designates a Liason to lead energy conservation efforts[58]
Indiana	Energy Challenge	Energy conservation contest between 10 dorm halls, separate contest for Greek houses
Iowa		
Michigan	Energy Fest	Annual festival promoting conservation, energy efficiency, and alternative technologies[59].
Michigan State	Be Spartan Green Environmental Stewards	Each department designates a steward who is responsible for promoting conservation behavior and providing information[60]
Minnesota	It All Adds Up	Promotes Energy Conservation Pledges. Has 11,000 individual and 400 group pledges[61]
Northwestern		
Ohio State	Scarlet Gray and Green	Encourages students to sign a sustainability pledge and to reduce energy use[44.]
Penn State	Take Charge! My20 Campaign	Provides educational resources and online dashboards that monitor real time energy use for residence halls and other buildings[62] [63]. Challenges residence halls to reduce energy consumption over a week long period[64].
Purdue	Energy Competition	Competition between 4 residence halls[65]. Metering systems are available online[66].
Wisconsin	I Pledge	Suggests ways individuals could lessen their energy consumption. Has 2,000 pledges. [54.]

Energy Overview

The University of Iowa and Penn State University have emerged as the top two leaders in the terms of energy and emissions reduction. The University of Iowa has taken large strides toward reducing their total greenhouse gas emissions, resulting in the lowest amount of GHG emissions in the Big Ten, weighted and unweighted. The University of Iowa has achieved such success due to their emphasis on renewable resources and more specifically their oat hull biomass project. Behind only Iowa, Penn State has the 2nd lowest amount of GHG emissions per student and also emerges as a leader in energy conservation. Penn State University invests in a significant amount of renewable energy and has also strived to reduce total energy use through their intensive building improvement program. Other Big Ten Schools can follow the lead of PSU and the University of Iowa by seeking opportunities to increase renewable energy use, whether through purchase or onsite generation, and implementing programs to reduce current energy consumption levels, such as building retrofits or awareness campaigns.

Transportation

Transportation can have significant impacts on the environment due to negative effects of burning fossil fuels. The release of green house gases and volatile organic compounds from vehicle tailpipes has major environmental and public health implications. Reducing the environmental footprint from transportation can reduce these impacts, as well as instill more efficient and healthier practices in society. Big Ten campuses are ideal areas to implement these practices due to the large size and populations of these schools. Many different programs have been put in place within this conference and are evaluated based on commuting statistics, campus fleet sustainability, bike sharing, and car sharing.

Table 5. **Transportation Options at Big Ten Schools**

University	Campus Bus System	Bike Program	Car Sharing
Illinois[67]	No	No	Yes
Indiana[68]	Yes	No	Yes
Iowa[69]	Yes	No	No
Michigan[70]	Yes	Yes	Yes
Michigan State[71]	No	Yes	No
Minnesota[72]	Yes	Yes	Yes
Northwestern[73]	Yes	No	Yes
Ohio State[74]	Yes	Yes	Yes
Penn State[75]	Yes	No	No
Purdue [76]	No	No	No
Wisconsin[77]	Yes	Yes	Yes

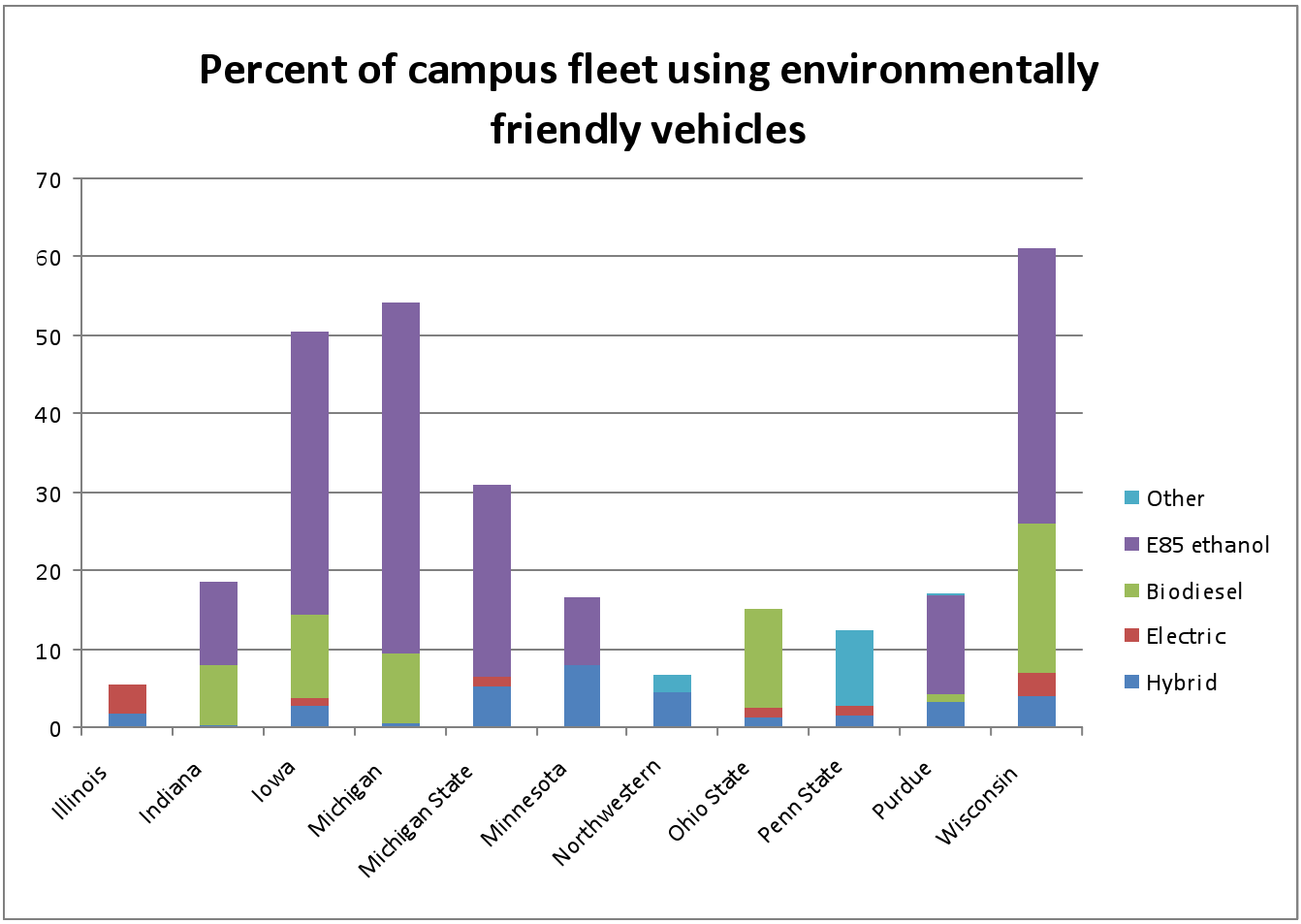


Figure 5: **Percent of environmentally friendly vehicles per fleet**

The frequent use of vehicles in campus motor fleets can have significant energy usage and green house gas emissions. More sustainable vehicles can offset these impacts. Most schools are implementing hybrid-electric cars into their campus fleet, such as Minnesota with 68 hybrids (Table 5). Biodiesel and ethanol are also popular, accounting for more than half of the environmentally friendly vehicles on most campuses. Pennsylvania State University distinctively has 69 vehicles running on compressed natural gas or hydrogen in combination with gasoline, and is the only Big Ten school vastly using this technology[78]. Even with many alternatively powered vehicles in campus fleets, the majority on each campus runs on less efficient engines and fuels.

Campus Bus System

Having a campus bus fleet is important in providing students, faculty, and staff a quick and easy method of cross-campus transportation. Because traveling on Big Ten campuses can be time consuming or out of reach by walking or bicycling, the use of properly managed campus buses can ward individuals away from using a private vehicle. Currently, 8 of the 11 schools have their own bus system (Table 5). Even though many Big Ten schools have a completely subsidized campus bus fleet, it is also important to note that having a partnership with the local transit system can play a key role in sustainable transportation. Most Big Ten universities have free or discounted bus passes for faculty and/or students, and incentives such as these can increase the use of transit systems for those living further away from campus. Also, this would allow individuals to travel more easily to grocery stores or shopping districts, reducing the need for private transportation. Illinois, Michigan, Ohio State, Purdue, and Wisconsin offer free bus passes to students and employees for the local city bus system [79,80,81,82].

Bike Sharing Programs

Bike sharing programs have the potential to reduce the use of private cars, as well as promote a healthy community. Although the University of Michigan, Ohio State University, and the University of Wisconsin have initiated bike programs on campus, Michigan State University and the University of Minnesota have played leadership roles in implementing vast bike sharing programs on campus and in the surrounding community (Table 5).

MSU Bikes offers over 1000 bicycles for leasing and rentals on an hourly, daily, weekly, and semester basis at affordable prices. Also, the programs offers education, repair work, storage, bike accessories, and used bikes for sale as well[83].

The University of Minnesota and Minneapolis are partnering to implement a community-wide bike sharing program, similar to those seen in Paris and Barcelona. The program would consist of 1,000 bicycles at 75 different stations throughout campus and Minneapolis. Programs such as these can be very expensive though, which has led to many delays at Minnesota, although the overall environmental and health benefits exceed the cost over time[84].

Car Sharing

Car sharing can be a more economic and environmental mode of transportation compared to a personal vehicle. Many car sharing programs are popular among campuses, especially Zipcar. Illinois, Indiana, Michigan, and Minnesota have partnerships with Zipcar, meaning they have allotted parking spots on campus reserved for Zipcars and subsidized rates for university affiliates[85,86,87,88]. Other Big Ten schools also practice car sharing through other businesses, such as with Hertz, as Michigan State University has.[89] Also, Wisconsin and Northwestern have their own car sharing program completely managed by their respective universities (Table 5).

Carpool/Ride Sharing

Carpooling can provide cheaper alternatives to driving alone to campus. Many campuses in the Big Ten conference offer incentives for car and van pooling. Many universities offer a parking permit for a group of carpoolers for the price of one, an allotted amount of emergency ride homes for unplanned events, and/or preferential parking, however a combination of these can be used to attract university members to join these types of programs.

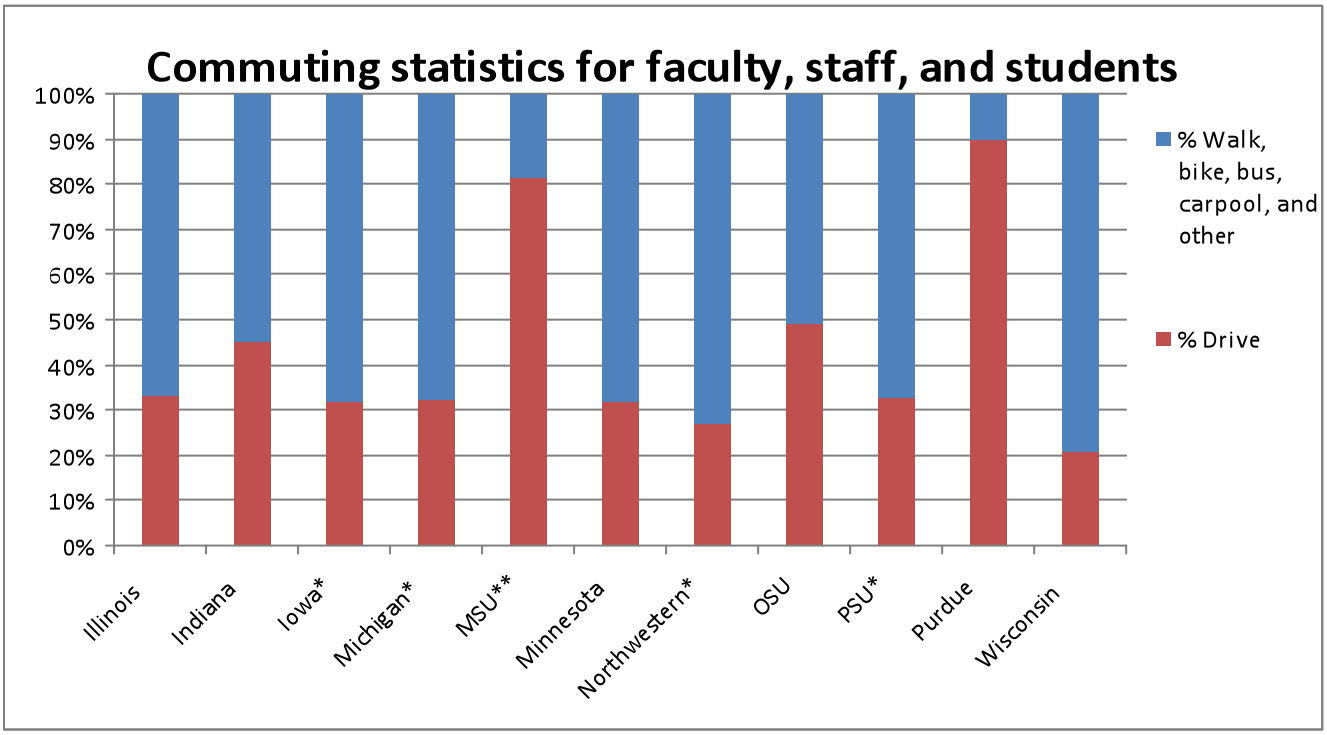


Figure 6. **Commuting statistics for faculty, staff, and students**

Transportation Overview

Big Ten campuses have initiated programs to increase transportation sustainability, however large proportions of the university communities in these schools still commute to campus unsustainably. Urban and land use planning, although not mentioned, have strong effects on transportation preference. For instance, Purdue University may be sprawled compared to other Big Ten universities, which explains the large amount of the population driving to campus. However, with proper bus lines and carpool programs (with incentives) coupled with innovative urban planning strategies, this number can greatly decrease. Pennsylvania State University and the University of Wisconsin have the largest proportions of university individuals commuting to campus sustainably (Figure 6).

Recycling

In order to evaluate the recycling efforts at Big Ten schools, our team referenced the Sustainability Reports and main websites for each school and used *greenreportcard.com* to supplement this data. Each school had some sort of recycling program and many had already created initiatives to promote participation, increase total recycling, and reduce overall waste. Only four schools, Indiana, Iowa, Michigan State, and Penn State do not participate in RecycleMania, a national program that fosters competition in recycling among colleges and universities, but it seemed that this did not have a huge effect on the quality of recycling at each school. The biggest obstacle in comparing these schools was the inability to find the same types of data from each school, but it was apparent that every school had at least some sort of recycling initiative on campus.

Recycling Rates

The overall recycling rates from within the past few years for each school are below:

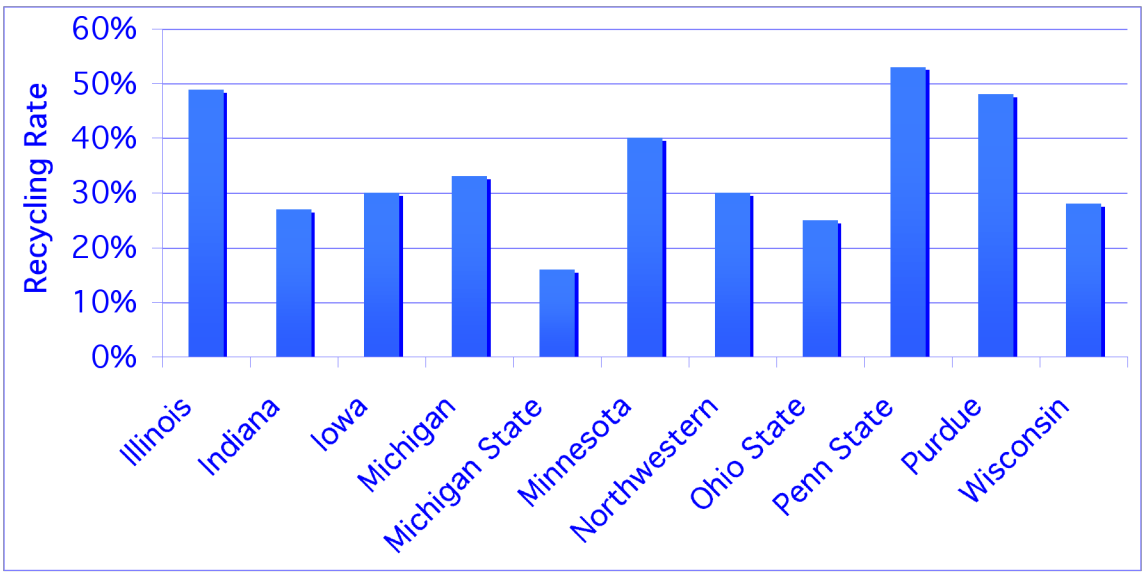


Figure 7. **Recycling Rates at Big Ten Universities**. [90] [91] [92] [93] [94] [95] [96] [97] [98] [99] [100]

These results show most schools recycle around 30% of all waste, with two standout schools, the University of Illinois and Penn State University. As these figures are a percentage of the total waste produced, they are not skewed by differences in enrollment or overall size of the university community.

These numbers vary greatly among the schools, likely due to the different recycling initiatives for each university. Programs include stores for reuse or donation programs for unused goods and construction materials, such as the Habitat for Humanity ReStore[101] and Architectural Salvage Warehouse at the University of Illinois[102], a program to reuse construction materials at Penn State University[103], projects to reuse furniture at the University of Iowa[104], a clothing donation during move-out at Northwestern University[105], and a surplus program at the University of Wisconsin to donate extra goods[106].

Some schools have very specific programs to reduce waste, such as the "Go Green Challenge" at the University of Indiana that provides water bottles to students[107], and a similar program at Michigan State University that has reduced overall plastic water bottle purchases by 32.5%[108]. Other schools have adopted ambitious goals to increase recycling rates. Purdue University has a goal of reaching an 85% rate by 2014[109], while Ohio State University has a goal to reduce waste by 40% by the year 2010[110], and already has a requirement that all copy paper purchased must be 30% recycled content[111].

There are a few highlighted campaigns to increase recycling across campus – the University of Michigan is going to switch to single stream recycling in the summer of 2010, and has a subsequent recycling campaign to go along with the transition. At the University of Minnesota, they are trying to raise awareness by holding a "Trash Dump," which physically showcases the amount of waste produced by the university community on campus grounds and sorting through it manually to find discarded recyclables[112].

Recycling Overview

While recycling is not a true indicator of a university's ability to reduce, reuse, and thus completely eliminate the energy and resources needed for processing and shipping additional products and materials, it is nonetheless an important factor in a school's ability to become sustainable. Because of their efforts and the extent of their achievements, the University of Illinois, Penn State University, and Purdue University should be considered the most outstanding of the Big Ten Schools in terms of recycling and waste.

Universities spend a large amount of money on food products, and therefore, when considering sustainability, it is important to analyze practices in the food market for economic as well as environmental reasons. When comparing the schools in the Big Ten Conference for their level of sustainability in the category of food and food waste, tray-less dining, composting, on-campus farms, local food purchases, and organic food purchases were all taken into consideration along with their letter grade assigned by greenreportcard.org.

Table 6. **Food Programs at Big Ten Universities**

University	Pre/Post Consumer Compost	Trayless Dining	On-Campus Farms	Green Report Card Grade
Illinois[113] [114]	Pre & 2 Post	Yes – 3 Locations	Yes	A
Indiana[115]	Pre	Yes – 1 Location	No	B
Iowa[116]	Pre	No – Only during Earth Week	Yes – Small Garden	B
Michigan[117]	Pre and 1 Location Post	No – But successful pilot test	Yes – Garden	A
Michigan State[118]	No	Yes – 2 Locations	Yes	B
Minnesota[119] [120]	Pre and Post	Yes	Yes	A
Northwestern[121]	No	Yes	No	A
Ohio State[122]	No	Yes	Yes – Small Garden	B
Penn State[123]	Pre	No – Pilot Planned	Yes – Limited	A
Purdue [124]	No	No – Current Testing	No	B
Wisconsin[125]	Pre	No	Yes – Limited	A

Pre/Post Consumer Compost

Most schools that have a food-waste compost system in place only use pre-consumer waste. This is due to the cost and contamination risks associated with post-consumer compost. The University of Illinois, the University of Minnesota and the University of Michigan are the only schools that have post-consumer compost systems and they are only in select locations. Seven of the eleven schools in the Big Ten have a pre-consumer compost system established in their dining areas. Pre-consumer compost is much easier to sort and regulate which is why the majority of schools opt to have composting for pre-consumer waste rather than include post-consumer waste.

Tray-less Dining

Only six of the Big Ten schools have a tray-less dining system, and many that have tray-less dining systems do not have it in all of their cafeterias. Northwestern's tray-less dining program seems to be the most successful. It did a trial run in 2008 for Earth Day[126]. The trial was so successful and well received by students that it decided to continue with tray-less dining in the majority of the cafeterias for the following school years. One of the largest problems faced when switching to a tray-less dining system is getting the students to accept and adapt to the new system. Many of the schools that have tray-less dining also have plans for expanding their programs and several schools that do not have tray-less dining have shown interest in running pilot-tests.

On-Campus Farms

Many of the Big Ten schools have on-campus farms or gardens, but they all are relatively small. Most schools only harvest a limited amount of food from these gardens and in some cases, only one crop (e.g. Pennsylvania State has an on-campus garden for mushrooms[127]). These gardens are mostly used for educational purposes for students as well as for a symbol representing the idea of local foods. In order for an on-campus farm or garden to contribute a notable percentage of food to the university, they would have to be much larger than the farms and gardens that are currently in place.

Local and Organic Food

There is a large range in the percentage of Big Ten universities' food budgets that are spent on local food. The University of Minnesota gets about 30% of its food sustainably, whereas the Universities of Indiana and Iowa spend less than 1% of their budgets on locally grown food. There was only data available on organic purchases for 6 of the 11 schools. Of these 6 schools, the highest percentage spent on organic food was the University of Wisconsin at 2.2% but most were right around 1%. There is a much larger emphasis on local food purchases versus organic food purchases.

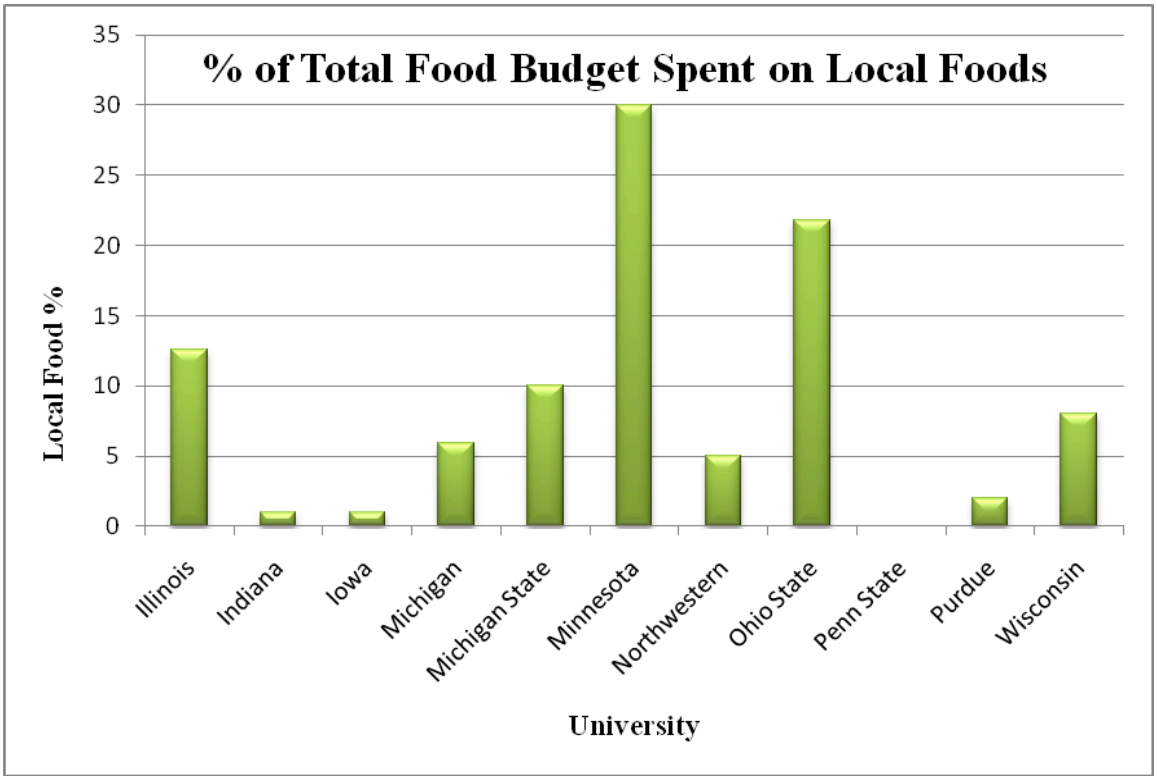


Figure 8**. Percent of Total Food Budget Spent on Local Foods** (all data from greenreportcard.org)
*Schools with 0 indicates that this data was not available

Food Overview

Overall, each of the schools in the Big 10 conference are taking steps forward to become more sustainable in their food and food waste programs. The "College Sustainability Report Card" has assigned each of these eleven schools at least an A or a B letter grade in this category which shows strong leadership among the Big Ten in the college community. From the categories evaluated in this analysis, the University of Minnesota and the University of Illinois seem to be the current leaders of the Big Ten in the food system sustainability, although the rest of the schools are not too far behind. With increased local and organic purchases, increased waste diversion and composting, along with reduction of overall consumption, all of the schools in the Big Ten could be leading the country towards a more sustainable future.

Conclusion

With continual research, the Big Ten Sustainability Report can serve as a valuable resource for advancing sustainability and conservation efforts as it facilitates benchmarking among institutions of higher education. This report is intended to complement databases such as STARS by providing a deeper comparative analysis of sustainability practices. Our findings revealed that there was no clear leader in campus sustainability in the Big Ten Conference. This indicates that each university has potential for improvement in several categories. Analyzing best practices from each school and adapting them to other campuses can drastically improve the environmental movement in the Big Ten Conference.

Universities in the United States play an especially important role in guiding broader sustainability efforts. Their cumulative prominence and power gives them unprecedented influence on surrounding communities and an enormous amount of leverage on businesses and private entities. Big Ten Universities have already taken steps toward achieving more sustainable practices, but campuses can further improve their individual practices by learning from the successful initiatives of peer institutions. In order to make a statement and significantly reduce their ecological footprint, universities and colleges need to work together to establish programs and policies in all aspects of sustainability. If universities can collectively make the stride toward conservation and sustainability, working together to establish programs and policies in all aspects of sustainability, there is potential for substantial improvements and benefits for future generations.

Appendix 1. Supplemental Tables

Table 1. **Administration Statistics at the Big Ten Universities**

	Illinois[128]	Indiana[129]	Iowa[130]	Michigan[131]	Michigan State[132]	Minnesota[133]	Northwestern[134]	Ohio State[135]	Penn State[136]	Purdue[137]	Wisconsin[138]
ffice of ampus ustainability	**2008**	**2009**	**2008**	**2009**	**2000**	--	Northwestern Institute for Sustainable Practices	**2006**	**1995**		We Conserve Initiative
dvisory	Reports to President	Reports to the Provost	Reports to President	Reports to President	Reports to	--	Reports to VP on Student	Reports to President	Senior Vice	Reports to University	--

Table 2. **Energy Use at Big Ten Universities**
*Note: Energy data from Indiana 2007, OSU 2008, Purdue 2008, NU & Minn n/a

University	Total Energy Use (MMBTU)	Energy Use/1000 sq. ft.	Energy use/student
Illinois	5730016	284.9	142.9
Indiana	4511319	289	106.5
Iowa	3516320	214.4	115.9
Michigan	6400287	205.3	156
Michigan State	6813950	298.3	144.7
Ohio State	4965355	225.9	90.3
Penn State	3233368	167.5	73.5
Purdue	2710161	234.3	68.3
Wisconsin	4440000	222	111.2

Table 3. **Greenhouse Gas Emissions at Big Ten Universities**

University	Total GHG Emissions (tons)	GHG Emissions/Student	GHG Emissions/1000 sq ft
Illinois	505272	12.6	25.1
Indiana	463434	11.9	29.7
Iowa	217200	7.2	13.2
Michigan	615416	15	19.7
Michigan State	602327	12.8	26.37
Minnesota	642925	12.6	29.8
Ohio State	644423	12.3	29.3
Penn State	455069	10.3	23.57
Purdue	x	x	x
Wisconsin	x	x	x
Northwestern	x	x	x

Table 4. **Environmentally Friendly Vehicles**

Schools	Campus fleet	Hybrid	Electric	Biodiesel	E85 ethanol	Other	Percent alternative
Illinois[139]	223	4	8	0	N/A	0	5.4
Indiana[140]	357	1	0	27	38	0	18.5
Iowa[141]	740	20	8	80	274	0	50.5
Michigan[142]	1098	5	0	98	491	0	54
Michigan State[143]	406	21	5	0	100	0	31
Minnesota[144]	862	68	0	0	75	0	16.6
Northwestern[145]	137	6	0	0	0	3	6.6
Ohio State[146]	996	13	12	124	N/A	0	15
Penn State[147]	718	11	9	0	0	69	12.4
Purdue[148]	~900	28	0	9	114	2	17

Wisconsin[149]	648	25	19	124	226	0	61

Table 5. **Commuting Statistics**

Schools	% Drive	% Walk, bike, bus, carpool, and other	% Carpool	% Bus/Transit	% Bike	% Walk	% Other
Illinois[150]	33	67	7	25	7	28	0
Indiana[151]	45	55	7	15	5	22	6
Iowa*	32	68	N/A	N/A	N/A	N/A	N/A
Michigan*	32.2	67.8	N/A	N/A	N/A	N/A	N/A
MSU[152]**	81.4	18.6	11.9	1.8	2.5	2.2	0.2
Minnesota[153]	32	68	8	27	10	23	0
Northwestern*	26.8	73.2	N/A	N/A	N/A	N/A	N/A
OSU[154]	49	51	N/A	N/A	N/A	N/A	N/A
PSU*	32.6	67.4	N/A	N/A	N/A	N/A	N/A
Purdue[155]	90	10	N/A	N/A	N/A	N/A	N/A
Wisconsin[156]	21	79	8	23	11	32	5

***percentages were extrapolated using campus parking permit data (Table 5)**
****statistics are only for employees**

Table 6. **Parking permit statistics**

School	Parking permit holders	Employees and Students
Iowa[157]	14132	44160
Michigan	24627[158]	76397[159,160]
Northwestern*	6221[161]	23237[162,163]

PSU	18368[164]	56384[165]
***estimated parking permit holders**		

Appendix 2. Big Ten Sustainability Report Guide

The Big Ten Sustainability Report is an important resource that is meant to inspire collaboration and the development of best practices in sustainability for the top universities in the Midwest.
It also is a benchmarking tool that gives Big Ten schools the chance to measure their progress relative to other schools. This report can be simple or in-depth and can include a wide variety categories depending on the interests of the group.
We have created a guide based on our experience, which will hopefully make the research and report writing process easier. Please do not hesitate to contact us at big10sustainability@gmail.com with questions.

1. Determine research categories and decide which group members research what topics.

For our report, we decided to research the following six categories: administration and education, LEED buildings, energy and climate, transportation, recycling, and food. However, any number of topics such as water consumption, land use, culture, and more could be researched.

2. Determine specific measurable subtopics such as greenhouse gas emissions or percentage of local food purchases.

Each topic should include measurable data points for which you can realistically find relevant data. Greenreportcard.org and university websites can be good resource for finding subtopic ideas.

3. Create a database to collect information that is easily accessible to all group members.

We decided to compile our data in an excel spreadsheet that was accessible to all group members (via google docs). This made it easier to add data to all categories. Also, this made it easier to see which subcategories had substantial data, and which subcategories were too vague and should not be included in the final report.

4. Research sustainability websites of each school in order to find information and data.

Most schools have a website dedicated to sustainability. These websites can be very useful in providing data and contact information for schools. Most schools also have links to their sustainability website on www.greenreport.org. If this information is unavailable, contact sustainability staff at those school and ask if they have a website.

5. Contact sustainability leaders and inform them of your project.

The contact information for sustainability leaders can usually be found on sustainability websites for each schools. We have also included a list of people we were in touch with at the bottom of this guide. It is very important to establish a relationship with staff and administration at each school, as they are a very useful resource for reviewing the accuracy of your data and providing supplemental information.

6. Use The College Sustainability Report Card, Association for Advancement of Sustainability in Higher Education (AASHE), and Sustainability Tracking Assessment & Rating System (STARS) to gather data within each category.

- The College Sustainability Report Card: http://www.greenreportcard.org/
- AASHE: http://www.aashe.org/
- STARS: http://stars.aashe.org/

7. E-mail the contacts you established earlier in the semester in order to request additional data you were unable to find online.

Sometimes it can be helpful to contact staff or administration who are specialists in the topic you are researching. Be sure to send drafts to all of the people you contacted in order to double check for accuracy.

8. Create graphs and tables within each category that summarize your data. Supplement any quantitative data with and overall trends, acknowledgements of exceptional achievements as well as additional information that may be difficult to quantify.

The format of your report is flexible, however make sure to use a similar format and reporting style for each section for consistency.

9. Send your final draft each school for final comments and feedback.

It is very important to get final approval from each school before distribution, in order to avoid conflict with due to inaccurate data or misrepresentation.

10. Format your report so it is aesthetically appealing, and distribute it to all of the big ten schools!

Your report is not useful to schools unless they have it! This is a great project with a lot of potential. Have fun!

This report and guide was created by Lydia McMullen-Laird, Rahul Gondalia, Jillian King, Nicole Flores, Erik Boren and Celia Haven for Environment 391: Sustainability and the Campus with Michael Shriberg and Julian Dautremont-Smith, University of Michigan, Winter 2010.

Appendix 3. Big Ten University Contacts

University	Contact	E-mail	Phone	Title
University of Illinois Urbana-Champaign	Morgon Johnston	mbjohnst@fs.uiuc.edu		Transportation Deman Management Coordinator
	Additional Contacts	sustainability-committee@illinois.edu, choyle57@comcast.net, lsweet@illinois.edu		
ndiana University	Emilie Rex	ekrex@umail.iu.edu	(812) 679-8646	Sustainability Prograr Coordinator
	William Brown	brownwm@indiana.edu		
University of Iowa	Liz Christiansen	liz-christiansen@uiowa.edu	(319) 335-5516	
	Michelle Ribble	michelle-ribble@uiowa.edu		
University of Michigan	Don Scavia	scavia@umich.edu	(734) 615-4860	Special Council to U-M President on Sustainability
	Ken Rapp	kenrr@umich.edu		University Landscap Architect
Michigan State University	Stephen Troost	troost@cpa.msu.edu	(517) 884-0773	Campus Planner
	Lauren Olson	olsonla3@msu.edu		Program Coordinator OCS
	Jennifer Battle	Jennifer@msu.edu		
University of Minnesota	Amy Short	short038@umn.edu		
	Heather Dickson	Mentg001@umn.edu		Marketing Manager
	Jaqueline Brudlos	Jbrudlos@umn.edu	(612) 624-4161	Communications Coordinator Parking an Transportation Services
Northwestern University	Julie Cahillane	cahillane@northwestern.edu	(847) 467-1374	Manager of Recycling an Refuge

Ohio State University	Corey Hawkey	hawkey.13@bisfin.osu.edu	(614) 292-1528	Sustainability Coordinator
	Sharon Bierman	bierman.7@osu.edu		
Pennsylvania State University	Erik Foley	ebf3@nw.opp.psu.edu	(814) 865-2714	Sustainability Program Manager
	Lydia Vandenbergh	LBV10@nw.opp.psu.edu		
	David Dorman	djd6@psu.edu		Parking Allocatio Manager
	Milea Perry	MAP40@nw.opp.psu.edu		
	Doug Holmes	wdh1@psu.edu		Transportation
Purdue University	Robin Ridgeway	rmridgway@purdue.edu		
University of Wisconsin-Madison	Darwin Ward	dward@fpm.wisc.edu	(608) 263-2076	Program Planning Analys Senior (Transportation)

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