

# THE BIG 10

**Indiana University**

**Michigan State University**

**Northwestern University**

**Ohio State University**

**Penn State University**

**Purdue University**

**University of Illinois**

**University of Iowa**

**University of Michigan**

**University of Minnesota**

**University of Wisconsin**

For the un-initiated, the Big Ten Conference is a group of 11 large universities — 10 public and one private — that compete in some of the country's greatest college sports venues. But off the court, these schools also compete

quietly in the environmental arena.

And with a combined student body larger than the population of Miami, this competition is one that could affect our world long after the final buzzer sounds. ▶

With such a huge potential to impact the environment, it's no wonder these universities — leaders not only in athletics, but also in intellectual and creative prowess — commissioned a report on their energy consumption and production.

Upon discovering this report, *EJ* decided to conduct its own examination of the Big Ten's environmental footprint. We investigated not only energy use, but also recycling programs, transportation options and innovative environmental initiatives. These are our findings.

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# BIG 'mini cities'

Collectively larger than the population of Miami, the Big Ten Conference demands a huge amount of electricity. The fuel used, where it comes from and how it's burned contribute to efficiency.

BY MATTHEW HUND, KRISTIN V. JOHNSON  
& HANNAH NORTHEY

**N**inety-one percent of energy in the United States is produced from non-renewable sources that pollute the environment. As these sources of energy diminish, society turns its attention to the country's centers of intelligence, free thought and creativity for leadership — universities in the Big Ten Conference.

In Spring 2006, Big Ten universities compiled their 17th annual report on energy production and consumption. The collaboration is a result of the "Big Ten and Friends" engineering meeting, initiated in the 1960s by the University of Illinois to provide an opportunity for university power plant managers to train on new systems and exchange information.

The report, although complicated by the passage of time and the introduction of new technologies and poli-

cies, provides an invaluable look at how Big Ten universities measure up in terms of the energy they use, how much they produce and consume and how their future is shaping up.

## ENERGY DEMAND

The U.S. Department of Energy (DOE) refers to university campuses as "mini cities." But "mini" might be an understatement, since the combined student population of the 11 schools in the Big Ten conference is larger than the population of Miami. That doesn't even include faculty and staff.

And according to the U.S. National Center for Education Statistics, enrollment is increasing on college campuses nationwide — by approximately 25 percent between 1990 and 2004.

With larger student bodies demanding even more energy-intensive services, such as air conditioning and

# TEN create big impact

personal computers, university campuses put increasing demands on local utilities and on-campus power plants — and they also spend more on their power bills. For some schools, the economic solution lies in burning cheaper fuels or buying energy from a grid that may or may not produce responsibly.

Collectively, Big Ten universities consume more than 166 kilowatt-hours per gross square foot — those are the feet inside buildings — each year. Since the University of Illinois and Northwestern

University did not participate in the report, that translates into an average of 18.47 kilowatt hours per gross square foot per university.

According to pollution calculators, which approximate the pollution produced by kilowatt-hours generated by specific types of fuel, that much energy has the potential to create more than 4,700 tons of sulfur dioxide, which causes acid rain, and more than 8 million tons

of carbon dioxide, which contributes to global climate change.

Ohio State University was the largest consumer of energy in 2005, using 24.1 kilowatt-hours per gross square foot. The high usage could be because OSU has the second largest “electrified area” in the Big Ten. The electrified area encompasses all parts of campus that require electricity, such as lit parking lots, classrooms and

#### Energy terminology

- Kilowatt-hours are the common currency among power producers.
- A kilowatt is defined as the amount of energy needed to heat one pound of water one degree Fahrenheit.
- The rate at which energy flows (the electric current) is the kilowatt-hour, which measures the amount of energy flowing from producers to consumers in any given system. One kilowatt hour is the energy required to keep a standard light bulb lit for approximately 10 hours.

	Electricity (kilowatt-hrs) per GSF*	Electricity (kilowatt-hrs) per student
Illinois	no report	no report
Indiana	17.73	6,672
Iowa	20.28	8,436
Michigan	20.63	7,738
Michigan State	12.61	5,387
Minnesota	18.50	7,614
Northwestern	no report	no report
Ohio State	24.10	9,400
Penn State	16.74	7,166
Purdue	16.67	6,623
Wisconsin	19.04	10,087
<b>**Average</b>	<b>18.47</b>	<b>7,680</b>

Source: Big Ten & Friends Utilities Benchmarking Survey, July 1, 2004, through June 30, 2005.

\*GSF stands for Gross Square Foot, which are the feet inside campus buildings.

\*\*The average was taken from the nine schools reporting data in this category.

laboratories. According to Ohio State's Web site, it is also the largest public research institution in the United States.

Michigan State University's campus, on the other hand, consumed the smallest amount of energy in 2005-06, using 12.6 kilowatt hours per gross square foot. Although MSU has the fourth largest electrified area in the Big Ten, it also has numerous energy conservation programs.

For example, MSU has:

- A worm composting program run by a student-run group called MACgreen,
- A green roof experiment to save on the heating and cooling of buildings, and
- A campus-wide energy campaign, launched in 2001, that promotes energy conservation at all university buildings and dorms.

## FUEL TYPES

Universities vary in the energy they use. The source is based on cost and the availability of fuel types and plant machinery. In the Big Ten, fuel sources are as diverse as coal, natural gas, recycled tires and biomass.

Fuel sources are measured by the amount of energy released as heat when they burn. The heat value is measured in British Thermal Units (BTUs), the amount of heat required to raise the temperature of a pound of water by 1 degree Fahrenheit. One BTU is the amount of energy released as heat by striking a match.

### ■ COAL

Coal is a plentiful, yet controversial, energy source. While 1 ton of coal provides about 20 million BTUs, burning this fuel also produces gases that contribute to respiratory problems, climate change, smog and mercury build-up in aquatic food chains.

Jonathan Cogan, an energy information specialist at the DOE, said burning coal emits more carbon dioxide and sulfur dioxide than petroleum or natural gas.

The largest consumer of coal in the Big Ten was Michigan State University, having used more than 6 trillion tons of coal in 2004-05 alone. Bob Ellerhorst, the power plant manager at MSU, said the university uses coal because it's the cheapest form of fuel.

But the university is able to emit less sulfur and fewer noxious gases because of specialized machinery called a fluidized bed. Purdue and Iowa State also have this technology, Ellerhorst said.

Sulfur must also be controlled by MSU to meet state air quality requirements. MSU ships its coal from eastern Kentucky, where low-sulfur coal is mined.

According to Ellerhorst, MSU is one of the Big Ten schools farthest from the southern coal mines and therefore pays the most for coal shipping costs.



Photo courtesy of Madison Hall

The MSU power plant is the largest user of coal in the Big Ten, although the MSU campus consumed the smallest amount of energy: 5,387 kilowatt-hours per student and 12.61 kilowatt-hours per gross square foot.

### ■ NATURAL GAS

The University of Michigan is the Big Ten's largest consumer of natural gas, using 4 trillion BTUs in 2004-05, according to the Big Ten survey.

Natural gas, formed when organic materials trapped in sediments decompose, is an increasingly attractive source of energy that emits less carbon and nitrogen than coal or oil. It has almost no ash particles left after burning and emits no sulfur, according to the DOE's Cogan.

On the other hand, burning natural gas produces carbon dioxide and is made up of mostly methane — two substances that contribute to global climate change. Natural gas is also more difficult to transport — especially in colder climates like Michigan's — and therefore more expensive.

"Many, many years ago, people at this university recognized that coal was not a sustainable fuel," said Diane Brown of U-M media relations. "It's an efficient power plant that co-generates electricity on the side after it generates the steam."

Co-generation is a process that creates two sources of energy from one natural resource — steam to heat buildings and electricity to power them.

### ■ OIL

The University of Minnesota, with campuses in Minneapolis and St. Paul, is the largest consumer of oil in the Big Ten, having used 91.7 billion BTUs in 2004-05.

Power plants can burn the oil in boilers to produce steam and turn a turbine, burn the oil in combustion turbines or use the hot exhaust to make steam to drive a steam turbine.

But the school's main source of energy is natural gas, according to Jerome Malmquist, director of energy management at the University of Minnesota. Oil is only used as a supplementary source in the coldest months of the year, when natural gas becomes more difficult to transport.

Minnesota law prevents the university from using coal to produce more than 30 percent of its annual energy.

Burning oil at power plants produces nitrogen oxides, sulfur dioxide, carbon dioxide, methane and mercury compounds, according to the U.S. Environmental Protection Agency (EPA).

According to the DOE's Fred Mayes, oil's high cost and pollution concerns make it an undesirable energy source.

### ■ BIOMASS

The University of Iowa leads the Big Ten in the use of biomass — biological material used as fuel or for industrial production. For the third year in a row, the university is purchasing oatmeal hull from the Quaker Oats Company to use in one of its two coal-burning boilers. The oat hulls, which cost half as much as coal, are burned instead of coal.

The use of biomass has had positive financial and environmental effects, said

Ferman Milster, associate director of Utilities and Energy Management.

“We’ve saved a quarter of a million to one million dollars a year, and we’re not increasing the global inventory of CO<sub>2</sub>,” Milster said. “It provides the university with a local business partnership where we’re both benefiting — Quaker gets money for oat hulls, and we get a source of fuel.”

Milster said the university spent two years developing, testing and getting permits for the separate fuel system added to the boiler for the purpose of burning hulls.

Since its installment, emissions of sulfur dioxide, carbon monoxide, nitrogen oxide, volatile organic compounds and particulate matter have decreased. Additionally, Milster said the university is in the process of adding the hull-burning fuel system to its second boiler.

Currently, energy generated from the burning of oat hulls accounts for 13 percent of University of Iowa’s total purchased energy.

## THE GRID

Comparing Big Ten schools on the basis of energy use comes with many caveats. Each school is unique and has different programs to achieve maximum efficiency.

One such caveat is that some universities have their own power plants. These schools, unlike those that purchase energy from outside companies, have the power to implement programs that control pollution and

# Comparing Big Ten schools on the basis of energy use comes with many caveats. Each school is unique and has different programs in place to achieve maximum efficiency.

the university’s carbon footprint.

Some schools are signing up to take part in the Chicago Climate Exchange, the world’s first legally binding greenhouse gases registry, reduction and trading system. Members make a voluntary but legally binding commitment to reduce their production of greenhouse gas emissions by 1 percent each year.

Member universities include Tufts University, Michigan State University and the universities of Oklahoma, Iowa and Minnesota. Businesses that are members include Ford Motor Co., IBM, Motorola, non-governmental organizations and even cities. Universities that buy their energy from outside sources, however, cannot vouch for how it is produced.

But there are many other caveats to how each Big Ten school — indeed, each university in the world — makes its energy decisions, ranging from differences in power plant machinery and available funding to

proximity to natural resources and the existence of high-consumption buildings like hospitals and large laboratories. These variables leave moot any ranking of university energy efficiency, but they don’t negate the importance of questioning the manner in which these “mini cities” power their campuses — the very places where cutting-edge research on energy efficiency occurs. ☺

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## Innovative environmental initiatives in the Big Ten



### UNIVERSITY OF ILLINOIS, URBANA-CHAMPAIGN

The University of Illinois at Urbana-Champaign is purchasing three utility-scale wind turbines. According to sustainability coordinator Matt Malten, this facility will be one of the first university-owned, multi-turbine, on-campus wind farms in the nation.

The ability to purchase the turbines, which will provide approximately 3 percent of the campus’ total energy consumption, was made possible in part by a student initiative, which raised and committed \$30,000 for the project. In 2003, the U of I became the first school in the state to institute a student fee in support of clean energy.

The fee will also be used to support:

- Purchase of a solar photovoltaic array and two green roofs for the new Business Instructional Facility, which is currently under construction.
- Design, construction and installation

of a reactor that will convert waste food grease from campus dining facilities into biodiesel for use in the university’s fleet.

- Support the campus research project on Miscanthus, a perennial grass that can be used as a renewable energy source; long-term plans are to plant 1,000 acres and to build a new boiler to use the Miscanthus as a supplemental fuel. —*Jessica A. Knoblauch*



### INDIANA UNIVERSITY

Indiana University has several innovative projects in the planning stages, including green buildings, composting and alternative fuel sources.

While the university claims to meet Green Building Council standards in the construction of new buildings and the renovation of older facilities, it is not yet taking part in the official program.

In addition, IU promotes carpooling among staff and faculty with cheaper parking permits for cars transporting three or more people. The university also facilitates

carpooling by finding people who travel to campus from the same origin.

The campus buses also use alternative fuel sources to reduce emissions.

—*Matthew Hund*



### UNIVERSITY OF IOWA

The University of Iowa’s Biomass Fuel Project helps decrease the amount of coal burned to provide energy while creating an environmentally friendly use for thousands of tons of oat hulls, a by-product of cereal manufacturing.

Unlike coal, burning oat hulls doesn’t result in new carbon dioxide emissions. The carbon dioxide released into the atmosphere equals the amount absorbed by the plant as it grew. The total amount of carbon stays the same. When fossil fuels are burned, additional carbon buried underground in coal and oil is released into the atmosphere.

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