



VI. CHIEF OF FACILITIES OR PLANT OPERATIONS

Key Findings³

College and University Campuses Making Strides Towards Energy Efficiency

- ✿ Colleges and universities across the nation are making concerted efforts to improve energy efficiency, and many plan to do more in the future. Large majorities of schools have already implemented lighting, water, heating, ventilation, and air conditioning upgrades, while half of schools have developed efficiency design codes and implemented life-cycle analysis for energy project evaluation. Moreover, a solid minority of campuses meet at least some of their electricity, heating, and cooling demands by renewable energy sources.

American Colleges and Universities Major Consumers of Energy and Natural Resources

- ✿ Despite efficiency efforts, as the home to millions of students each year, colleges and universities consume huge amounts of energy and natural resources. The average campus uses millions of gallons of water and consumes millions of kilowatt hours of electricity, in addition to thousands of gallons of gasoline, propane, and fuel oil. Each school provides heating and air conditioning to thousands, if not millions, of square feet of building space. To meet their diverse energy needs colleges use everything from coal and firewood to purchased steam and chilled water.

Recycling Widespread on College and University Campuses

- ✿ Virtually every campus in the country has initiated recycling efforts, and these efforts are not just limited to aluminum cans. In addition to aluminum, majorities of colleges and universities across the country are recycling corrugated cardboard and high and low grade paper, while half of colleges and universities recycle glass bottles, food scraps

³ Results in this section are based on the return of 325 surveys from Head of Facilities or Chief Engineers and have a margin of error of plus or minus five percent. These 236 colleges and universities include 84 four-year and 147 two-year schools.

and landscape trimmings, construction materials, and plastic. More than half of schools also have a materials exchange program. One caveat, while so many schools have recycling programs, only a quarter of the total municipal solid waste generated was recycled or composted, so much waste still ends up in landfills or incinerators.

Reducing Paper Consumption, Environmental Purchasing Top List of Programs

- ✿ In addition to recycling, schools have taken steps towards greater environmental responsibility through other programs. Many schools have already created programs to reduce the need for paper hard copies and encourage both environmentally sound purchasing and micro-scale lab experiments. Fewer, yet still a significant number, have programs requiring that office paper be chlorine-free or have a minimum of 25 percent post-consumer waste.

Landscaping and Grounds Programs Gain Footing on Campuses

- ✿ Not only have colleges and universities begun to embrace recycling and energy conservation efforts, many schools now factor the environment into their landscaping and grounds management plans. Integrated pest management and native landscaping programs have already been implemented on at least half of campuses, while solid minorities of schools have also implemented programs to provide food and shelter to attract wildlife, restore natural habitats on campus, and identify and remove exotic species. Majorities of colleges and universities have also reserved at least part of their campuses as protected, agricultural or horticultural land.

Transportation Programs Slowly Moving Forward

- ✿ A few schools have made concerted efforts to make transportation around campus more environmentally responsible, an area of great opportunity for colleges and universities to make strides into a relatively uncharted, but highly important, territory. Schools are making strides by providing adequate and protected bicycle racks and free or discounted bus passes for students, faculty, and staff, creating carpooling programs, and providing incentives not to drive alone. Moreover, a relatively small, but significant group of schools use alternative fuels for at least some of their fleet vehicles.

Schools That Talk the Talk are Walking the Walk

✿ Of the small number of schools that answered both the presidents section and the facilities sections, the schools that say they have written policies for recycling, water efficiency and conservation, and environmentally sound purchasing are more likely to be recycling, making water efficiency upgrades, and purchasing environmentally sound goods.

Energy and Utilities

Perhaps because the cost benefits are relatively easy to calculate, energy and utility upgrades have been implemented by a large majority of American campuses. In particular, we asked about three types of upgrades-lighting, water, and heating, ventilation and air conditioning. Lighting upgrades top the list of energy efficiency programs implemented on campuses. Most colleges and universities have implemented lighting efficiency upgrades in all or some campus units (81%), and some schools (20%) have plans to do more in this area.

Almost as many schools implemented heating, ventilation, and air conditioning upgrades. Three in four (73%) have implemented heating, ventilation, and air conditioning efficiency upgrades in all or some campus units, and a quarter (24%) plan to do more. Water efficiency upgrades are equally as common as heating and cooling upgrades. Three in four have implemented water efficiency upgrades in all or some campus units (72%). One in five plan to do more regarding water efficiency upgrades (19%). Small schools (enrollment < 1,000) are less likely than others to have implemented heating, ventilation, and air conditioning upgrades, while schools in the East are more likely than those in the Midwest to have done so.

Implementation of Energy Efficiency Programs and Plans to Do More⁴

	CURRENT	FUTURE
Lighting efficiency upgrades	81%	20
Heating, ventilation, and air conditioning upgrades	73	24
Water efficiency upgrades	72	19
Efficiency design codes for new or existing buildings	52	17
Life-cycle analysis for energy project evaluation	48	14

⁴ When tables in this section are not broken down by two- and four-year schools it is because no statistically significant difference between two- and four-year schools exists.

Colleges and universities are less likely to have implemented efficiency design codes for buildings and life-cycle analysis for energy project evaluation. One in two have developed efficiency design codes for new or existing buildings (52%), with 17 percent planning to do more in this area. Again, the smallest schools are less likely than larger ones to do this. Half of all campuses (48%) have implemented life-cycle analysis for energy project evaluation, with 14 percent having plans to do more in this area.

Amount of Electricity, Heating, or Cooling Demands Met by Renewable Sources

None	63%
Less than 10 percent	11
10 percent or more	13
Gave no answer	14

Although not utilized as often as energy efficient up-grades, some schools are using renewable sources and alternative fuels such as solar, wind, hydro, or fuel cells to meet their heating and cooling demand. One in four (24%) colleges and universities report using renewable energy sources to meet their electric, heating, or cooling demand, with 13 percent of schools reporting that 10 percent or more of their energy needs are met by renewable sources. One in 10 plan to do more to meet their schools' energy needs by utilizing renewable energy resources.

Colleges Especially Committed to Energy Conservation

Leading Schools for Energy Efficiency and Conservation (Schools listed alphabetically)

- Bard College
- Cardinal Stritch University
- Chippewa Valley Technical College
- College of Saint Benedict
- Colorado State University
- Florida Gulf Coast University
- Humboldt State University
- Jefferson Davis Community College
- Middlebury College

Raritan Valley Community College
Rush University
Umpqua Community Coll.
University of Wisconsin-River Falls
University of Utah

Leading Schools for Doing More w/Energy Efficiency and Conservation

(Schools listed alphabetically)

Barstow College
Bates College
Bethany College
Catholic University
George Fox University
Jefferson College
Johns Hopkins University
Massachusetts Institute of Technology
Mercer County Community College
Minot State University
Ohio University
Portland Community Coll.
Reed College
Salish Kootenai College
Tufts University
Tuskegee University
University of Nebraska at Omaha
University of South Carolina-Aiken
University of Texas Medical Branch-Galveston
University of Vermont
Washburn University

Throughout the country, colleges and universities have designed programs to reduce energy consumption, but there is a small group of schools that stand apart from the rest when it comes to energy conservation. These schools have taken virtually all of the steps listed above to improve efficiency—including using renewable energy resources, upgrading water, lighting, heating, ventilation, and air conditioning efficiency, developing efficiency design codes for new or existing buildings, and implementing life-cycle analysis for energy project evaluation. These high performing colleges and universities are located across the nation, and vary with regard to size and the types of degrees offered.

Leading Schools for Which More than 50% of Energy Comes from Renewable Sources
(Schools listed alphabetically)

Central Oregon Community College
Central Virginia Community College
George Fox University
Jefferson Davis Community College
John Brown University
Johnson Bible College
Linfield College
Northwest Missouri State University
Pierce College
Reconstructionist Rabbinical College
Saint Peter's College
Salish Kootenai College
Santa Monica College
University of Idaho
University of Portland

There is also a group of colleges and universities that, while not necessarily energy efficient right now, are especially committed to doing more to promote energy efficiency and conservation on their campuses. Of the six policies listed above—using renewable energy sources, upgrading water, lighting, heating and cooling efficiency, developing efficiency design codes for new or existing buildings, and implementing life-cycle analysis for energy project evaluation—these schools have plans to pursue at least five

of them. Similar to the leading schools that already excel in energy efficiency and conservation, this group includes two-year and four-year schools that vary in size and are located all over the country.

In terms of using renewable energy, all of the schools listed say that in order to meet their heating and cooling demand, more than 50 percent of the energy comes from renewable sources such as solar, wind, hydro, or fuel cells. This group is diverse, containing large public universities as well as private and two-year community schools. They come from across the country with the largest ones located in the West.

Solid Waste, Recycling, and Materials Exchange

Amount of Municipal Solid Waste That is Recycled or Composted

None	4%
1%—10%	20
20%—30%	25
40%—50%	9
60% or more	8
Gave no answer	34

Recycling is another way schools are protecting the environment. Six in ten recycle or compost at least some of the municipal solid waste generated on their campus (62%). In fact, two in 10 (17%) report that they recycle or compost 40 percent or more of their waste. Only 4 percent of schools say that none of the municipal solid waste generated on campus is recycled or composted. The schools that give an answer to this questions report an average recycling rate of about a quarter (26%) of their total municipal waste generated. Even though a large number of schools recycle at least somewhat, more than three quarters of waste generated still ends up in landfills or incinerators.

What do campuses recycle? Aluminum, paper (higher and lower grade), and cardboard top the list. A large majority of schools report that they recycle aluminum containers in all or some campus units (85%). And the same large percentages of schools say they recycle higher grades of paper (84%). Nearly as many schools say they recycle corrugated cardboard (80%) and lower grades of paper (77%). Relatively few schools intend to do more recycling of these waste products. Fifteen percent or less say they plan to do more recycling of higher grades of paper (15%), lower grades of paper (12%), aluminum containers (10%), or corrugated cardboard (9%).

Percentage of Schools That Recycle Specific Items and Plan To Do More

	CURRENT	FUTURE
Aluminum	85%	10
Higher grades of paper	84	15
Corrugated cardboard	80	9
Lower grades of paper	77	12
Glass bottles and jars	50	9
Food scraps and landscape trimmings	48	8
Construction materials	47	6
Plastic	46	9

In addition to these four solid waste products—aluminum, high- and low-grade paper, and cardboard—colleges and universities have taken on the challenge of recycling other items, as well. Half of American colleges and universities say they recycle glass bottles and jars (50%), food scraps and landscape trimmings (48%), construction materials (47%), and plastic (46%). One in 10 plan to do more recycling of glass bottles and jars (9%), plastic (9%), food scraps or landscape trimmings (8%), or construction materials (6%). Moreover, 55 percent have a materials exchange program. Overall, larger colleges and universities, public schools and Eastern schools report more recycling than smaller schools, private schools and Western, Southern and Northern schools.

Purchasing, Hard-Copy, and Lab Practices and Plans to Do More

	CURRENT	FUTURE
Programs to reduce the need for paper hard copies	69%	15
Programs to encourage environmentally sound purchasing	49	20
Programs to encourage microscale lab experiments	43	7

	CURRENT	FUTURE
Programs requiring minimum 25% post-consumer waste for office paper	29	9
Programs requiring chlorine-free requirements for office paper	8	4

Traditionally, schools and paper go together hand in hand, so both the reduction of hard copies and attention to the type of paper purchased are significant ways for schools to contribute to the greening of campuses. This fact is not lost on our colleges and universities, as a strong majority indicate they have programs in place to reduce the need for hard copies (69%). And some schools plan to do more in terms of reducing hard copies (15%). Moreover, when asked about paper purchasing practices, three in 10 (29%) schools said they purchase office paper with a minimum of 25 percent post-consumer waste and 8 percent said they purchase paper that is chlorine-free.

More generally, one in two schools report they have programs to encourage environmentally sound purchasing (49%). The other half of American colleges and universities do not (41%) or gave no answer (11%). Public colleges and universities (56%) are more likely than private schools (42%) to have programs that encourage environmentally sound purchasing.

Lab experiments are another area for conservation. A large minority (43%) of schools have programs in place in all or some campus units to encourage lab courses to implement micro-scale experiments that consume milliliters rather than liters. This practice is more prevalent among the largest colleges (enrollment > 8,000) than it is among those with fewer than 1,000 students.

Colleges and Universities That Take Lead in Recycling Efforts

Leading Schools for Recycling, Solid Waste, and Materials Flow

(Schools listed alphabetically)

Bard College

Barstow College

Brown University

California State University-San Marcos

Colorado State University

Dartmouth College

East Carolina University
Georgia Institute of Technology
Humboldt State University
Kaskaskia College
Lenoir Community College
Medical College of Wisconsin
Miami University (Ohio)
Middlebury College
Northwest Missouri State
Princeton University
University of Colorado at Boulder
University of Maine at Augusta
University of Nebraska at Omaha
University of Oregon
University of South Carolina-Columbia
University of Vermont
Warren Wilson College

Most colleges and universities across the country are taking giant steps in recycling the various sources of waste that they produce, but there is a group of schools that truly stand out above the rest. They collect virtually all solid wastes for recycling, including paper, food scraps, plastic, and corrugated cardboard. Moreover, most of these elite schools have a materials exchange program and programs in place to encourage environmentally sound purchasing, reduce the need for paper hard copies, and encourage lab courses to implement micro-scale experiments that will consume milliliters rather than liters. Many of these schools also specify that office paper purchased must contain a minimum 25 percent post-consumer waste and also have chlorine-free requirements for office paper. Of the eight recyclable goods and six environmental programs, the top recycling schools have undertaken at least twelve of these.

Leading Schools for Doing More w/ Recycling, Solid Waste, and Materials Flow

(Schools listed alphabetically)

Albany State University
Alvernia College
Ball State University
Barstow College
Bethany College
Catholic University
Johns Hopkins University
Massachusetts Institute of Technology
Mercer County Community College
Princeton University
Reed College
Saint Peter's College
Salish Kootenai College
SUNY-Potsdam
University of Oregon
University of South Carolina-Spartanburg
University of Texas at Arlington
University of Texas Medical Branch-Galveston
Washburn University of Topeka
Westfield State College

There are other colleges and universities that should also be noted here, not just for their current recycling efforts, but for their future plans to do more recycling. Some of these schools already have strong recycling programs and would just like to improve upon them, while others are just beginning to seriously undertake recycling efforts. As was the case with the schools that currently have recycling, material exchange, and environmentally sound purchasing programs, these colleges and universities are big and small in size and are located across the US. Most of these colleges are four-year schools, although there are some two-year schools in this group, as well.

Leading Schools for Recycling 60% or More of Their Total Municipal Waste Generated (Schools listed alphabetically)

Bainbridge College
Ball State University
Bard College
Bates College
Bridgewater State College
Cardinal Stritch University
Chippewa Valley Technical College
Emperor's College of Traditional Oriental Medicine
Henderson Community College
John Brown University
Kaskaskia College
Miami University
Middlebury College
Mt. Hood Community College
Portland Community College
Reconstructionist Rabbinical College
Texas Christian University
Texas Tech University
The University of Maine at Augusta
United Theological Seminary of the Twin Cities
University of Idaho
Waycross College

Finally, a select group of schools report that they recycle or compost a large percentage, 60 or more, of the total waste generated. The schools listed vary in size, include both public and private campuses, two- and four-year schools, and are located throughout the country.

Landscaping and Grounds

Percentage of Schools with Landscaping and Grounds Programs

Integrated Pest Management	60%
Native Landscaping	51
Food and Shelter to Attract Wildlife	37
Habitat Restoration	36
Identification and Removal of Exotic Species	29

Colleges and universities have undertaken numerous landscaping and grounds programs with varying levels of frequency. Integrated pest management tops the list of grounds programs, and is the only program present in a clear majority of schools. Sixty percent have implemented integrated pest management in all or some campus units. Another half (51%) have implemented native landscaping programs in all or some campus units.

Proportion of Land That is Protected and Agricultural/Horticultural

Protected

None	40%
1%-20%	15
21%-50%	10
More than 50%	10
Unknown/Not sure/No answer	28
Mean percentage	17%
Mean acres of land	99

Agricultural and Horticultural

None	45%
1%-20%	12
21%-50%	13
More than 50%	6

Unknown/Not sure/No answer	28
Mean percentage	13%
Mean acres of land	127

Although not quite as prevalent as pest management and native landscaping programs, a significant minority of colleges and universities have established other programs as well. Slightly less than four in 10 have programs to provide food and shelter to attract wildlife (37%) and to restore the natural habitats on their campuses (36%). Another three in 10 (29%) have implemented programs to identify and remove invasive exotic species.

Rural and small-town schools have done more than city and suburban ones to provide food and shelter to attract wildlife, while large schools have done more than smaller ones to restore natural habitats and remove exotic species from the campus. Midwestern colleges and universities lag behind in promoting integrated pest management and native landscaping programs.

Schools were asked about the kinds of land they have and about the environmental management of those grounds. Our findings show that colleges and universities have chosen to protect a great deal of land that they own. A third (35%) have at least some protected land, with one in 10 (10%) reporting that half or more of their land is protected. Another two in 10 (25%) report that less than half of their land is protected. Three in 10 (28%) facilities chiefs are not sure how much campus land is protected or gave no answer. On average, schools protect 99 acres of land, which amounts to 17 percent of their total land.

Turning to the percentage of total land that is agricultural or horticultural, 45 percent report that they have no agricultural or horticultural land at all. Three in 10 (31%) have land that is agricultural or horticultural. One in four (25%) report that half or less of their total land is agricultural-horticultural land, while 6 percent reserve more than half of their land for agriculture or horticulture. Three in 10 (28%) schools are not sure how much land is agricultural or horticultural or gave no answer.

Colleges and Universities That Take the Lead in Landscaping and Grounds Programs

Leading Schools for Land and Grounds Management Programs

(Schools listed alphabetically)

Bethany College
Florida Gulf Coast University
Lackawanna Junior College
Mt. Hood Community College
Northwest Missouri State University
Norwich University
Pepperdine University
Portland Community College
Reed College
Saint Olaf College
University of California-Berkeley
University of Nebraska at Omaha
University of North Carolina at Asheville
University of Oregon
Villanova University

There is a group of schools that stand out from the rest with regard to landscaping and grounds management programs. They have implemented all of the five types of programs discussed above—habitat restoration, native landscaping programs, identification and removal of invasive exotic species, integrated pest management, and programs to provide food and shelter to attract wildlife. Located throughout the US, this group consists of four-year and two-year colleges and universities, and campuses of various sizes. Three of these schools are located in Oregon, indicating a particularly strong commitment coming from our 33rd state.

Leading Schools for Doing More w/ Land and Grounds Management Programs (Schools listed alphabetically)

Bethany College
 Denison University
 Mercer County Community College
 George Fox University
 Purdue University North Central Campus
 Reed College
 Saint Olaf College
 United States Naval Academy
 University of South Carolina-Columbia

Other colleges and universities stand out for their commitment to future plans for improving their land management from an environmental perspective. Some of these schools have already taken significant steps toward environmentally-focused land management. Again, this group is diverse in terms of size, location, and types of degrees that undergraduates can pursue.

Transportation

Percentage of Schools with Transportation Programs

	CURRENT	FUTURE
Adequate and protected bicycle racks	59%	5
Free or discounted bus passes to students	23	2
Free or discounted bus passes to faculty and staff	19	2
Carpooling program	17	3
Incentives not to drive alone	13	2

Transportation is an area where campuses are doing somewhat less to protect the environment. While a majority (59%) of schools offer adequate bike racks, beyond this basic transportation program many schools fall short. Still, promotion of mass transit through free or discounted bus passes for students (23%) and employees (19%), a carpooling program (17%), or incentives not to drive alone (13%) are offered at a significant minority of colleges and universities. Although a solid number have established environment-friendly transportation programs, few schools plan to do more to promote mass transit in the future. Most likely because transportation programs are most necessary at larger colleges and universities, schools with enrollment of 8,000 or higher are far more likely than smaller ones to have established each of these programs.

Use of Alternative Fuels in Fleet Vehicles on Campus⁵

	TOTAL	2-YEAR DEGREE	4-YEAR DEGREE
Do not use alternative fuels	80%	92	75
Use alternative fuels in some vehicles			
< 10% of vehicles	13	3	17
10% or more of vehicles	7	5	9

Use of alternative fuels follows the same pattern. Among colleges and universities that answered the question, 80 percent say that none of their fleet vehicles use alternative fuels. Two in 10 (20%) use alternative fuel in at least some of their fleet vehicles. Again, this practice is more prevalent among larger rather than smaller colleges and universities, in four-year as opposed to two-year schools, and is also more prevalent among schools in the West than schools in the Midwest or South.

⁵ Percentages are only for schools that answered question on alternative fuels.

Colleges That Lead the Way on Transportation Programs

Leading Schools for Transportation Programs (Schools listed alphabetically)

Colorado State University
Georgia Institute of Technology
Humboldt State University
Massachusetts Institute of Technology
Mt. Hood Community College
Ohio State University
Reed College
Seattle Central Community College
South Puget Sound Community College
Southern Illinois University at Edwardsville
University of Colorado at Boulder
University of Minnesota-Twin Cities
University of Portland
University of Texas Medical Branch-Galveston
University of Vermont

There is a group of colleges and universities that stand above the rest with regard to their transportation programs and policies. These schools have shown a dedication toward promoting environment-friendly transportation by establishing most of the following programs—providing adequate bicycle racks, free or discounted bus passes for students, faculty and staff, establishing a carpooling program, and creating incentives for members of the community to not drive alone. Moreover, most of these schools own at least some fleet vehicles that operate on alternative fuels. Many of these schools are located in the West, three again coming from Oregon, although this group has representation across the country.

Background Information on Consumption

Transportation

Parking Spaces Provided for Student, Faculty, or Staff Parking⁶

400 spaces or less	20%
401—800 spaces	23
801—1,500 spaces	23
1,501—3,000 spaces	16
3,001—5,000 spaces	9
More than 5,000 spaces	10
Mean number of parking spaces	3,093
Median number of parking spaces	938

Colleges and universities were asked about the number of parking spaces they offer and about the average commute in miles. Among schools that responded to the parking space question, two in 10 (20%) have 400 spaces or less, one in four (23%) have between 401 and 800 parking spaces, and another 23 percent have between 801 and 1,500 spaces. One in four (25%) have between 1,501 and 5,000 parking spaces, while 10 percent have more than 5,000 spaces. Four in 10 (38%) did not respond to this question.

Average Commute of Students, Faculty, and Staff Who Drive to Campus⁷

5 miles or less	14%
6—10 miles	35
11—15 miles	22
16—25 miles	20
More than 25 miles	9
Mean commuting distance (in miles)	16
Median commuting distance (in miles)	12

⁶ Percentages are only for schools that answered the question on the number of parking spaces (n=208; 54 from 2-year schools and 154 from 4-year schools).

⁷ Percentages are only for schools that answered the question on the average commute (n=179; 47 from 2-year schools and 132 from 4-year schools).

Total Municipal Solid Waste Generated in 1999⁸

	TOTAL	2-YEAR DEGREE	4-YEAR DEGREE
50 short tons or less	37%	53	26
51—200 short tons	19	33	11
201—1,000 short tons	21	11	28
More than 1,000 short tons	23	3	36
Mean short tons	1,773	351	2,691
Median short tons	150	50	452

For the most part, students, faculty, and staff do not have a very long commute to get to campus each day. Among colleges and universities that answered this question, half (49%) said the average commute for students, faculty and staff who drive to campus was no more than 10 miles. In another four in 10 (42%) the average commute is between 11 and 25 miles, while one in 10 (9%) have an average student and employee commute of more than 25 miles. Nearly half (47%) of all respondents did not answer this question. The mean commuting distance is 16 miles, and the median is 12.

Solid Waste

Chiefs of facilities or plant operations were asked about the total municipal solid waste (product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, batteries) generated on their campus in 1999. Like many of the other open-ended questions from the survey, nearly half (45%) of all schools did not answer the question. Among those that responded, nearly four in 10 (37%) generated 50 short tons of municipal solid waste or less in 1999, with another four in 10 (40%) generating between 51 and 1,000 short tons of waste, and 23 percent generating more than 1,000 short tons of municipal solid waste. The mean amount of waste totaled 1,773 short tons, while the median equaled 150 short tons. In other words, the 165 colleges and universities that responded to this question generated a total of 292,545 short tons of municipal solid waste. Not surprisingly, waste varied by the size of the school with larger schools reporting more waste generated on their campus than smaller schools, and four-year colleges and universities producing vastly more waste than two-year colleges.

Per capita, waste also varies among different campuses. For each student, faculty, and staff member, colleges and universities generate a mean of 1.17 short tons and a median of .08 short tons of municipal solid waste. Students and employees of four-year schools generate greater amounts of waste per capita

⁸ Percentages are only for schools that answered the question on municipal solid waste consumption (n=165; 46 from 2-year schools and 119 from 4-year schools).

than those at two-year schools, while those in the Midwest produce far greater waste per capita than those in the East, South, or West.

Water Use

Water Use on College Campuses⁹

	TOTAL	2-YEAR DEGREE	4-YEAR DEGREE
5 million gallons or less	31%	67	31
5—20 million gallons	18	20	18
20—80 million gallons	27	10	27
80+ million gallons	25	3	25
Mean gallons (millions)	27.0	9.8	27.0
Median gallons (millions)	16.1	4.8	16.1
Mean per capita use	14,671	3,821	14,671
Median per capita use	6,411	1,000	6,411

Schools with the Lowest Per Capita and Per Square Foot Water Use

(Schools listed alphabetically)

- California State Polytechnic University-Pomona
- Community College of Allegheny County-Boyce
- Emory University
- Kent State University Main Campus
- Massachusetts College of Liberal Arts
- Pace University-White Plains Campus
- Pensacola Junior College
- Saint Louis University
- State University of New York Albany
- Sul Ross State University
- University of Kansas Main Campus
- University of South Carolina-Aiken

⁹ Percentages only for schools that answered question on the amount of water consumed (n=134; 27 from 2-year schools and 107 from 4-year schools; 83 from public schools and 51 from private schools).

Our nation's colleges and universities use a great deal of water, even as many of them are trying to conserve one of our planet's most essential resources. Conserving water can reduce energy consumption and costs since most schools get charged three times: to purchase the water, to heat the water, and to discharge it to the sewer system. On average, each school used 27 million gallons of water in 1999. The median amount of use equaled 16.1 million gallons. Among those that responded to the question, half (49%) used 20 million gallons of water or less, one in four (27%) used between 20 million and 80 million gallons, and 25 percent used more than 80 million gallons of water. More than six in 10 (63%) gave no answer or did not know how much water their campuses used.

Thinking of water use in terms of how much each campus used can be a bit daunting. What does it really mean for a campus to use 27 million gallons of water? Surely the answer differs with regard to the physical size of the campus and the number of people it holds. Five million gallons for a 20-acre campus with 500 students is very different than five million gallons for a 2,000-acre campus with 30,000 students.

Therefore, we calculated the amount of water used per student, faculty, and staff member, and the amount used per square foot of campus land.

We find that colleges and universities use a large amount of water per person, and per square foot each year. The average per capita use of water in 1999 totaled 14,671 gallons, with a median of 6,411 gallons. Among schools that responded to the water use question, four in 10 (43%) used less than 5,000 gallons of water per capita, one in three (32%) used between 5,000 and 14,999 gallons per student or employee, and 25 percent used 15,000 gallons or more per capita. Average residential use is 90 gallons per capita per day. Probably due to economies of scale, average use on campuses is a bit less than residential use, roughly between 40 and 54 gallons per person per day depending upon the length of the school year.

When analyzed by area rather than by person, we find that in 1999, schools used an average of 9.6 gallons of water per square foot of campus space and a median of 2.1 gallons. Among those that responded to the water use question, one in three (35%) use less than one gallon of water per square foot of campus space, another one in three (31%) between one and five gallons of water per square foot of campus space, and the final third (34%) more than five gallons of water per square foot of campus space.

Per capita water use differs across demographic groups. Four-year schools (mean=18,653) use far more gallons of water per student and employee than two-year colleges (mean=3,821). This disparity might be expected since students at four-year schools are far more likely than those at two-year colleges to live on campus. On average, private colleges and universities use nearly twice as much water per capita than public ones (20,024 vs. 11,319 gallons).

Electricity and Natural Gas

Colleges and universities were also asked about their consumption of electricity and natural gas in 1999. With a mean of 44.6 million kilowatt hours (KWHs) of electricity and a median of 11.0 million KWHs, it is clear that colleges are a major consumer of electricity. Again, six in 10 (60%) did not respond to this question. But among those that did respond to the electricity question, one in four (27%) used 4 million or fewer kilowatt hours of electricity in 1999. Another one in four (24%) consumed between 4 million and 50 million kilowatt hours, 28 percent used 10 million to 50 million KWHs, and one in five (21%) consumed more than 50 million KWHs.

Electricity Consumption on College Campuses¹⁰

	TOTAL	2-YEAR DEGREE	4-YEAR DEGREE
<4 million kilowatt hours	27%	52	17
4—10 million KWHs	24	35	19
10—50 million KWHs	28	11	35
50+ million KWHs	21	3	29
Mean KWHs (millions)	44.6	13.5	44.6
Median KWHs (millions)	11.0	4.7	11.0
Mean per capita KWHs	12,673	1,602	17,288
Median per capita KWHs	2,986	925	3,733

It is also useful to understand how much electricity schools consume per student, faculty, and staff member. On average, colleges consumed 12,673 kilowatt hours of electricity per student, faculty, and staff member in 1999, with median per capita consumption totaling 2,986 KWHs. Among colleges and universities that responded to the electricity consumption question, one in five (22%) consumed 1,000 or fewer KWHs per capita, three in 10 (29%) consumed between 1,000 and 3,000 KWHs, 29 percent consumed between 3,000 and 5,000 KWHs, and 21 percent consumed more than 5,000 KWHs per capita. As with other consumption and use patterns, four-year schools consume far more electricity than two-year schools, both overall and per capita.

¹⁰ Percentages only for schools that answered question on the amount of electricity consumed (n=142; 32 from 2-year schools and 110 from 4-year schools).

Natural Gas Consumption on College Campuses¹¹

	TOTAL	2-YEAR DEGREE	4-YEAR DEGREE
< 10K MCFs	36%	50	31
10K—80K MCFs	20	17	21
80K—200K MCFs	20	21	19
200K + MCFs	24	12	28
Mean MCFs (000s)	486.5	83.3	652.61
Median MCFs (000s)	93.1	67.4	103.9
Mean per capita MCFs	619	18	865
Median per capita MCFs	10	4	14

Natural gas consumption varies greatly across college and university campuses. Whereas all schools use large quantities of electricity, a large number did not consume any natural gas in 1999, and among those that did there is a great deal of variability. This is evident in the huge difference between the mean (486,000 MCFs) and the median (93,000 MCFs) natural gas consumption levels. The distribution is positively skewed, with many schools consuming little or no natural gas, and others consuming huge quantities. Again, six in 10 (61%) did not respond to this question. Among those that answered the question, 36 percent used 10,000 or fewer MCFs, two in 10 (20%) used between 10,001 and 80,000 MCFs, 20 percent consumed 80,000-200,000 MCFs, and 24 percent used more than 200,000.

Per capita natural gas consumption varies tremendously across college and university campuses, which is once again evident with the disparity between the mean and median levels. Mean natural gas consumption per student, faculty, and staff totals 619.4 MCFs, but the median is just 10.1 MCFs. Among the schools that answered the natural gas consumption question, three in 10 (29%) used less than one MCF per student, faculty, and staff member in 1999. Two in 10 (20%) used between one and 10 MCFs of natural gas per capita, one in four (25%) consumed between 10 and 30, and 26 percent consumed 30 or more MCFs of natural gas per capita. Consumption varies tremendously between two- and four-year schools.

¹¹ Percentages only for schools that answered question on the amount of natural gas consumed (n=140; 29 from 2-year schools and 111 from 4-year schools).

Fuel, Fuel Oil, Propane, Coal, Steam/Hot/Chilled Water, and Firewood

Consumption of Other Sources of Energy

Percentage of colleges that consumed each source of energy in 1999.¹²

	TOTAL	2-YEAR DEGREE	4-YEAR DEGREE
Gasoline or diesel fuel	93%	87	96
Fuel oil	43	20	57
Propane	28	25	30
Coal	9	0	15
Purchased steam or hot water	4	0	6
Firewood	2	0	4
Purchased chilled water	1	0	2

Aside from water, electricity, and natural gas, schools also consume a number of other sources of energy. We asked specifically about seven different kinds of energy sources and found a wide range of consumption patterns. As was the case for virtually all open-ended energy questions, approximately six in 10 respondents did not answer the various questions. Among those schools that did respond, virtually all (93%) used gasoline or diesel fuel in 1999, while less than a handful consumed purchased steam or hot water (4%), purchased chilled water (1%), or firewood (2%). Consumption patterns of other energy sources were less extreme, with four in 10 (43%) reporting consumption of fuel oil and three in 10 (28%) reporting propane consumption. One in 10 (9%) consumed coal in 1999.

With different needs for their campuses, colleges and universities consume gasoline or diesel fuel at varying levels. Two in 10 (18%) schools used less than 3,000 gallons of gasoline or diesel fuel in 1999, and an equal amount (20%) used between 3,000 and 9,999 gallons. Another one in three (33%) consumed 10,000-29,999 gallons of gasoline or diesel fuel in 1999, while 22 percent used 30,000 gallons or more. Just 7 percent did not use gasoline or diesel fuel in 1999. On average, colleges and universities consumed 29,287 gallons of gasoline or diesel fuel in 1999, while the median consumption level was 10,346 gallons. The largest schools (enrollment 8,000) consumed more gasoline and diesel fuel than smaller schools.

¹² Percentages reported only for colleges that responded to each question.

Consumption of fuel oil is not as common on college and university campuses as gasoline use, but there are many schools using fuel oil. Similar to gasoline and diesel fuel consumption, schools use varying amounts of fuel oil. In 1999, nearly two in 10 (17%) used some fuel oil, but less than 10,000 gallons, while 11 percent used between 10,000 and 99,999 gallons of fuel oil. Another 16 percent consumed 100,000 gallons of fuel oil or more. Slightly more than half (57%) of colleges did not use fuel oil in 1999. Colleges and universities consumed an average of 107,007 gallons of fuel oil in 1999.

Schools are even less likely to have used propane, but still a considerable minority of schools utilizes this energy source. Sixteen percent of colleges and universities consumed some propane in 1999, but less than 1,000 gallons, while 13 percent used 1,000 gallons or more. Seven in 10 (72%) schools did not consume any propane in 1999. On average, schools used 1,412 gallons of propane. If we limit the analysis to only those that used propane, this average jumps to 4,978 gallons, with a median of 677.

Per capita consumption of gasoline, fuel oil, and propane also vary greatly among colleges and universities. One in four (27%) consumed less than one gallon of gasoline per student, faculty, and staff member in 1999. Another 16 percent consumed between one and two gallons of gasoline per capita, while one in four (23%) consumed between two and five gallons. A third (33%) consumed five or more gallons of gasoline per capita. The mean per capita consumption equaled 6.1 gallons, while the median totaled 2.8 gallons.

Although fewer schools used fuel oil than gasoline, per capita fuel oil consumption is actually higher. Six in 10 (57%) schools did not use fuel oil in 1999, but the average per capita consumption was 19.5 gallons. In fact, if we just examine the averages for schools that consumed fuel oil, we find that the mean per capita consumption totaled 46.6 gallons. The median per capita consumption for schools that used fuel oil was just 4.7 gallons in 1999, suggesting that most schools did not consume very much fuel oil, but that there was a group that used a great deal of this resource. Per capita consumption of propane was far lower, with 14 percent having used .20 gallons of propane per capita in 1999, and 11 percent having consumed more than .20 gallons of propane. Mean per capita consumption was .39, while the mean per capita consumption only for those schools that used propane totaled 1.5 gallons.

When comparing consumption patterns at two- and four-year schools, two-year schools reported using predominantly gasoline or diesel fuel. About two in 10 said they use propane or fuel oil. None of the two-year schools claimed to use coal, firewood, purchased steam or hot water, or purchased chilled water. Four-year schools had a greater diversity of fuel types used, but used predominantly gasoline or diesel fuel and fuel oil. Smaller percentages reported used propane (30%), coal (15%), purchased steam or hot water (6%), firewood (4%), and purchased chilled water (2%).

Electricity (Co)Generated

A small group of colleges and universities generate at least some of the electricity that their campuses consume. Among those that answered the question, one in 10 (9%) say they generated at least some electricity in 1999, while 91 percent did not generate electricity. Half of all schools (52%) did not respond to this question. If we examine all colleges and universities, including those that did not generate electricity in 1999, we find that schools generated an average of 5.2 million KWHs of electricity in 1999. In fact, if we narrow our analysis to only those schools that generated electricity in 1999, the mean electricity generated equals 55.8 million KWHs with a median of 3.1 million.

Schools were even less likely to produce cogenerated steam or hot water from their campus electrical generators. Just 11 percent of colleges and universities that answered this question produced cogenerated steam or hot water. Eight in 10 (81%) did not respond to this question, so it is difficult to get a good read on what campuses are doing with regard to producing cogenerated steam or hot water. On average, colleges and universities produced 32.0 billion BTUs of cogenerated steam. And if we consider only those schools that produced cogenerated steam or hot water in 1999, they produced a mean of 284.5 billion BTUs and a median of 3.3 billion BTUs.

Total Area of Heated and/or Air Conditioned Buildings on Campus¹³

200,000 square feet or less	18%
200,001—400,000 square feet	23
400,001—600,000 square feet	14
600,001—1,000,000 square feet	15
1,000,001—2,000,000 square feet	16
More than 2 million square feet	14
Mean square footage (in millions)	1.33
Median square footage (in millions)	.55

Even a quick look at the heating and cooling demands of schools shows just how much energy they consume in order to cover their campuses' needs. Looking at colleges and universities that answered the question, we find that a full 30 percent of schools have more than one million square feet of heated and/or air conditioned buildings on their campuses. Another three in 10 (29%) have between 400,000 and 1 million square feet of building space that is heated and/or air conditioned, while 41 percent of

¹³ Percentages reported only for colleges that responded to gross square footage question (n=237; 63 from 2-year schools and 174 from 4-year schools).

schools have 400,000 or fewer square feet of heated and/or air-conditioned buildings on campus. On average, campuses have 1.3 million square feet of building that is heated and/or air-conditioned. The median amount of campus space equals 550,000 square feet. As one might expect, larger schools had more building space that was heated or air conditioned than smaller ones, while four-year schools had more square feet of heated and/or air conditioned buildings than two-year ones. Three in 10 (28%) did not respond to this question.

Open-ended Questions Yield Low Response Rate

One consistent finding from the analysis of facilities and operations officers is that, for the most part, a large portion of respondents did not answer the open-ended questions. Whether the question concerned municipal solid waste generated on campus, the number of heating or cooling days, or the amount of water used, many, if not most, colleges did not respond to the question. There are several possibilities for why this might happen, and these should have implications for future research in this area.

As is the case with any other survey, there is always the possibility that some of the respondents simply did not want to disclose certain information. But it is unlikely that this is the major cause of the high rate of “no answers” for the facilities and operations questionnaire because regular close-ended questions had much lower refusals (10%). Moreover , for the most basic open-ended question of how much total land area the campus included, just 15 percent gave no answer.

Therefore, it is more likely that the problem rests somewhat with the questions that were asked or, more specifically, with the kind of information that we asked chiefs of facilities or plant operations to provide in the survey. There are two potential problems that might have happened that pertain to the type of information we asked for. First, many of the open-ended questions asked schools to provide very detailed information that nobody would know without investigating. It is highly unlikely that the chiefs of facilities or plant operations knew offhand how many kilowatt hours of electricity their campuses consumed or the gallons of water that the campus used in 1999. We knew going into this project that we would be interviewing very busy people, and although this questionnaire could be done in pieces, some respondents probably decided not to research the answers to these open-ended questions.

While non-response for the above reason is cause for concern, another important issue might be at stake, as well. Some respondents might not have all of this data available to them, or they did not entirely understand what we were asking for. Do all schools keep records on the number of heating and cooling days, MCFs of natural gas, or gallons of gasoline that are consumed annually? It is likely that while some excel in keeping records on their energy, waste, and landscaping activities, others do not.

Assuming that poor records and data gathering are at least part of the problem, this provides a unique and important opportunity for the National Wildlife Federation. Because these issues are so important, it is essential that colleges and universities understand why they should keep better records on their environmental practices. Perhaps NWF can take steps toward providing schools with assistance towards improving how they collect information and process data on energy consumption, waste management, and landscaping practices.