Go-Green Measurement & Analysis: Measure, Monitor, Benchmark

Millersville University
May 10, 2010
**Sightlines Members**
- Sightlines works with more than 220 institutions
- Sightlines works with institutions in over 34 states and the District of Columbia

**Go-Green Measurement and Analysis Members**
- Sightlines has more than 50 Members
- Approximately 1/3 are public
- More than 1/2 have signed the ACUPCC
- More than 40% are Charter Signatories of the ACUPCC

**Data Collection and Member Web site**
- Go-Green Measurement and Analysis collects over 20 pieces of data in 8 categories
- Go-Green Measurement and Analysis now delivers nearly 70 benchmark charts
Simplifying the Types of GHG Emissions
All Expressed as Metric Tons of Carbon Dioxide

Scope 1: Emissions from the direct activities of the campus
Scope 2: Emissions from utility production not at the institution
Scope 3: Indirect emissions including transportation, waste disposal, etc.

This slide courtesy of CA-CP
## Contextualizing MTCDEs

### What is a Metric Ton of Carbon Dioxide Equivalent?

<table>
<thead>
<tr>
<th>MTCDE</th>
<th>Commodity Used</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 MTCDE</td>
<td>190 CCFs of Natural Gas</td>
<td>Heating a home for three months</td>
</tr>
<tr>
<td>1 MTCDE</td>
<td>1,651 kWh (national average)</td>
<td>Powering a 60W equivalent CFL for 117,929 hours</td>
</tr>
<tr>
<td>1 MTCDE</td>
<td>112 Gallons of Gasoline</td>
<td>Driving 2,475 miles by car</td>
</tr>
</tbody>
</table>
### Collected Carbon Emissions at Millersville

<table>
<thead>
<tr>
<th>Scope 1</th>
<th>Scope 2</th>
<th>Scope 3</th>
<th>Offsets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fossil Fuel: Natural Gas and Oil</td>
<td>Purchased Electricity</td>
<td>Student Commuting: zip code data</td>
<td>Green Power REC’s at 10% of total electricity purchased, consistent with all PASSHE institutions</td>
</tr>
<tr>
<td>Vehicle Fleet</td>
<td></td>
<td>Faculty &amp; Staff Commuting: survey</td>
<td></td>
</tr>
<tr>
<td>Refrigerants</td>
<td></td>
<td>Study Abroad Air Travel</td>
<td></td>
</tr>
<tr>
<td>Fertilizer</td>
<td></td>
<td>Faculty &amp; Staff Financed Air Travel</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wastewater</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paper</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Solid Waste</td>
<td></td>
</tr>
</tbody>
</table>

**Offsets**
- Green Power REC’s at 10% of total electricity purchased, consistent with all PASSHE institutions
Total Carbon Emissions: 38,912 MTCDE in FY09

Electricity consumption is responsible for 66% of emissions.

### Carbon Emissions by Type

- Commute: 20%
- Electricity: 60%
- Study Abroad: 3%
- Air Travel: 4%
- T&D Losses: 6%
- Wastewater: 0%
- Paper: 0%
- On-Campus Stationary: 4%
- Vehicle Fleet: 1%
- Refrigerants: 2%
- Agriculture: 0%

### Carbon Emissions by Scope

- **Scope 1 Emissions**
- **Scope 2 Emissions**
- **Scope 3 Emissions**
## Longitudinal Performance

5% emission increase in 5 years despite consistent GSF

<table>
<thead>
<tr>
<th>Year-to-year Emission Changes:</th>
<th>+2.2%</th>
<th>-2.0%</th>
<th>+1.9%</th>
<th>+4.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
<td>FY2005</td>
<td>FY2006</td>
<td>FY2007</td>
<td>FY2008</td>
</tr>
<tr>
<td><strong>MTCEDE</strong></td>
<td>11,427</td>
<td>11,821</td>
<td>11,841</td>
<td>11,933</td>
</tr>
<tr>
<td><strong>GSF In Millions</strong></td>
<td>23,388</td>
<td>22,846</td>
<td>22,631</td>
<td>23,138</td>
</tr>
<tr>
<td><strong>Scope 1</strong></td>
<td>1,663</td>
<td>2,596</td>
<td>2,047</td>
<td>2,134</td>
</tr>
<tr>
<td><strong>Scope 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Scope 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total GSF</strong></td>
<td>1,973,693</td>
<td>1,983,659</td>
<td>1,988,545</td>
<td>1,988,545</td>
</tr>
</tbody>
</table>

*Graph showing year-to-year emission changes and GSF emissions from FY2005 to FY2009.*
Longitudinal Performance
Increase in campus population effects Scope 3

Year-to-year Population Changes:
- FY2005: -1.1%
- FY2006: +3.2%
- FY2007: +1.2%
- FY2008: +0.4%

Year-to-year Emission Changes:
- FY2005: +2.2%
- FY2006: -2.0%
- FY2007: +1.9%
- FY2008: +4.5%

MTCDE

<table>
<thead>
<tr>
<th>Year</th>
<th>Scope 3</th>
<th>Scope 2</th>
<th>Scope 1</th>
<th>Headcount</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY2005</td>
<td>11,427</td>
<td>23,388</td>
<td>1,663</td>
<td>9,081</td>
</tr>
<tr>
<td>FY2006</td>
<td>11,821</td>
<td>22,846</td>
<td>2,596</td>
<td>8,985</td>
</tr>
<tr>
<td>FY2007</td>
<td>11,841</td>
<td>22,631</td>
<td>2,047</td>
<td>9,269</td>
</tr>
<tr>
<td>FY2008</td>
<td>11,933</td>
<td>23,138</td>
<td>2,134</td>
<td>9,383</td>
</tr>
<tr>
<td>FY2009</td>
<td>12,811</td>
<td>23,323</td>
<td>2,779</td>
<td>9,420</td>
</tr>
</tbody>
</table>
Go-Green Peer Institutions

- American University
- Bentley University
- Fitchburg State College
- Loyola University Maryland
- Rowan University
- Shippensburg University
- The University of Dayton

Considerations for Peer Group:
- Size
- Climate Zone
- Technical Complexity
- Program
- Campus Setting

Putting Millersville in context with peers
Smaller buildings on campus impact energy consumption

Tech Rating

![Tech Rating Graph](image)

Building Intensity

![Building Intensity Graph](image)

Institutions Ordered By: Density Factor
Go-Green Peer Institutions

- American University
- Bentley University
- Fitchburg State College
- Loyola University Maryland
- Rowan University
- Shippensburg University
- The University of Dayton

Putting Millersville in context with peers

Peer group falls within Climate Zone 2 and 3
Energy consumption increases with tech rating. Millersville’s consumption is below database trend.

**Correlation: Energy Consumption & Tech. Rating**

- **Fossil Consumption:** 29,362 BTU/GSF
- **Electric Consumption:** 77,495 BTU/GSF

![Graph showing correlation between energy consumption and tech rating](image-url)
Emissions per GSF are slightly above peer average. Scope 2 dominates Millersville’s emissions profile.
Key Building Emissions – Millersville University
Total Energy Consumption

Millersville is below peer average; however, consumption is increasing.
Natural gas consumption increased despite steady GSF
Millersville Fuel Usage
Higher emissions per unit of energy when the campus burns oil

MTCDE of Commonly Used Fossil Fuels

- Coal: MTCDE/MMBTU
- Residual Oil: MTCDE/MMBTU
- Distillate Oil: MTCDE/MMBTU
- Propane: MTCDE/MMBTU
- Natural Gas: MTCDE/MMBTU
Emissions from Fossil Fuel

Low utility emissions from fossil because of reliance on electric

Fossil Fuel Carbon Emissions: 1,682 MTCDE
4.3% of ’09 Total
Electricity consumption increasing longitudinally

Consuming electricity at higher levels than peer institutions

**Electricity Consumption**

- **FY2005**
- **FY2006**
- **FY2007**
- **FY2008**
- **FY2009**
Electric Fuel Mix Varies Across the Country
Fuel Mix of electric grid impacts emissions

MTCDE by Grid Operator

T&D Losses | MTCDE/1M kWh
--- | ---
Rockies | 1,200
Nebraska | 1,100
Wisconsin | 1,000
Illinois/Missouri | 900
Northern Plains | 800
Oklahoma | 700
Oahu | 600
Michigan | 500
Ohio Valley | 400
Tennessee Valley | 300
South | 200
Hawaii | 100
Texas | 100
Long Island | 100
Florida | 100
Alaska | 100
Southwest | 100
Vir./Carolina | 100
Mississippi Valley | 100
Mid-Atlantic | 100
New York City | 100
Northwest | 100
New England | 100
California | 100
Upstate New York | 100
Alaska Misc. | 100

Millersville University
Sightlines
Impact of Regional Fuel Mix for Millersville

Assume Highest Carbon

- RMPA
- Millersville (Mid-Atlantic)

Assume Lowest Carbon

- AKMS

National Average
Emissions from purchased electricity

Millersville is highest in the peer group

This graph shows how many emissions are produced for each kWh purchased based on the regional e-grid of each institution. Schools B, C, F, and H are all on the same e-grid as Millersville.

Electric Carbon Emissions: 23,323 MTCDE
60% of ’09 Total
• Only a few peers purchase RECs; however, Millersville benefits from the state government mandate
Mitigating Electricity
Analyzing the impact of using electric heat

Emissions per each unit of Energy

MTCDE/ MMBTU

Coal | Residual Oil | Distillate Oil | Propane | Natural Gas | Electric

Millersville University
Total Emissions from Energy Consumption
Millersville is slightly above peer average
Other Contributing Emissions
Summary of ancillary climate emissions
Scope 3 emissions represent 33% of total emissions

<table>
<thead>
<tr>
<th>Emissions Source</th>
<th>FY09 Total MTCDE</th>
<th>Percent of FY09 Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Commuting</td>
<td>5,696</td>
<td>14.6%</td>
</tr>
<tr>
<td>Scope 2 T&amp;D Losses</td>
<td>2,307</td>
<td>5.9%</td>
</tr>
<tr>
<td>Faculty/ Staff Commuting</td>
<td>1,981</td>
<td>5.1%</td>
</tr>
<tr>
<td>Directly Financed Air Travel</td>
<td>1,505</td>
<td>3.9%</td>
</tr>
<tr>
<td>Study Abroad Air Travel</td>
<td>1,214</td>
<td>3.1%</td>
</tr>
<tr>
<td>Paper</td>
<td>95</td>
<td>0.2%</td>
</tr>
<tr>
<td>Wastewater</td>
<td>24</td>
<td>0.1%</td>
</tr>
<tr>
<td>Solid Waste</td>
<td>(11)</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>Scope 3 TOTAL</strong></td>
<td><strong>12,811</strong></td>
<td><strong>32.9%</strong></td>
</tr>
</tbody>
</table>

Commuting = 20%
Air Travel = 7%
Components of Scope 3

Carbon Emissions by Scope

- Scope 1: 7.3%
- Scope 2: 59.9%
- Scope 3: 32.9%

Scope 3 Components

- Study Abroad: 9%
- Directly Financed Air Travel: 12%
- Wastewater: 0%
- Paper: 1%
- Commuting: 60%
- Staff: 17%
- Faculty: 9%
- Students: 74%

Commuting

- Staff: 17%
- Faculty: 9%
- Students: 74%
- Commuting: 60%
Majority of University employees drive to campus

How Often?
During a typical academic calendar week, how many roundtrips do you make to and from campus?

What Method?
What is your primary mode of transportation?

How Far?

<table>
<thead>
<tr>
<th></th>
<th>Average Trip Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff</td>
<td>10.4 miles</td>
</tr>
<tr>
<td>Faculty</td>
<td>8.9 miles</td>
</tr>
</tbody>
</table>

% who Drive to Campus (not including carpool)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff</td>
<td>90%</td>
</tr>
<tr>
<td>Faculty</td>
<td>84%</td>
</tr>
</tbody>
</table>

Avoided Emissions: 807 MTCDE Equivalent to 90,794 gallons of gas
What is the primary reason you do not use alternative transportation?

- Not convenient where I live (50%)
- I carry too much (6%)
- Lengthens my day too much (16%)
- Personal reasons (9%)
- Other (19%)

Summary of “Other”
- I work odd hours and the bus service does not run late into the night
- No one wants to ride the bus coming from work
- Mass transit is not near my house
- I take classes or have a second job so the schedule is not conducive
- No desire
- Not available where I live
- Need a vehicle for off-campus appointments
- Laziness
- I do errands before and after work
- My schedule fluctuates
- Do not carpool because schedules of co-workers do not match
- Too much traffic to bike to work, would love if there are dedicated cycling lanes
- Do not bike because no convenient facility to shower and change
- Would need a secure place to keep bike
- I am too old/do not have stamina/health reasons to bike/walk to work
- Biking is too hazardous
- Do not bike/walk because of weather reasons, or it is dark at end of work day
Encourage the use of electric cars. Set up battery recharging stations outside buildings for faculty/staff to recharge their electric vehicles. Charge the faculty/staff employee the going university rate for electricity. Develop an automatic paycheck deduction process so the cost of recharging ones vehicle comes right off an employees paycheck.

- The University should offer alternative transportation incentives, such as subsidizing bus fares, carpooling costs, bonuses for not driving, etc.
- A parking deck near Lyle; Wickersham and Stayer would alleviate parking issues
- Create shuttle bus to/from Lancaster train station to/from MU campus.
- Perhaps going to a 4 day work week would be beneficial
- A parking lot on the other side of the Conestoga from the MU ‘Bush’ with a pedestrian bridge over the river would be fabulous. It would cut down on the number of cars coming in from the east and south that have to enter campus via 999 or Cottage Ave and deal with both MU and Manor High School traffic. A satellite parking lot like that, if made cheap, would siphon off a good bit of student car traffic, also, judging from the number of students who either park illegally or park on Creek Drive rather than buying a parking permit.
- Dorms, academic departments compete for the least amount of energy or the most amount of recycling. The can win cool prizes provided by cool people( Dr. Mc Nairy) if they win.....Large scale tree planting is needed. Strong environmental messages need to be handed down as priorities from the top, the president’s office. Students, faculty, administrators have non factory farm days in the cafeteria to educate about the pollution associated with industrialized agriculture.
- It should be advertised that our Faculty ID card gives us free travel on the Lancaster - Millersville bus. I took the bus for a year before I found out I didn’t have to pay!
- One option I would be in favor of would be to allow staff the option of working from home for a partial work week thereby reducing travel to work.
- Improve traffic patterns on and around campus to prevent unnecessary circling for parking spaces. Add spaces to compensate for decreased spaces and increased student and administrator numbers; actually, with adjunct faculty there are more faculty vehicles although there has been no increase of full-time faculty numbers. Consider how difficult it is to return to George St. and turn left onto George, all of which has been aggravated by one-way and decreased parking patterns introduced in the last 5 years. The Walking Mall long-range plan was invented when MU had 2,000 fewer students and fewer administrators and adjunct faculty.... Re-plan, please.
- Start a campaign to promote walking/riding bike to campus and offer incentives for those who do use methods of transportation that will cut down on pollution. An incentive could be something like free access to the gym in the SMC. Maybe PBETF could start a larger campaign that would offer health care benefit savings for those who walk or ride bike? Maybe if there was on campus daycare more people could walk to campus with their children? Start a car-pool program so those who live further away could pick up those who aren’t capable of walking on their way in.

- Switch university vehicles (mostly maintenance) to electric.
- This is unrelated to your survey, however I think you should know that some of the housekeeping staff empty the recycling bins into the trash regularly
- Restructure to add parking spaces--especially for faculty--NEAR classroom buildings, in my case, especially Hash which actually LOST spaces.
- Students driving to a different parking lot between classes...bad.
- Faculty & Staff driving to lunch...bad
- Campus should be more bike friendly...there are no bike lanes, narrow windy roads for all traffic, not enough bike racks, no PR for riding bikes. U. Calif. at Davis has 35% of student body biking to class...that is over 7000 students!!!! Why can't MU encourage biking and make parking on the periphery like many other campuses. We are becoming a campus of parking lots...UGLY. Our beautiful campus is really going down hill without the proper plants and maintenance of them. No landscape design whatsoever! No student involvement in campus landscaping. What a waste
- I carpooled for about 8 months and really liked that, but my partner took another job elsewhere...It saved us both money and we chatted the entire way to work. Was real nice!
- It would be great to have a direct shuttle from the Lancaster train station.
- It would be helpful to work 4 day work weeks - less miles on the car, less pollution in the air from driving less, less electricity used , less cost for daycare.
- Environmental impact isn't just about transportation...its also about recycling, re-use, eating locally and vegetarian, environmental design, combining trips when driving, etc....
- We at Millersville are the single least green campus I am aware of. The water in our pond is toxically polluted, and ignored for years. Every year after the students leave in the Spring, we embark on a major tree decimation program, cutting down trees right and left. Students get no encouragement to recycle and control wasteful consumption.
- Our current jobs do not let us have the flex-time to commute. We have tried to commute but our schedules never seem to work together.
- The university should think about whether there are ways to encourage faculty/staff to live close to school.
- It might be worthwhile providing incentives for staff and faculty to form carpools with administrative assistance doing so.
- I'm amazed at how many people who live near campus who don't walk to work. Expenses for gas and automotive maintenance dropped drastically and insurance rates are lower.
- Parking is a nightmare! Instead of worrying about the gas it takes to get to MU, think about the gas it takes to circle endlessly in search of a parking space.
- It would be very helpful if somebody would send a request to the campus community to turn off lights after using classrooms. In many buildings, the lights are left on all day long.
Making an effort to “Go Green”
Recycling efforts on campus
Commuting makes up 60% of Scope 3 Emissions.
Go-Green GHG Summary Benchmarks
## National Benchmark Institutions

<table>
<thead>
<tr>
<th>Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>American University*</td>
</tr>
<tr>
<td>Babson College*</td>
</tr>
<tr>
<td>Bentley University**</td>
</tr>
<tr>
<td>Bowdoin College*</td>
</tr>
<tr>
<td>Carleton College*</td>
</tr>
<tr>
<td>Champlain College</td>
</tr>
<tr>
<td>Clemson University**</td>
</tr>
<tr>
<td>Davidson College</td>
</tr>
<tr>
<td>Eastern Oregon University</td>
</tr>
<tr>
<td>Eckerd College*</td>
</tr>
<tr>
<td>Fitchburg State College**</td>
</tr>
<tr>
<td>Gallaudet University</td>
</tr>
<tr>
<td>George Mason University</td>
</tr>
<tr>
<td>Grinnell College</td>
</tr>
<tr>
<td>Hamilton College**</td>
</tr>
<tr>
<td>Hamline University</td>
</tr>
<tr>
<td>Hampshire College**</td>
</tr>
<tr>
<td>Le Moyne College</td>
</tr>
<tr>
<td>Lewis &amp; Clark College**</td>
</tr>
<tr>
<td>Loyola College in Maryland</td>
</tr>
<tr>
<td>Loyola Marymount University**</td>
</tr>
<tr>
<td>Michigan State University</td>
</tr>
<tr>
<td>Millersville University of PA</td>
</tr>
<tr>
<td>Mount Holyoke College</td>
</tr>
<tr>
<td>Nova Southeastern University</td>
</tr>
<tr>
<td>Oregon Institute of Tech.**</td>
</tr>
<tr>
<td>Oregon State University**</td>
</tr>
<tr>
<td>Rensselaer Polytechnic Institute</td>
</tr>
<tr>
<td>Rowan University**</td>
</tr>
<tr>
<td>Saint Mary’s College of CA</td>
</tr>
<tr>
<td>Santa Clara University*</td>
</tr>
<tr>
<td>Shippensburg University</td>
</tr>
<tr>
<td>Southern Methodist University</td>
</tr>
<tr>
<td>Southern Oregon University**</td>
</tr>
<tr>
<td>St. Lawrence University</td>
</tr>
<tr>
<td>Texas A&amp;M University*</td>
</tr>
<tr>
<td>The Catholic University of America</td>
</tr>
<tr>
<td>The University of Alabama</td>
</tr>
<tr>
<td>The University of Oklahoma**</td>
</tr>
<tr>
<td>University of Arkansas**</td>
</tr>
<tr>
<td>University of Dayton</td>
</tr>
<tr>
<td>University of Denver**</td>
</tr>
<tr>
<td>University of Maryland*</td>
</tr>
<tr>
<td>U Mass – Lowell</td>
</tr>
<tr>
<td>University of Michigan</td>
</tr>
<tr>
<td>University of Notre Dame</td>
</tr>
<tr>
<td>University of Oregon**</td>
</tr>
<tr>
<td>University of Portland**</td>
</tr>
<tr>
<td>University of Redlands**</td>
</tr>
<tr>
<td>University of Sand Diego</td>
</tr>
<tr>
<td>University of San Francisco</td>
</tr>
<tr>
<td>University of the Pacific</td>
</tr>
<tr>
<td>Vassar College</td>
</tr>
<tr>
<td>Virginia Commonwealth University*</td>
</tr>
<tr>
<td>Washington &amp; Lee University *</td>
</tr>
<tr>
<td>Wesleyan University*</td>
</tr>
<tr>
<td>Western Oregon University**</td>
</tr>
<tr>
<td>Williams College</td>
</tr>
</tbody>
</table>

*ACUPCC Signatory
**Charter Signatories of the ACUPCC
Millersville is higher than average because of high electric consumption.
Density of campus impacts emissions
High density is a large contributing factor for Scope 3 emission sources
Providing perspective and moving forward

Actions at the top of the hierarchy are more transformative and lasting in reducing baseline emissions.

Avoid carbon-intensive activities

Improve operational efficiency

Fuel switching

Offset unavoidable emissions

Source: ACUPCC Voluntary Carbon Offset Protocol
Questions & Discussion