Western Michigan University
EoS$^2$

End of Semester Summary

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Research Assistant

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University of Indonesia (UI) Green Metric

- WMU is ranked #61 out of 224 (73rd percentile)
  - 301 institutions around the world responded to the survey this year
    - 224 "comprehensive" (Includes WMU)
  - 19 "comprehensive" US Institutions ranked higher, 29 lower
  - No other Michigan schools responded to the survey

- We stand to make improvements in categories:
  - Transportation, telecommuting, biking, car pooling
  - Education, with sustainability in curriculum & research lacking

- [http://greenmetric.ui.ac.id/id/page/ranking-2013](http://greenmetric.ui.ac.id/id/page/ranking-2013)
Gibbs’ House Modeling
Gibbs’ House Modeling
Converting Units & Comparing Waste Sources

1 Metric Ton = 2,204.62 lbs
1 kg = 2.205 lbs
1 m² = 10.76 ft²

2.08 lbs CO₂ emitted per kWh¹

5.1 Metric Tons CO₂
Annual CO₂ Emissions from the Average American Car²

5.4 Metric Tons CO₂
Annual CO₂ Emissions from the Average WMU Student³
# Lighting Upgrade Case Study

<table>
<thead>
<tr>
<th>Previous Lighting</th>
<th>Lighting Upgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixtures: 41 x 310 Watt Metal Halide</td>
<td>25 x 73 Watt 8’ LED &amp; 8 x 178 Watt T8 Fluorescents</td>
</tr>
<tr>
<td>Wattage: 12,710 Watts</td>
<td>3,249 Watts</td>
</tr>
</tbody>
</table>

Office for Sustainability

Lighting Case Study
Office for Sustainability
Lighting Case Study

Electricity Consumption 2014 vs. 2013

MONTH

JUL AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUN

kWh

2014 (kWh) 2013 (kWh)

5,000
4,000
3,000
2,000
1,000
0,000
### Average Monthly Savings and Offsets

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly kWh Savings</td>
<td>2,149 kWh</td>
</tr>
<tr>
<td>Monthly CO₂ Savings</td>
<td>4,470 lbs / 2.03 Metric Tons</td>
</tr>
<tr>
<td>Monthly $ Savings</td>
<td>241.82 $</td>
</tr>
</tbody>
</table>

### Predicted Yearly Savings and Offsets

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yearly kWh Savings</td>
<td>25,789 kWh Saved</td>
</tr>
<tr>
<td>Yearly CO₂ Savings</td>
<td>24.33 Metric Tons CO₂</td>
</tr>
<tr>
<td>Yearly $ Savings</td>
<td>2,901.84 $</td>
</tr>
<tr>
<td>Yearly Car Offset</td>
<td></td>
</tr>
<tr>
<td>Yearly Student Offset</td>
<td></td>
</tr>
</tbody>
</table>
Office for Sustainability Lighting Case Study

Other Fun Facts

- Our new lighting uses at most 25.5% of our original lighting wattage
- The separate lighting zones allowed us to light specific areas, offering the potential for further savings of 10 - 30%
- Daylight sensors decrease energy usage automatically
- Our predicted monetary payback period is 6.55 years
Office for Sustainability
Solar Rooftop Case Study

Rooftop Solar Case Study

Sunpower T5 Solar Roof Tile

Reasons for Choosing the T5 Solar Roof Tile

- All Inclusive Unit
  - Ballasted, no holes in the roof needed
  - Mounts included, no additional framing
  - Complies with the American Recovery and Reinvestment Act of 2009
  - Low weight / m² means our roof can support more
  - High wind, snow, and hail tolerances
  - Slope warranty outperforms step warranties
  - More closely matches real world conditions
Office for Sustainability  
Solar Rooftop Case Study

### Rooftop Solar Potential at OfS

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Yearly kWh Usage:</td>
<td>21,048 kWh</td>
</tr>
<tr>
<td>Average Yearly CO₂ Production:</td>
<td>43,779.8 lbs</td>
</tr>
<tr>
<td>Average Monthly Electricity Bill:</td>
<td>256.44 $</td>
</tr>
<tr>
<td>OfS Building Floor Print:</td>
<td>662.4 m²</td>
</tr>
<tr>
<td>kW per Meter Squared:</td>
<td>0.08 kW / m²</td>
</tr>
<tr>
<td>Rooftop Potential @ 50% Fill:</td>
<td>15.87 kW</td>
</tr>
<tr>
<td>Kilograms per Meter Squared:</td>
<td>5.86 kg / m²</td>
</tr>
<tr>
<td>Predicted Annual kWh:</td>
<td>20,273 kWh</td>
</tr>
</tbody>
</table>

### Rooftop Solar Potential University Wide

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WMU Campus Floor Print:</td>
<td>324,847 m²</td>
</tr>
<tr>
<td>Rooftop Potential @ 10% Fill:</td>
<td>2,775.59 kW</td>
</tr>
<tr>
<td>Predicted Annual kWh:</td>
<td>3,544 MWh</td>
</tr>
</tbody>
</table>
Predicted Offsets & Fun Facts

A 15.87 kW system would provide OfS with 96% of our energy needs.

OfS CO₂ Offset: 42,167 lbs / 19.13 Metric Tons

WMU CO₂ Offset: 3,344 Metric Tons
To Do

- Refinement Existing Models & Data
  - Improvements in Green Metric data & other metrics (STARS)
  - Higher precision of Gibbs house model, add interior to house
  - Collect further data for lighting studies
  - Refine estimates for rooftop solar potential