Wind Power Option

for Oakland University
There were two parts of the study

• Wind Speed Study Results
  • Wind speed was recorded for two years at a 50 meter tall “met tower” located on the south side of the main campus
  • Data collected for 2006 & 2007

• Feasibility Study Results
  • This data was then used in a full engineering and cost analysis for one or more wind turbines for the Oakland campus
OAKLAND UNIVERSITY

50 meter tall NRG wind anemometer tower.

In cooperation with Alternate Energy Solutions, Inc. of Eastpoint, Michigan.

www.aesmichigan.com
NRG TallTower™
Installation Manual and Specifications

For 10 m, 20 m, 30 m, 30 m HD, 30 m SHD, 40 m, 40 m HD, 50 m, 50 m HD, 60 m NRG TallTowers™
50 Meter Tall Tower Assembly

100' INNER GUY RADIUS

110' OUTER GUY RADIUS

50 meters
43.5 meters
36 meters
27 meters
18 meters
9 meters
# Average Wind Data Results

<table>
<thead>
<tr>
<th>Height</th>
<th>Wind Speed</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 m</td>
<td>3.0 m/s</td>
<td>measured</td>
</tr>
<tr>
<td>40 m</td>
<td>3.6 m/s</td>
<td>measured</td>
</tr>
<tr>
<td>50 m</td>
<td>4.1 m/s</td>
<td>measured</td>
</tr>
<tr>
<td>75 m</td>
<td>5.2 m/s</td>
<td>calculated</td>
</tr>
<tr>
<td>80 m</td>
<td>5.4 m/s</td>
<td>calculated</td>
</tr>
<tr>
<td>100 m</td>
<td>6.2 m/s</td>
<td>calculated</td>
</tr>
</tbody>
</table>
Here is a small sampling of the type of data gained in the wind study.

Wind Speed Frequency Distribution at 50 Meters (percent time for each wind speed)
Annual Average Wind Power Density

Wind Rose at 50 Meter Height
(shows magnitude and direction of annual wind power potential)
Potential Installation Sites

1  2  3  4
Artist’s Rendering of Oakland Wind Turbine

(image courtesy of Khaleds Dahr & Jim Leidel)
Here is a typical wind turbine under consideration

1,500 kW each

77 meter blade diameter

100 meter tower
Illustration of turbine components
Projected Cost per kW-hr Electricity Over 25 Year Project

- Ten Year History of Detroit Edison Rate
- 3% Escalation Per Year
- 4% Escalation Per Year
- Fixed Wind Power Cost

Expected Detroit Edison

Average Fixed Wind Power Cost

Projected Cost per kW-hr Electricity Over 25 Year Project
Biomass Power Option

for Oakland University
• Wood supply
• Campus growth & future needs
• Wood boilers
• Proposed sites
• Costs & savings
We looked at 14 counties in SE Michigan & found 1.7 million tons of urban waste wood per year
Urban Waste Wood
Findings from Study

a. Estimate from this study (2007)
   1.7 million tons per year (MTPY)
b. MSU – Univ. of Cincinnati Study (2007)
   1.5 MTPY
   4.3 MTPY for all of Michigan
   0.9 MTPY for 14 county area
c. Oak Ridge National Labs (1999)
   2-4 MTPY for all of Michigan (cost based)
Urban Waste Wood
Findings from Study

This study looked at:

White wood from industrial & construction
Storm damage
Land clearing for development
Non utility tree trimming
Utility company tree trimming
South Mich. Forest product residues
South Mich mill residue
2% of urban forest (dead & dying)
Existing biomass power plants

- Grayling Generating Station
  - Grayling, MI 1991
  - Capacity 38,000 kW
  - 400,000 GT/yr

- TEF Filer City Power Station
  - Filer City, MI 1990
  - Capacity 60,000 kW
  - 40,000 GT/yr (cofire with coal)

- Viking Energy - McBain
  - McBain, MI 1988
  - Capacity 18,000 kW
  - 210,000 GT/yr

- Viking Energy - Lincoln
  - Lincoln, MI 1989
  - Capacity 18,000 kW
  - 160,000 GT/yr

- Central Michigan University
  - Mt. Pleasant, MI 1984
  - Capacity 1,200 kW
  - 40,000 GT/yr

- Cadillac Renewable Energy
  - Cadillac, MI 1993
  - Capacity 39,600 kW
  - 400,000 GT/yr

- Hillman Power Co.
  - Hillman, MI 1987
  - Capacity 20,000 kW
  - 220,000 GT/yr

- Genesee Power Station
  - Flint, MI 1996
  - Capacity 35,000 kW
  - 360,000 GT/yr

- Proposed Wood Supply Counties
Nearby wood recyclers could easily serve the new system
Other campus’s heat with wood:

- Central Michigan University
- Northern Michigan University is developing a plant
CMU Wood Boiler Plant
(heats most of campus)
(note: only water vapor is coming from stack)
photo - Jim Leidel 2005
Next we look at the future needs for campus:

1. Replace aging boilers.
2. More capacity for future growth
# Existing Central Heating Plant

<table>
<thead>
<tr>
<th>Unit</th>
<th>Capacity (MMBTU/hr)</th>
<th>Year Installed</th>
<th>Age in years / Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>100</td>
<td>1969</td>
<td>39 / good</td>
</tr>
<tr>
<td>B-2</td>
<td>100</td>
<td>1969</td>
<td>39 / good</td>
</tr>
<tr>
<td>B-3</td>
<td>34</td>
<td>1959</td>
<td>49 / fair</td>
</tr>
<tr>
<td>B-4</td>
<td>32</td>
<td>1957</td>
<td>51 / marginal</td>
</tr>
<tr>
<td>Total</td>
<td>265</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Oakland University Ten Year Fall Enrollment Growth with 2020 Vision

Undergraduate and Graduate Enrollment Growth from 1997 to 2020.
Oakland University Ten Year Energy Growth with 2020 Vision

2020 Projection based on $0.085/kWhr electricity and $11/MMBTU gas
We then looked at various wood boiler systems
EPI Fluid Bed
(Steam & HW)

English Stoker
(Steam & HW)

Hurst Stoker
(HW Only)

Vynke Stoker
(Steam & HW)
Typical Vynke Plant Layout
Three Proposed Site Locations
Artist’s Renderings
A typical wood storage building (in Kingsville, Ontario)
Annual operating savings are in the range of $1.5 million
Operating Cost Estimates

![Bar chart showing annual operating costs and savings for different scenarios: Current, EPI 2-Turbine, EPI Peak Shave, EPI 1-Turbine, English Hot Water. Costs are represented in millions of dollars (MM).](chart.png)
Overview of an Integrated, Renewable Energy Supply Infrastructure

Biomass Boiler

Wood chips → Biomass ash

Steam turbine

Generator

Condenser

Hot & Chilled Water to Oakland University Campus
Overview of an Integrated, Renewable Energy Supply Infrastructure

Biomass Boiler

- Wood chips
- Biomass ash

Filters

Fan

Biomass ash

Steam turbine

Generator

Condenser

Absorption chillers in DHE, NFH, & VAH (Can serve 37% of campus)

Hot & Chilled Water to Oakland University Campus
Overview of an Integrated, Renewable Energy Supply Infrastructure

Biomass Boiler

Wood chips

Biomass ash

Fan

Filters

Absorption Chillers in DHE, NFH, & VAH (Can serve 37% of campus)

Condenser

Steam-turbine

Generator

Utility Power

Substation

Sustainable Power

Hot & Chilled Water to Oakland University Campus
Overview of an Integrated, Renewable Energy Supply Infrastructure
Overview of an Integrated, Renewable Energy Supply Infrastructure
## Overview of an Integrated Renewable Energy Supply Infrastructure

<table>
<thead>
<tr>
<th></th>
<th>Existing Fossil Fuel Mix</th>
<th>Proposed Renewable Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thermal (Heating)</td>
<td>Electrical</td>
</tr>
<tr>
<td>Central Heating Plant (natural gas)</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Detroit Edison</td>
<td></td>
<td>95%</td>
</tr>
<tr>
<td>Diesel Generators</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Biomass Boiler Plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind Power</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Biomass & Wind Power

Sustainable Energy Options for the Future of Oakland University
Energy Management
at Oakland University, Facilities Management

OU's Investigations into Wind Power
Oakland University will be investigating local wind power resources on campus with the installation of a 50 meter tall, wind sensor tower. It will be located several hundred yards south of Pioneer Drive, near Squirrel Road. Please visit Alternative Energy Solutions web site for more information and a press release.

Also, for information on wind power in Michigan and elsewhere, click here....

University Energy Usage & Cost
Take a look at the historical usage and cost of the west campus utilities over the past decade. About $275 is spent each year per Full Year Equivalent Student. This equates to 5 to 6% of a full time student’s tuition. (based on 16 credit hours for two semesters) more info...

University Energy Purchasing
Click here to learn more on how Oakland University spends its $5 million dollars each year to heat, cool, and power our fine institution.

OU Photovoltaic - Solar Electric Roof
OU was recently installed a 10kW photovoltaic demonstration project on the roof of the student apartment Community Building. The produced electricity from 500 Uni-Solar PV shingles is tied directly to the University electrical grid.

Click here for more information...

Visit www.oakland.edu/energy for more info...