Oakland Wind Data Results

• Wind Speed Study Results
  (Meteorological Tower Data Compilation and Analysis)

• Feasibility Study Results
# Oakland 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>
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)
(artist's rendering: courtesy of Khales Dahr & Jim Leidel. This is not the actual, proposed location.)
AAER Wind Turbine

1,500 kW each

77 meter blade diameter

100 meter tower
Illustration of turbine components
### One 1.5MW Wind Turbine Installed at Site #1

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAER 100m Tower at Location 1</td>
<td>$3,500,000</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$3,500,000</td>
</tr>
<tr>
<td>Owner Contingency</td>
<td>$210,000  6%</td>
</tr>
<tr>
<td><strong>Total Installed Cost</strong></td>
<td><strong>$3,710,000</strong></td>
</tr>
</tbody>
</table>

Cost per MW Installed  $2,473
Two 1.5MW Turbines Installed at Sites #1 and #2

- AAER 100m Tower at Location 1: $3,500,000
- AAER 100m Tower at Location 2: $3,500,000
- Two Turbine Crane Economy: $(100,000)

Subtotal: $6,900,000

Owner Contingency: $414,000 6%

Total Installed Cost: $7,314,000

Cost per MW Installed: $2,438
Net Annual and Cumulative Cash Flow Over 25 Year Project
(construction in 2009, beginning operation in 2010)

15 year CREB @ 0%
20 year financing on remainder @ 4.5%
3% utility cost escalation
3% O&M cost escalation
1.5 cent / kWhr REC's
Projected Unit Cost of Electricity Over 25 Year Project
Overview of an Integrated, Renewable Energy Supply Infrastructure
Overview of an Integrated, Renewable Energy Supply Infrastructure
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>95%</td>
<td>20%</td>
</tr>
<tr>
<td>Diesel Generators</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>Biomass Boiler Plant</td>
<td>80%</td>
<td>50%</td>
</tr>
<tr>
<td>Wind Power</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Proposed Funding Sources

1. Sale of Renewable Energy Credits
2. $1.5M Clean Renewable Energy Bond
3. Investigate grant opportunities
4. Leveraged lease
5. Issue 15 to 20 year bonds
6. Enter into one or more bank qualified debt arrangements
7. Public / private partnership arrangement
Recommendations

1. Select the project financing method
   a. Issue 15 to 20 year bonds
   b. Enter into bank qualified debt arrangements
   c. Combine with biomass project – 3rd party “owned & operated”

2. Hire a design/build firm
   a. Create high resolution wind map of campus
   b. Detailed engineering and construction documents
   c. Environmental study & any needed approvals

3. Establish a utility interconnect agreement with DTE

4. Offering of REC’s should be made to interested parties to solicit pricing and potential customers interested in a bilateral contract.

5. Enter into Call Contracts Against the Euro or Canadian Dollar
Wind Power

A Sustainable Energy Option for the Future of Oakland University