# Wind Power

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# ***Oakland Wind Data Results***

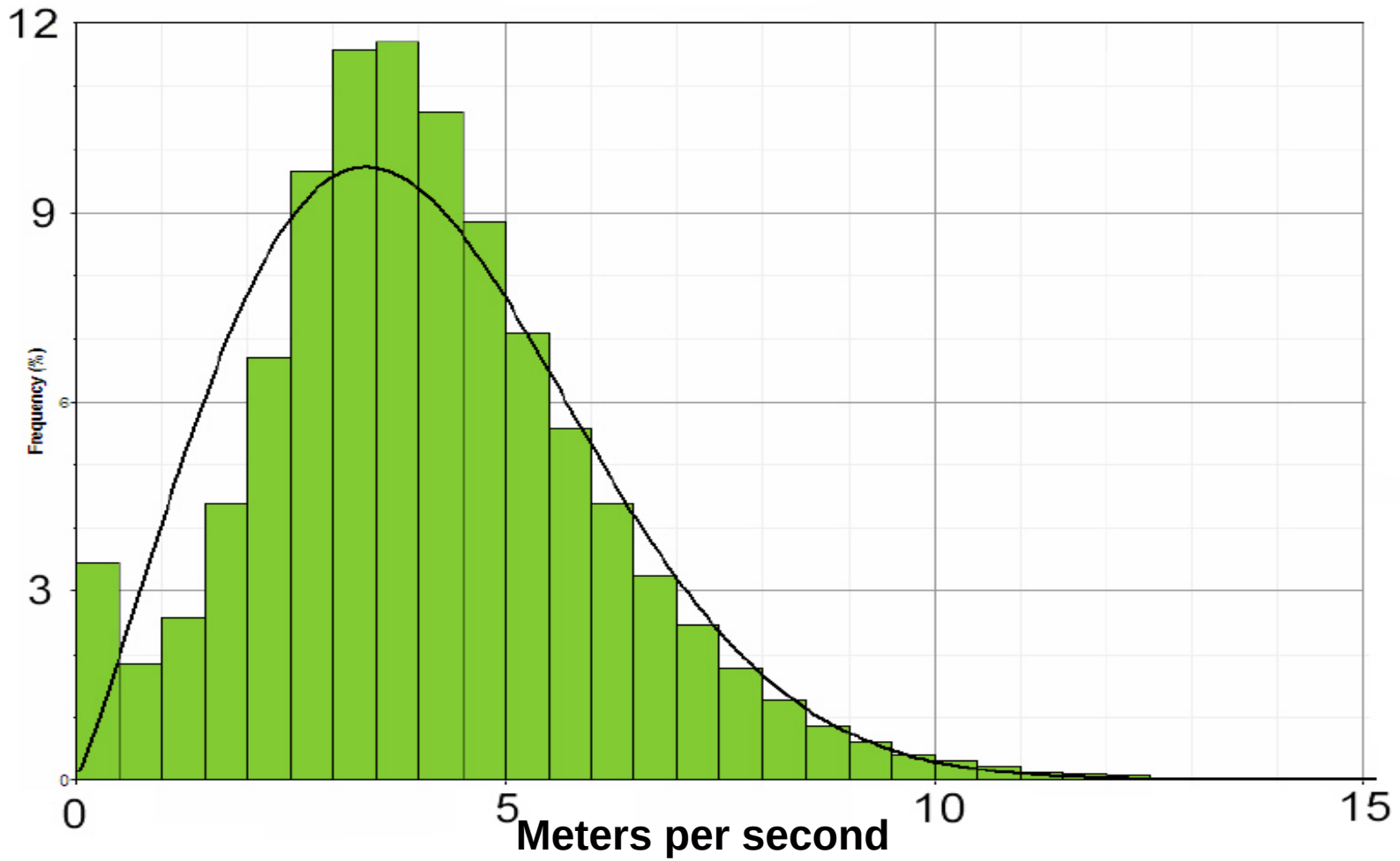
- **Wind Speed Study Results**

(Meteorological Tower Data Compilation and Analysis)

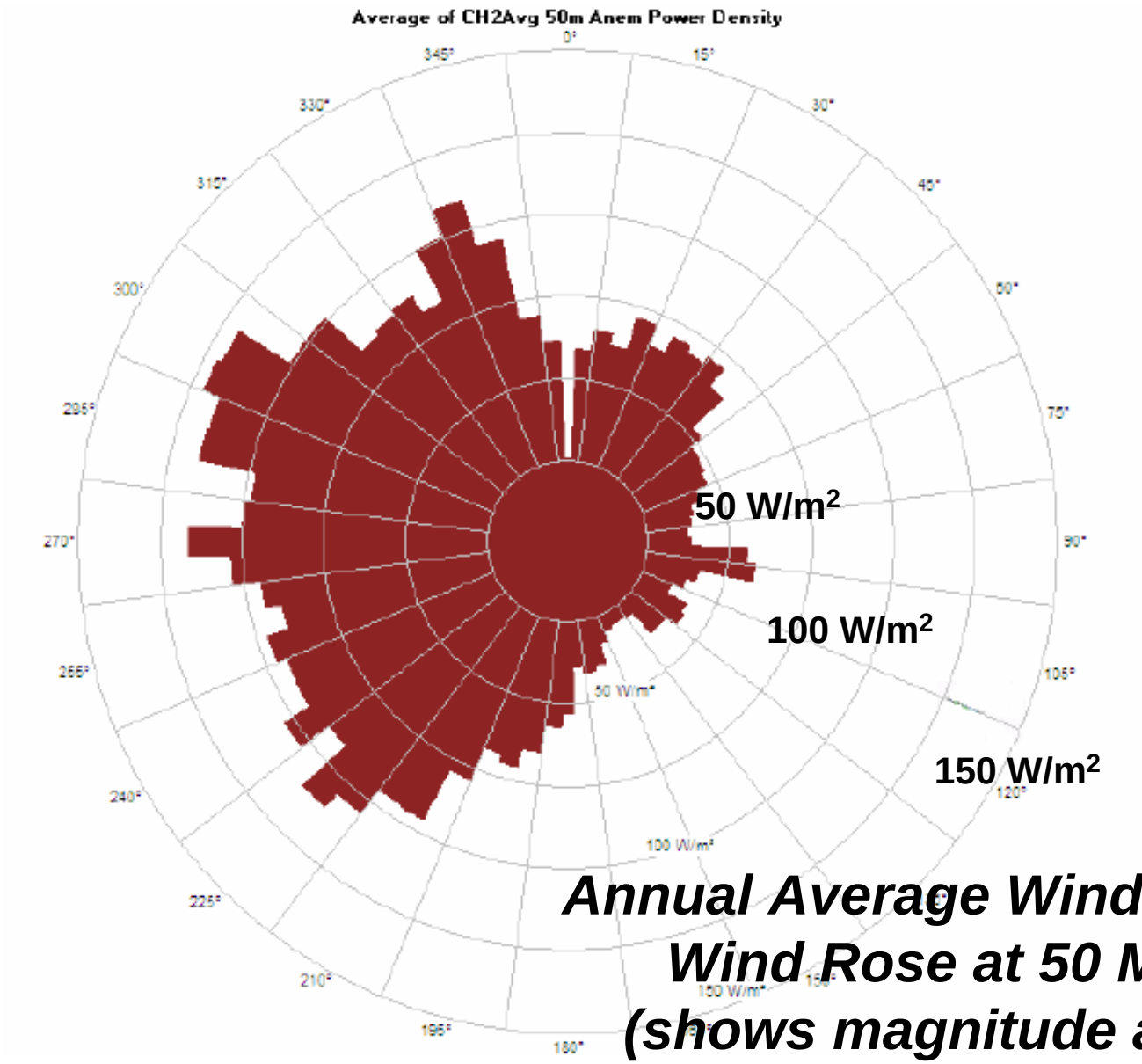
- **Feasibility Study Results**

# ***Oakland Wind Data Results***

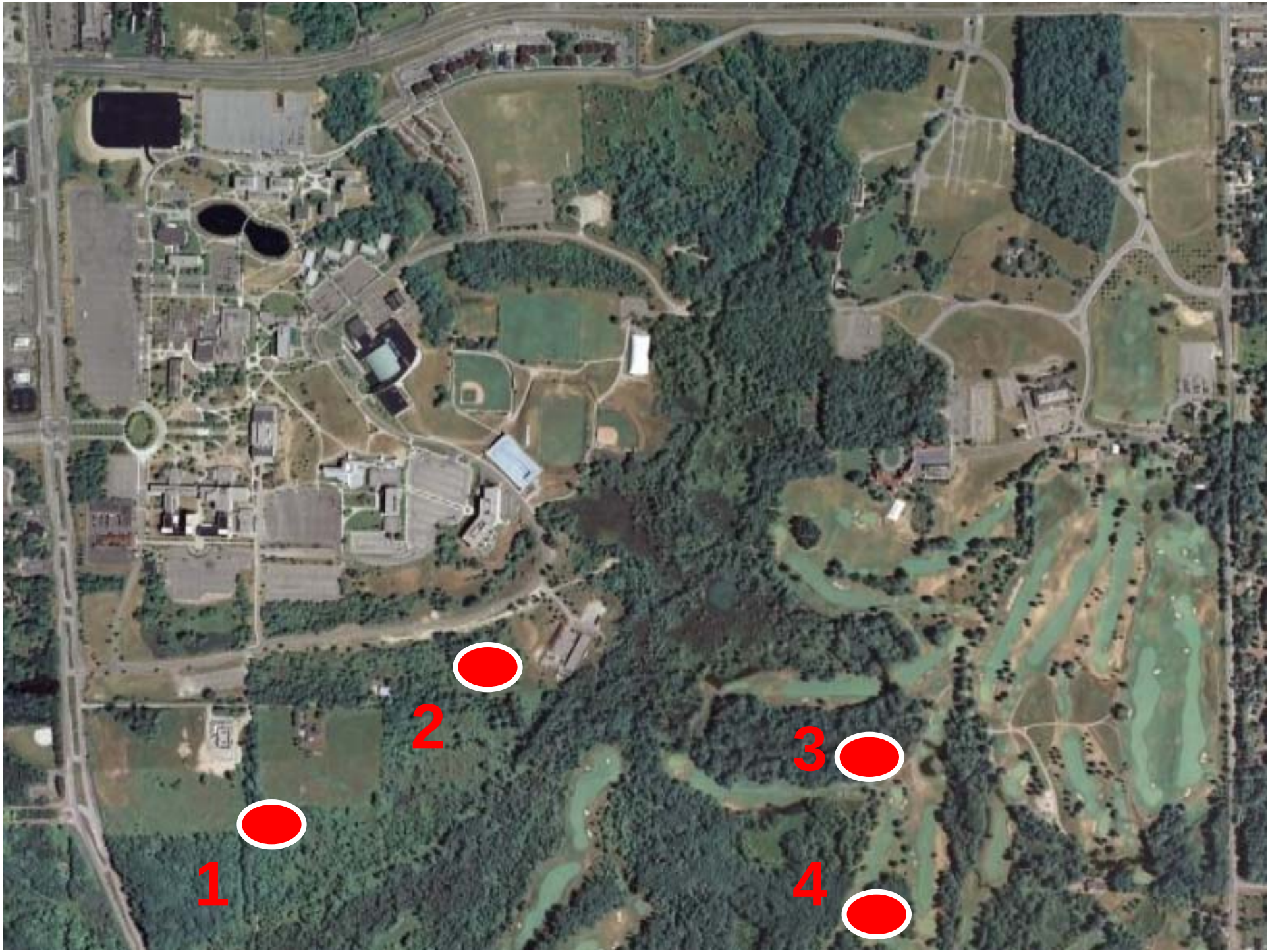
| Height | Wind Speed | Method |
|---|---|---|
| 30 m | 3.0 m/s | measured |
| 40 m | 3.6 m/s | measured |
| 50 m | 4.1 m/s | measured |
| | | |
| 75 m | 5.2 m/s | calculated |
| 80 m | 5.4 m/s | calculated |
| 100 m | 6.2 m/s | calculated |




***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)***


1
2
3
4

*( 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

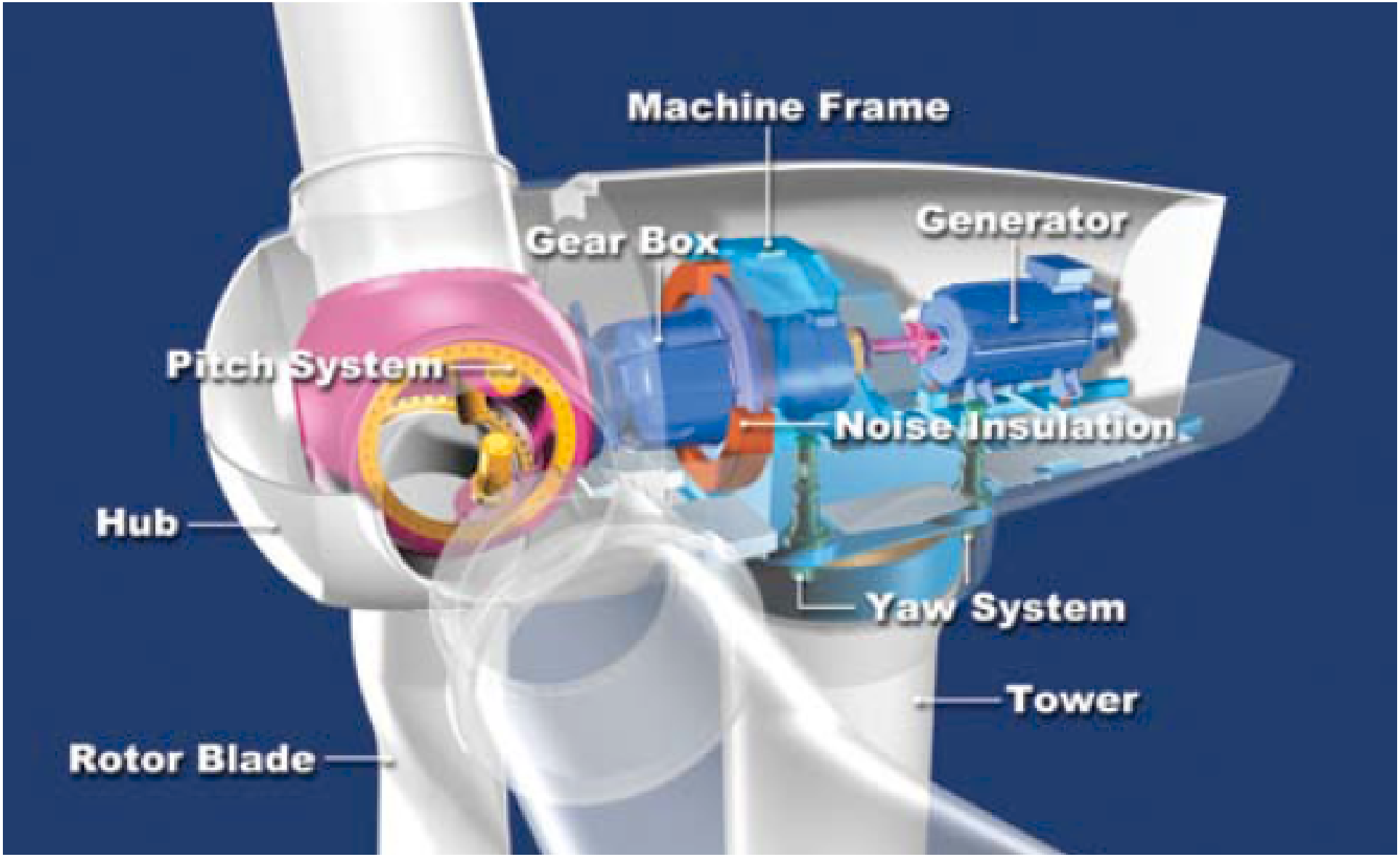


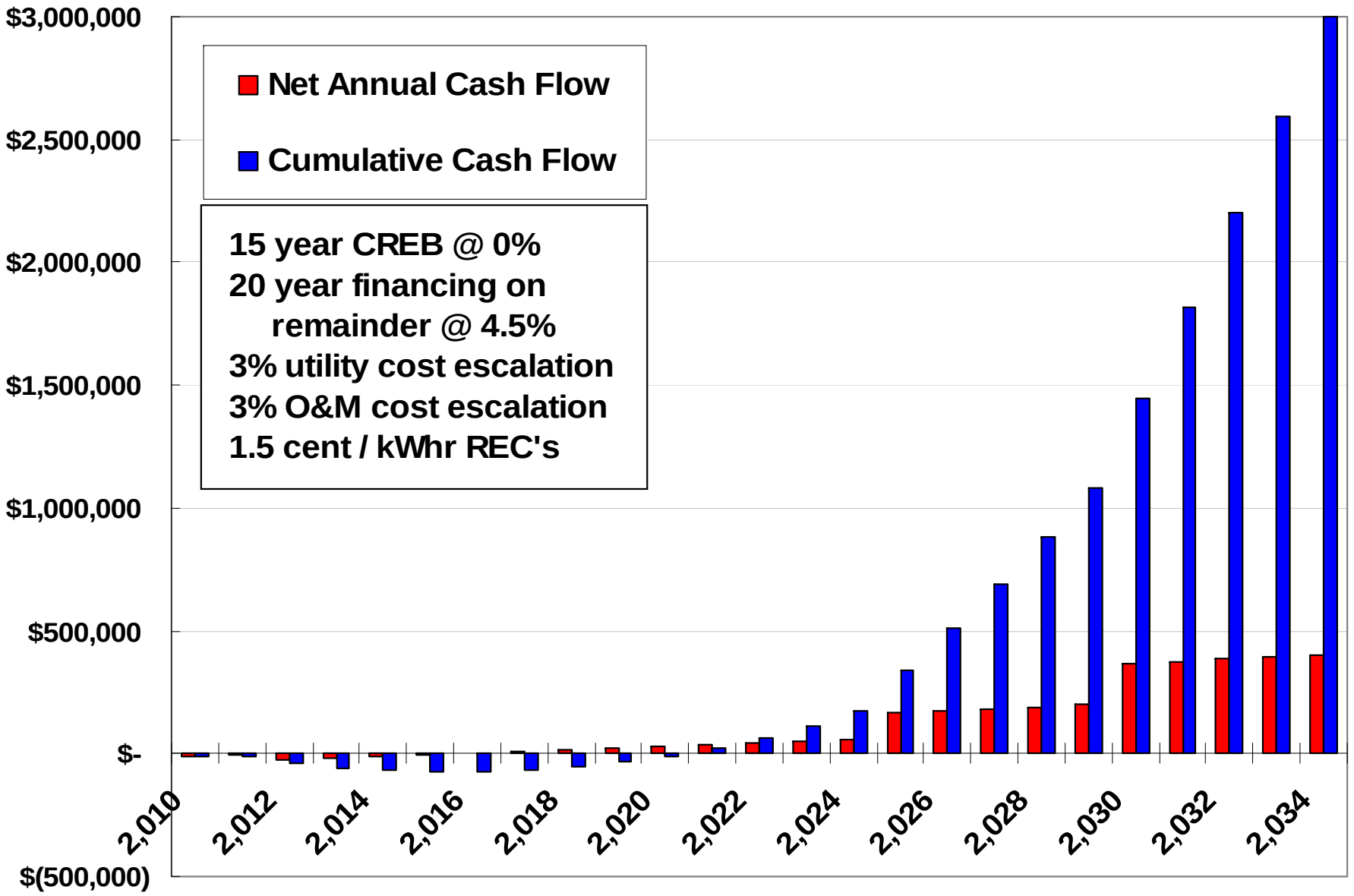

**Illustration of turbine components**

# One 1.5MW Wind Turbine Installed at Site #1

| | | | |
|---|---|---|---|
| **AAER 100m Tower at Location 1** | **$** | **3,500,000** | |
| **Subtotal** | **$** | **3,500,000** | |
| **Owner Contingency** | **$** | **210,000** | **6%** |
| **Total Installed Cost** | **$** | **3,710,000** | |
| Cost per MW Installed | $ | 2,473 | |

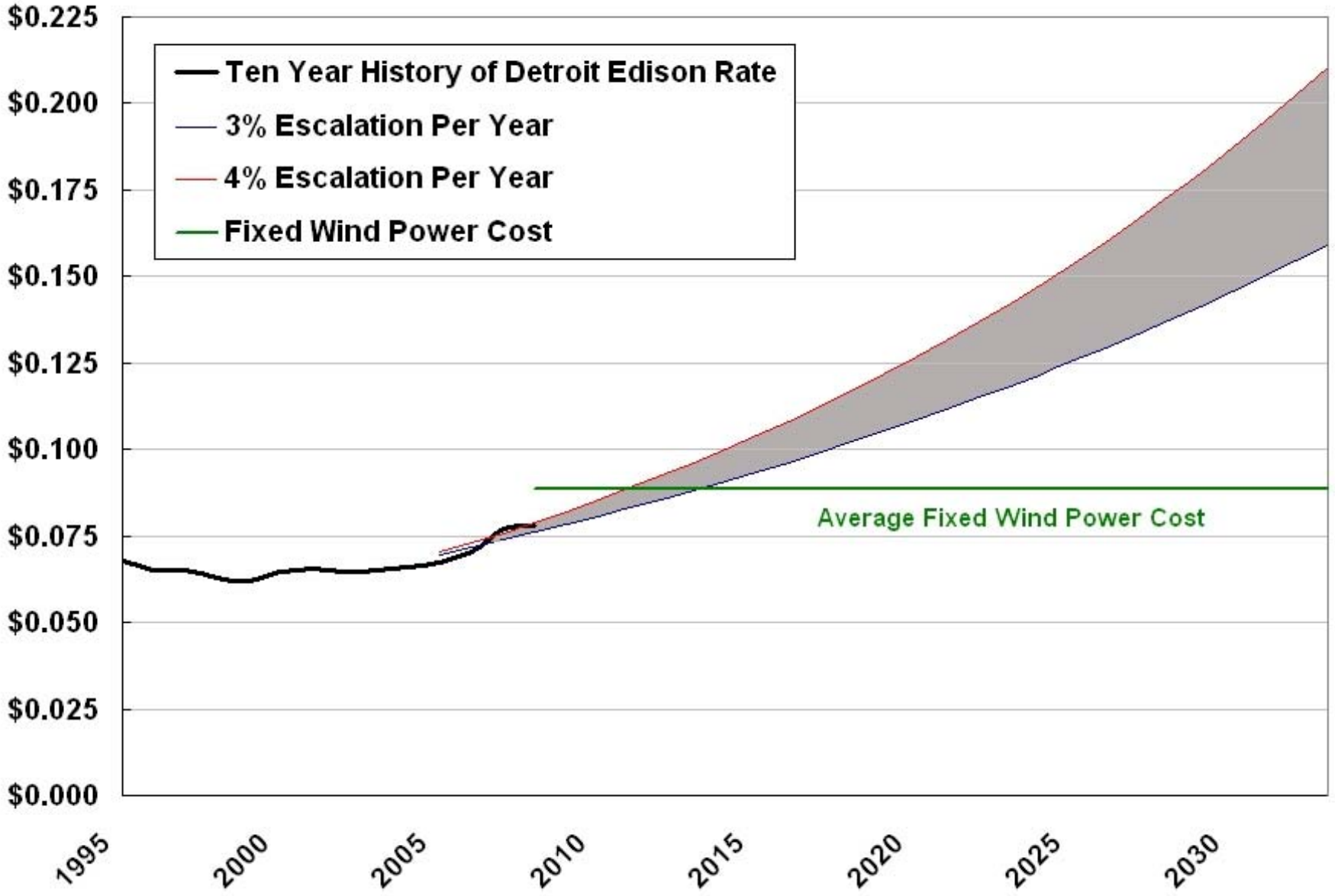
## Two 1.5MW Turbines Installed at Sites #1 and #2

| | | | |
|---|---|---|---|
| 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 | |



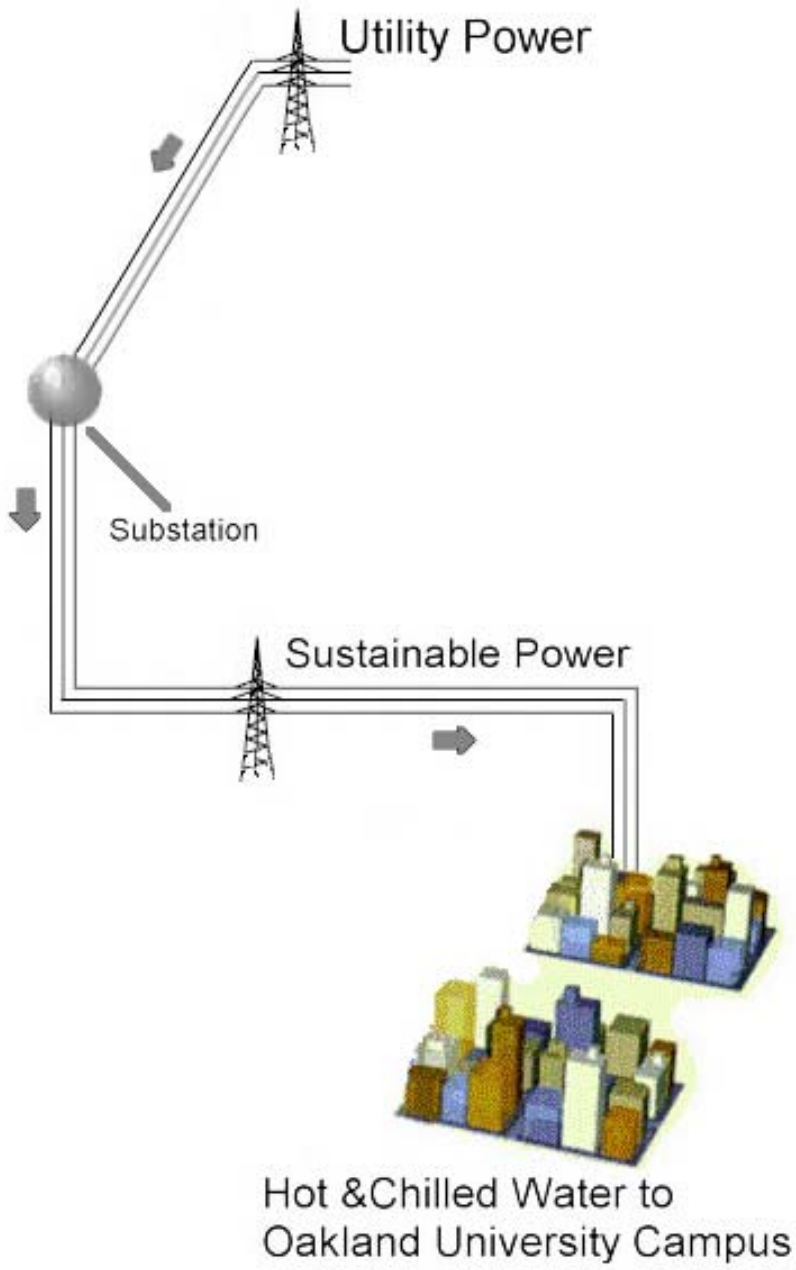

# Net Annual and Cumulative Cash Flow Over 25 Year Project

(construction in 2009, beginning operation in 2010)

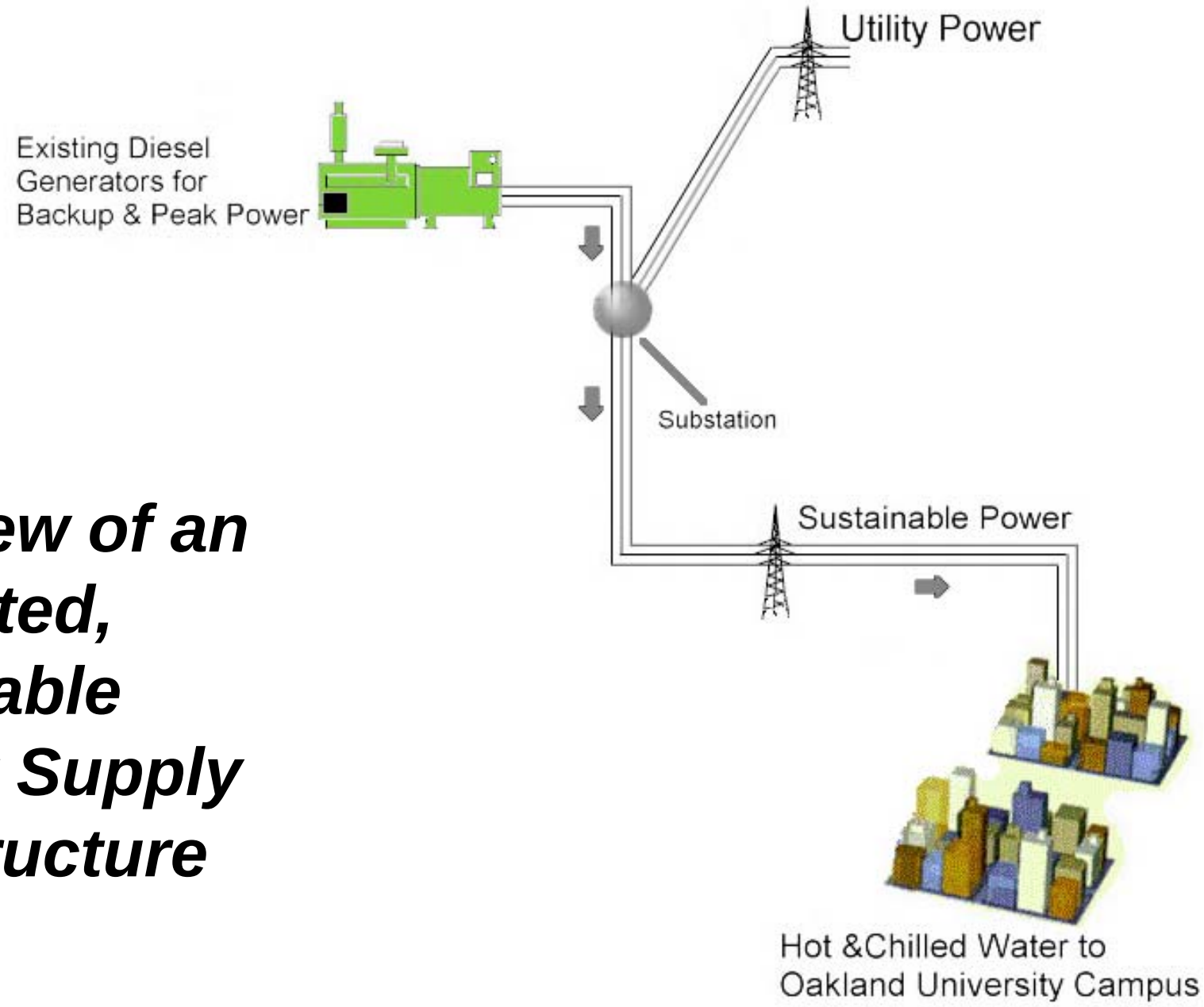



**Projected Unit Cost of Electricity Over 25 Year Project**

***Overview of an Integrated, Renewable Energy Supply Infrastructure***



# *Overview of an Integrated, Renewable Energy Supply Infrastructure*



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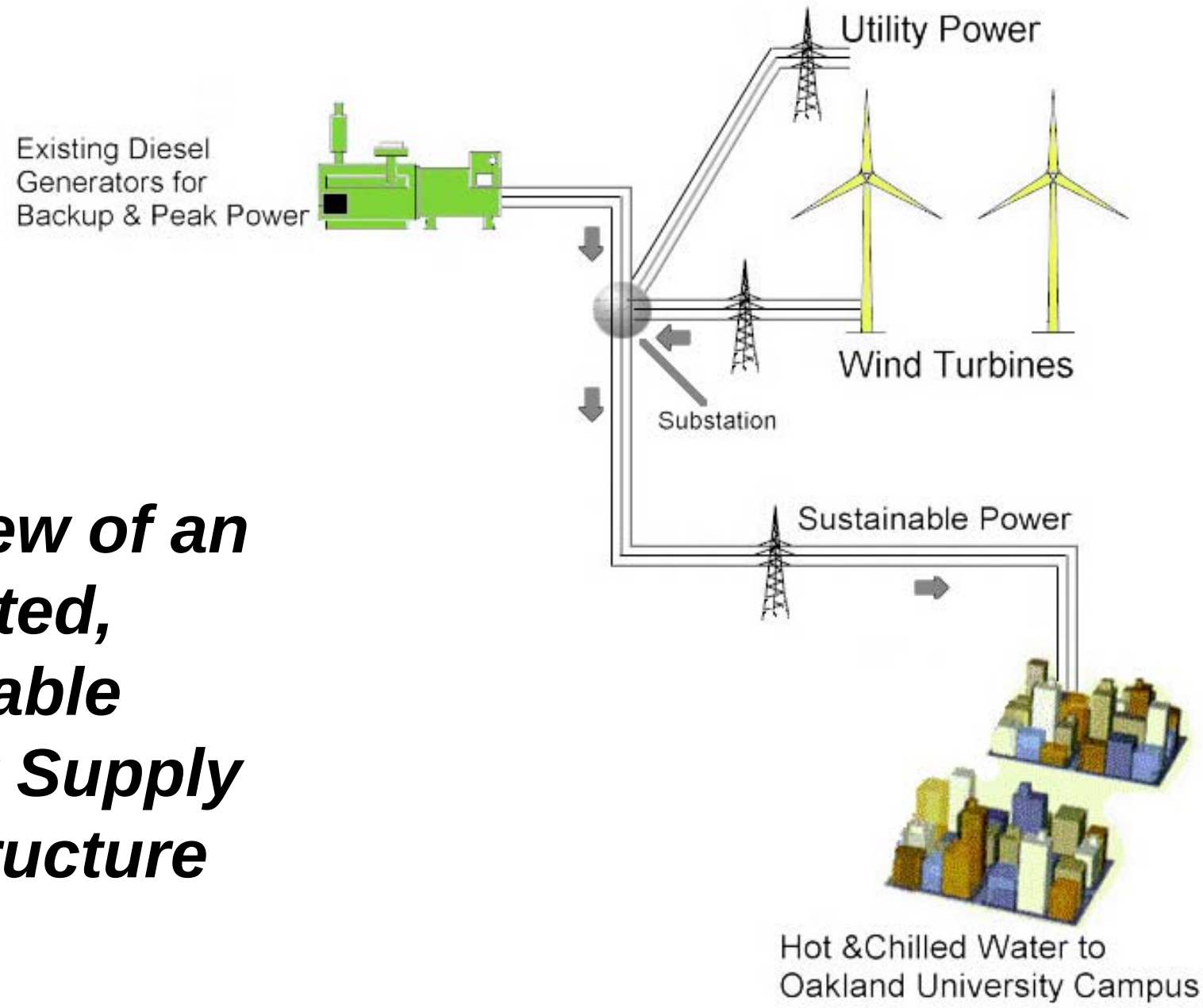

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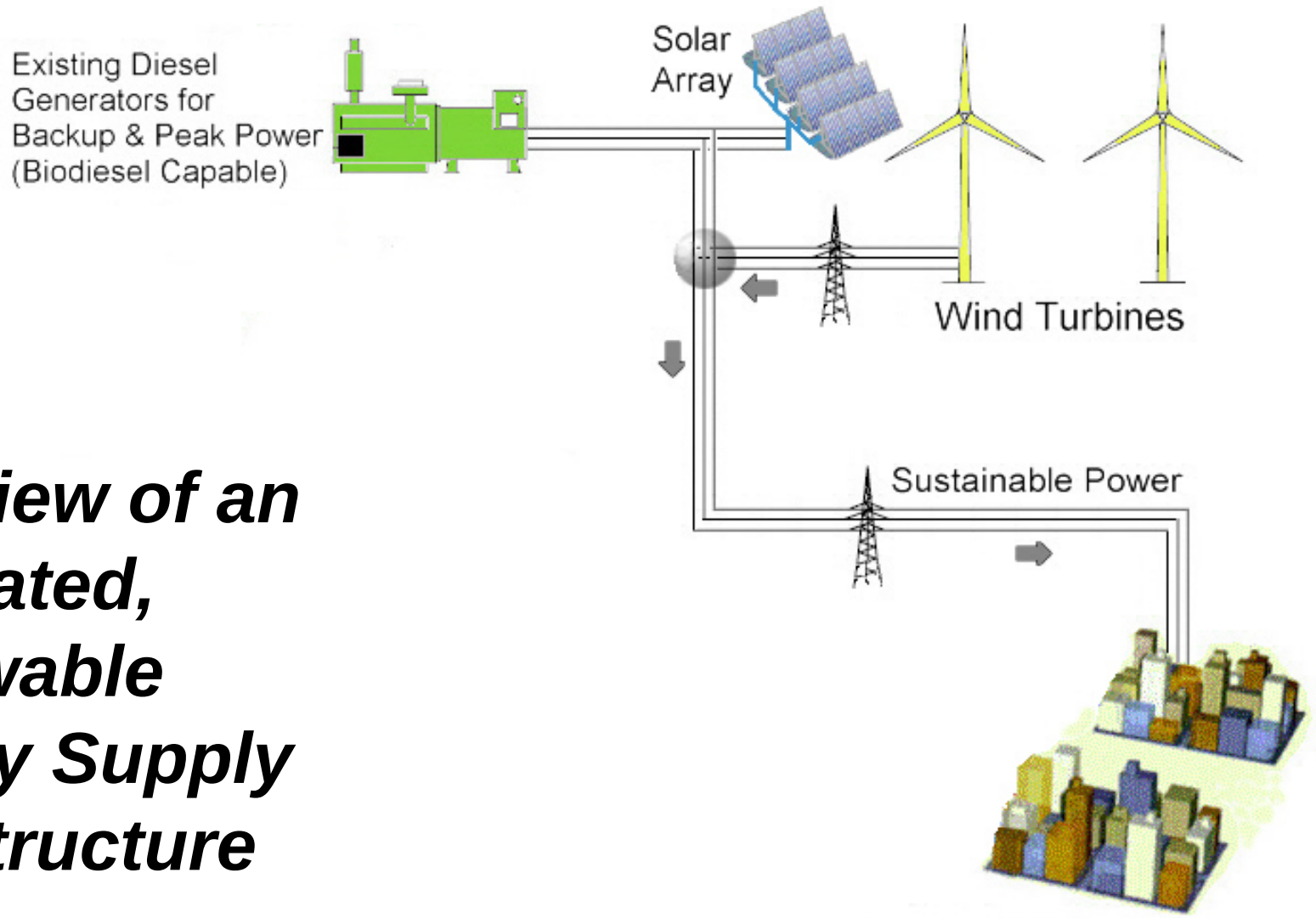

## *Overview of an Integrated Renewable Energy Supply Infrastructure*

| | Existing Fossil Fuel Mix | | Proposed Renewable Energy | |
|---|---|---|---|---|
| | **Thermal (Heating)** | **Electrical** | **Thermal (Heating)** | **Electrical** |
| **Central Heating Plant (natural gas)** | 100% | | 20% | |
| **Detroit Edison** | | 95% | | 20% |
| **Diesel Generators** | | 5% | | 10% |
| **Biomass Boiler Plant** | | | 80% | 50% |
| **Wind Power** | | | | 20% |
| **Totals** | 100% | 100% | 100% | 100% |

# ***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