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

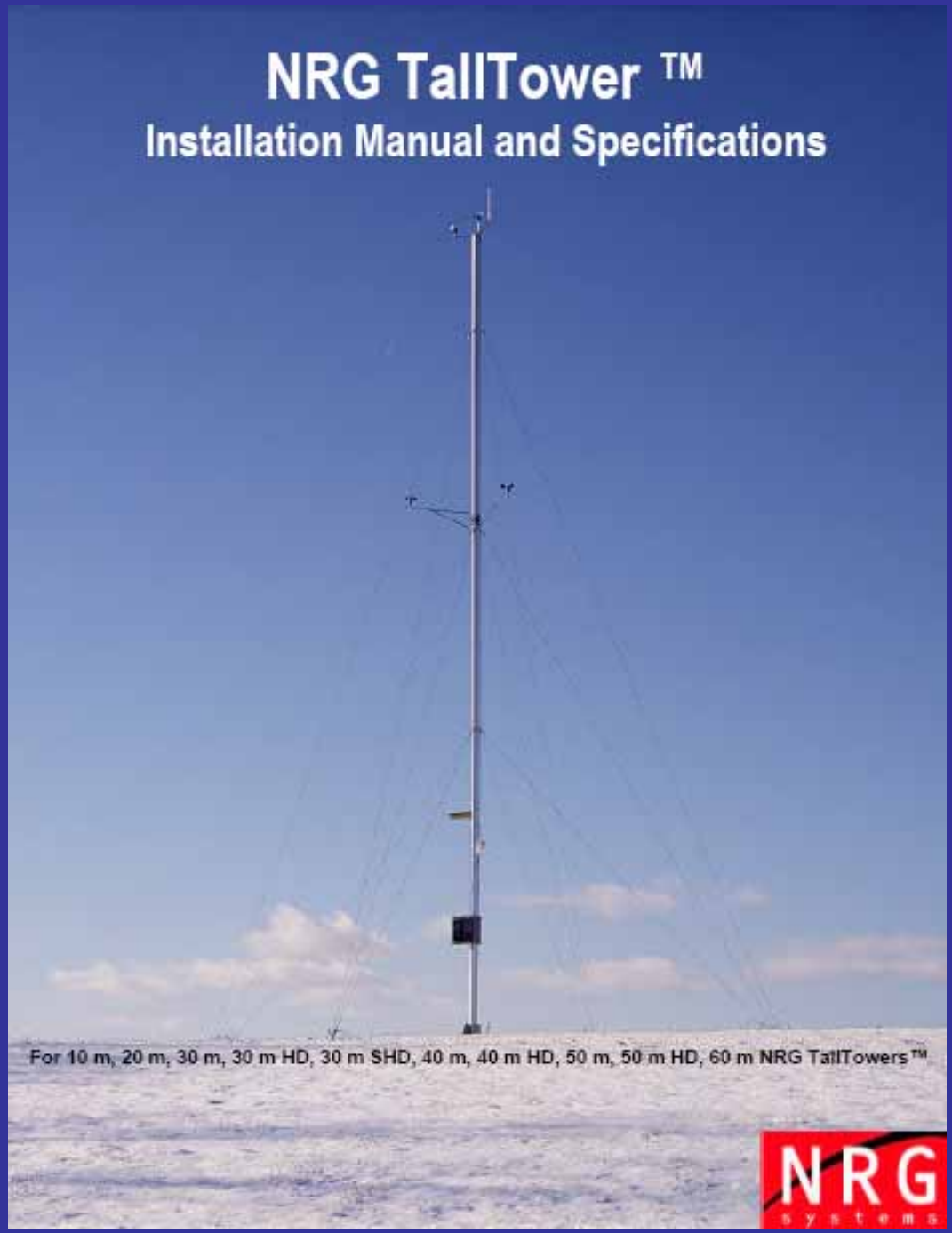
50 meter tall NRG wind anemometer tower.

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

www.aesmichigan.com

NRG TallTower ™

Installation Manual and Specifications

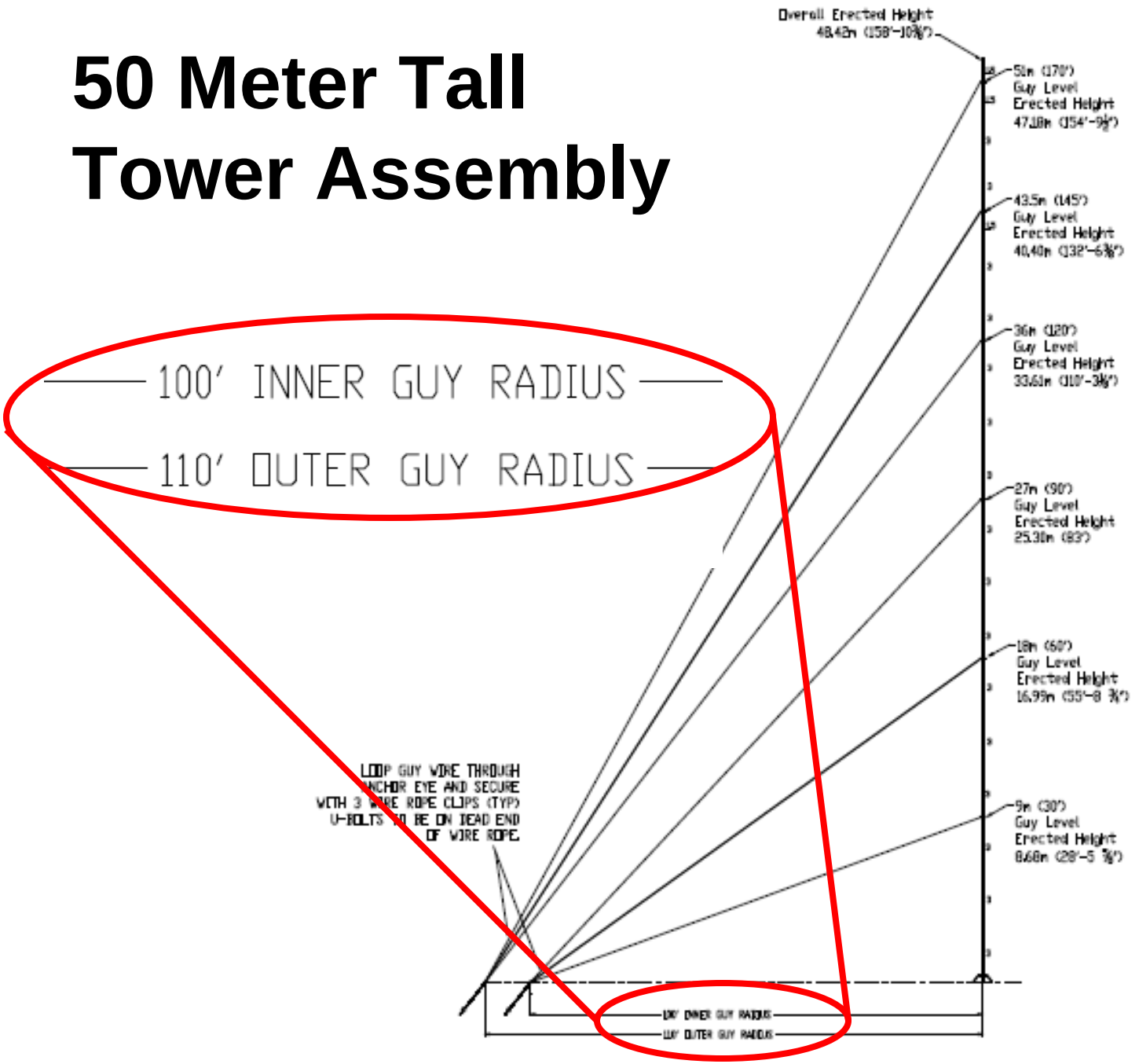


For 10 m, 20 m, 30 m, 30 m HD, 30 m SHD, 40 m, 40 m HD, 50 m, 50 m HD, 60 m NRG TallTowers™

NRG systems

Oakland UNIVERSITY

50 Meter Tall Tower Assembly



50 meters

43.5 meters

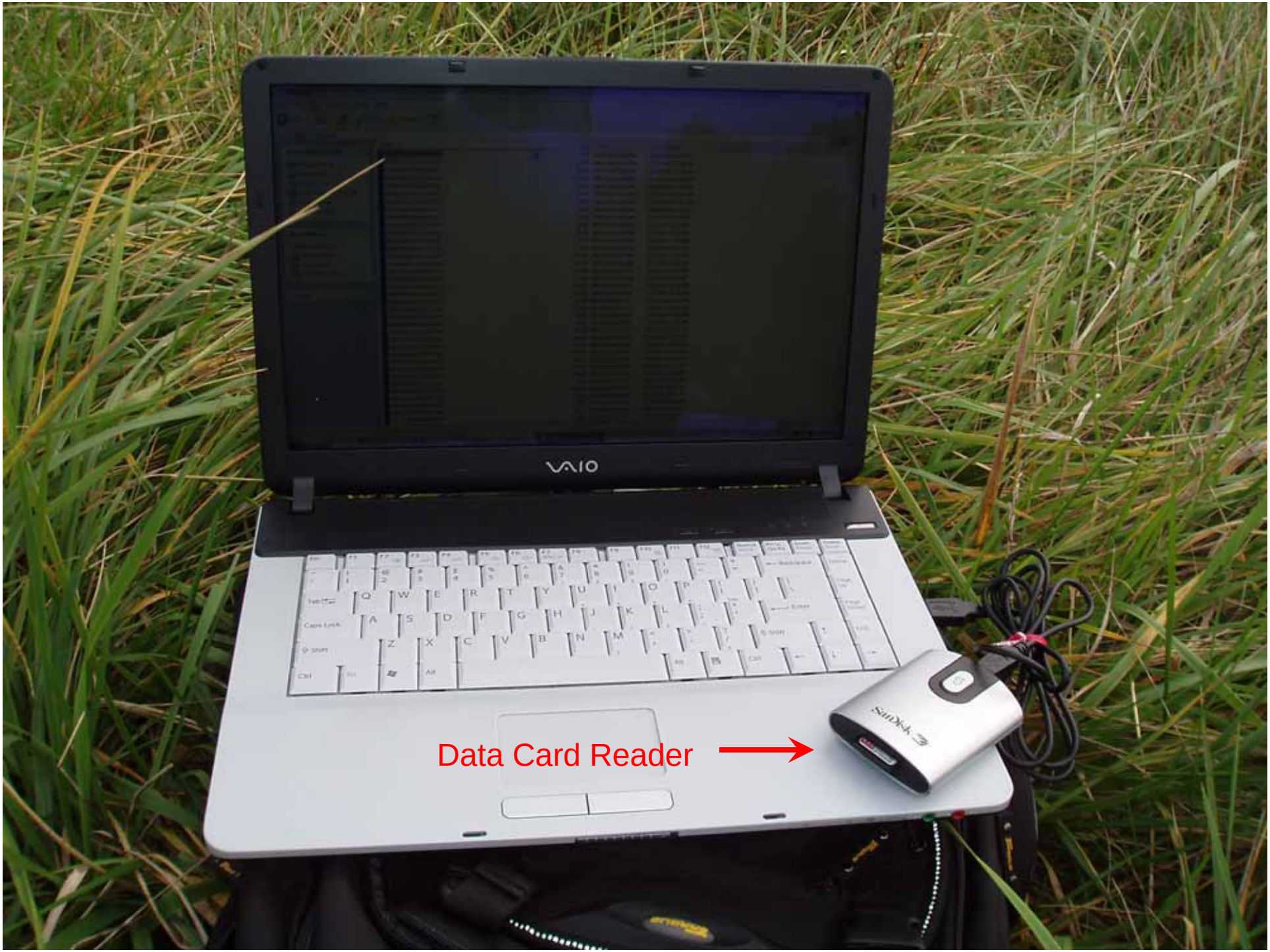
36 meters

27 meters

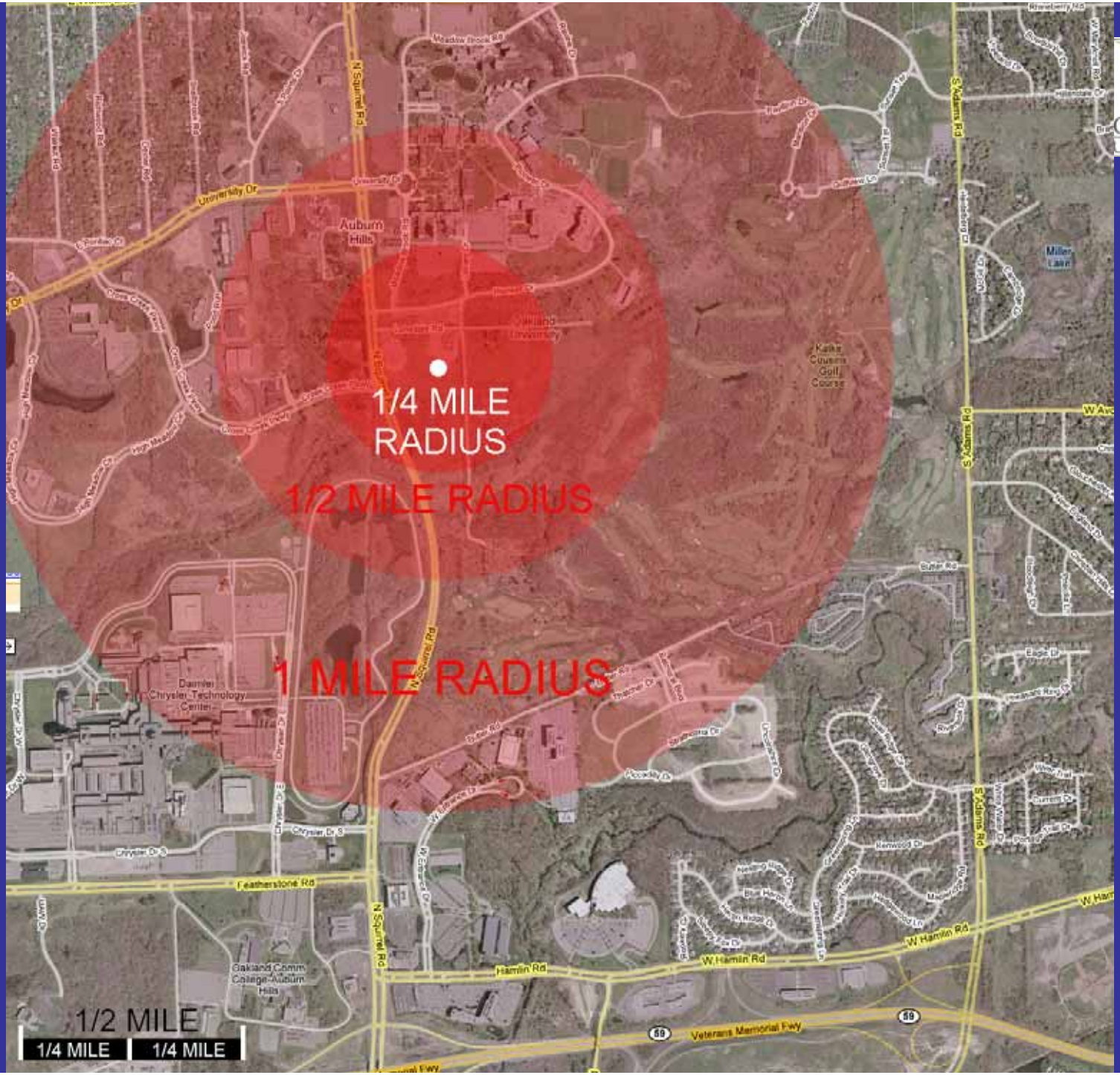
18 meters

9 meters


NRG Systems, Inc.
Symphonie SN:5282
Press [HOME]
Symphonie
INTERNET ENABLED
NRG
Industrial
Panasonic Alkaline
DRIERITE
DESICCANT BAG
2 OZ.

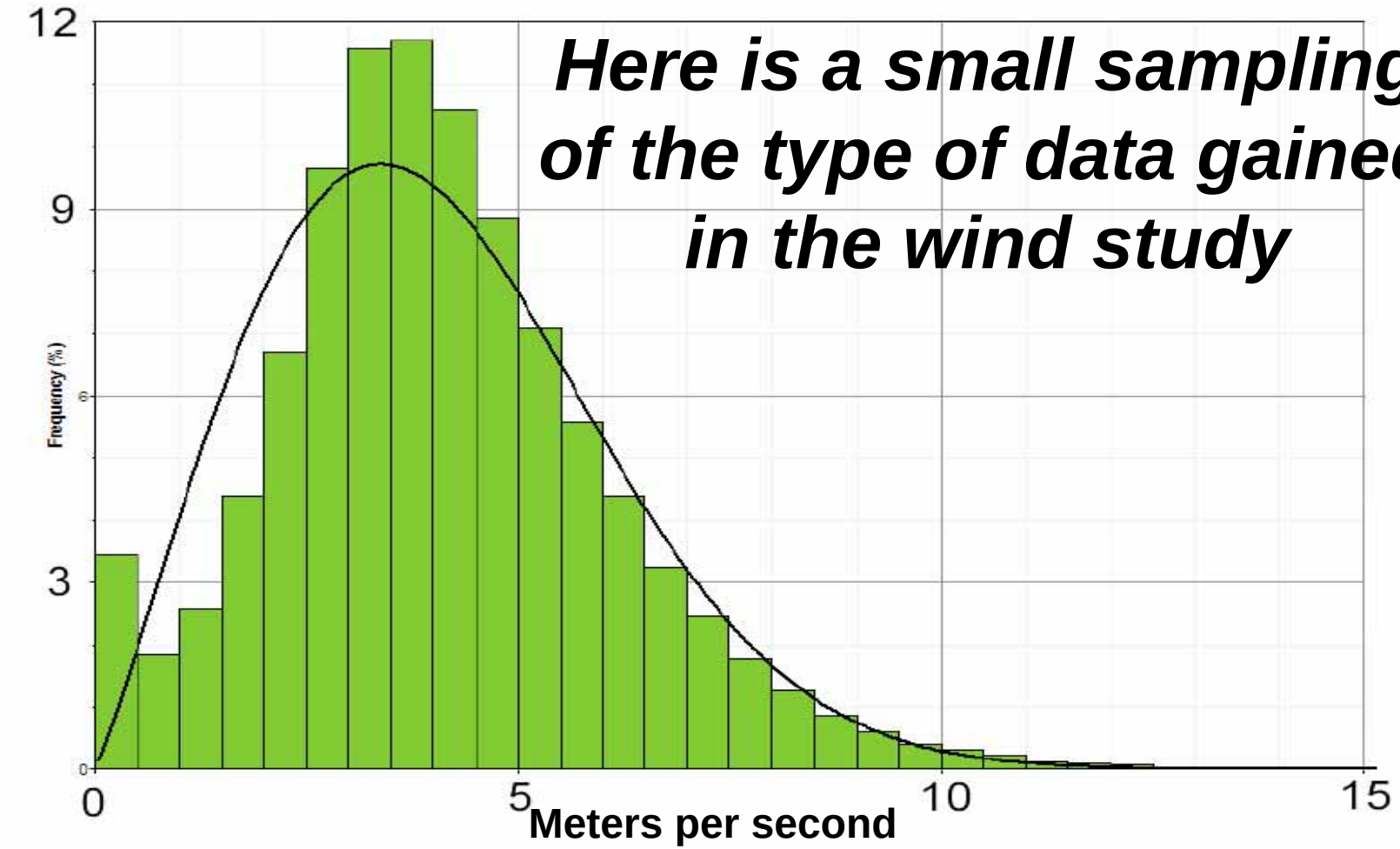

VAIO
Data Card Reader


ELECTRICAL SUBSTATION
Lonedale Rd
N Squirrel Rd
WIND SENSOR TOWER
University Dr
Auburn Hills
Oakland University
Daimler Chrysler Technology Center
Featherstone Rd
Hamlin Rd
W Hamlin Rd
Veterans Memorial Fwy
1/2 MILE
1/4 MILE
1/4 MILE

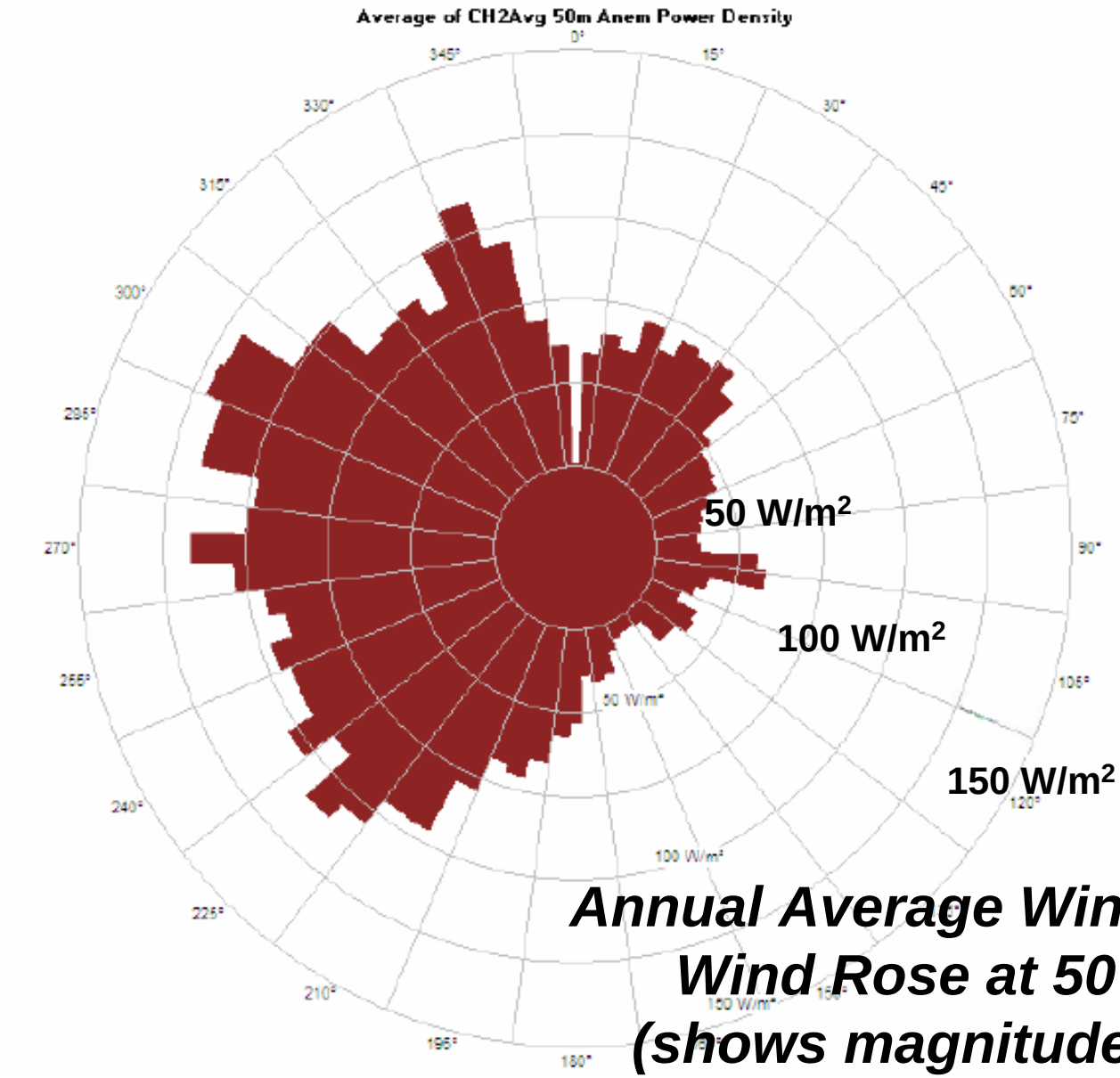

1/4 MILE
RADIUS
1/2 MILE RADIUS
1 MILE RADIUS
1/2 MILE
1/4 MILE
1/4 MILE
Auburn Hills
University Dr
N Squirrel Rd
S Adams Rd
Daimler Chrysler Technology Center
Featherstone Rd
Hamlin Rd
W Hamlin Rd
Oakland Comm. College-Auburn Hills
Veterans Memorial Fwy
69

Average Wind Data Results

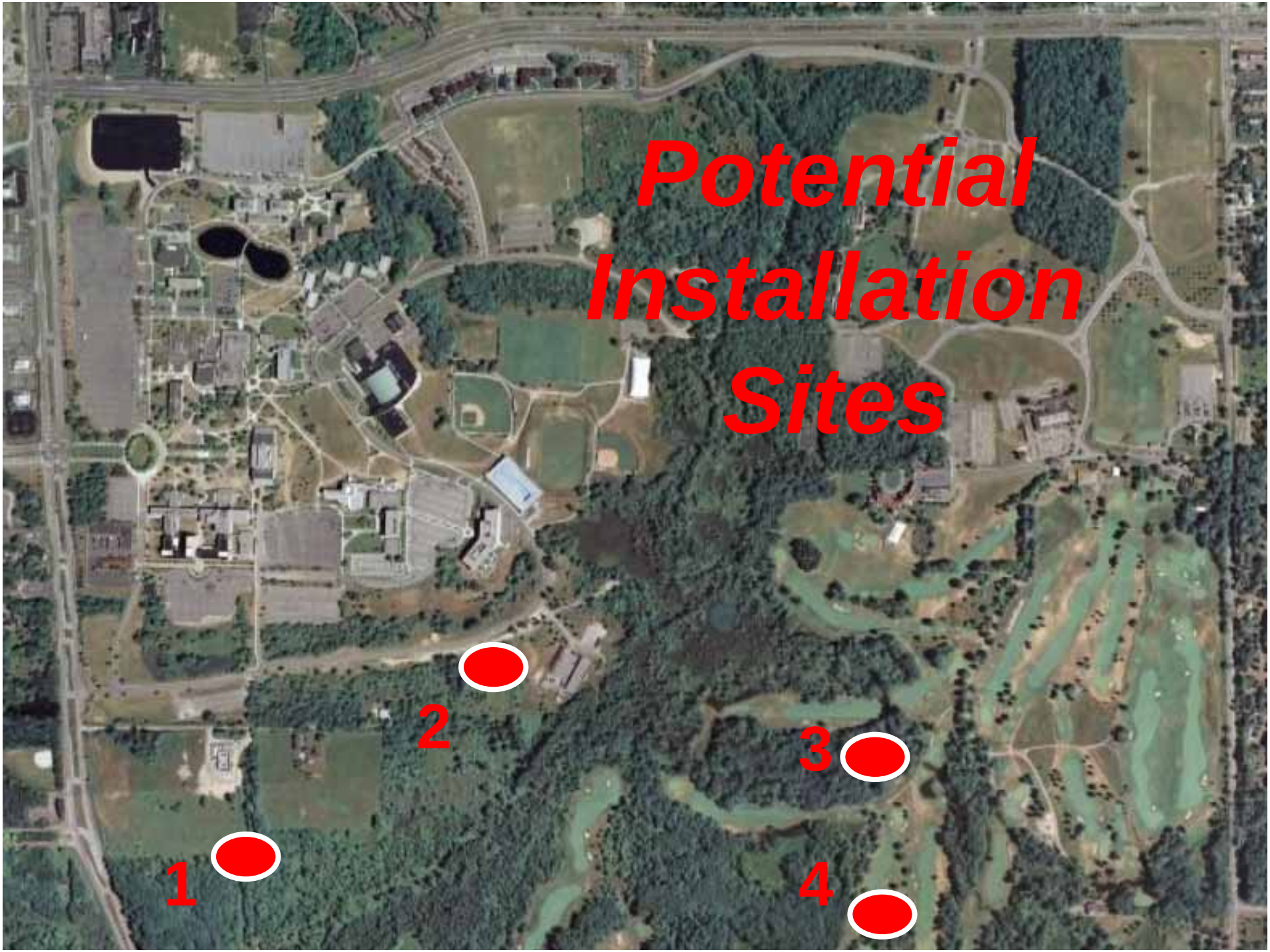
Height	Wind Speed	Method
30 m	3.0 m/s	measured
40 m	3.6 m/s	measured
50 m	4.1 m/s	measured
75 m	5.2 m/s	calculated
80 m	5.4 m/s	calculated
100 m	6.2 m/s	calculated



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)


Potential Installation Sites
1
2
3
4

Artist's Rendering of Oakland Wind Turbine

(image courtesy of Khales Dahr & Jim Leidel)

Here is a typical wind turbine under consideration

1,500 kW each

77 meter blade diameter

100 meter tower

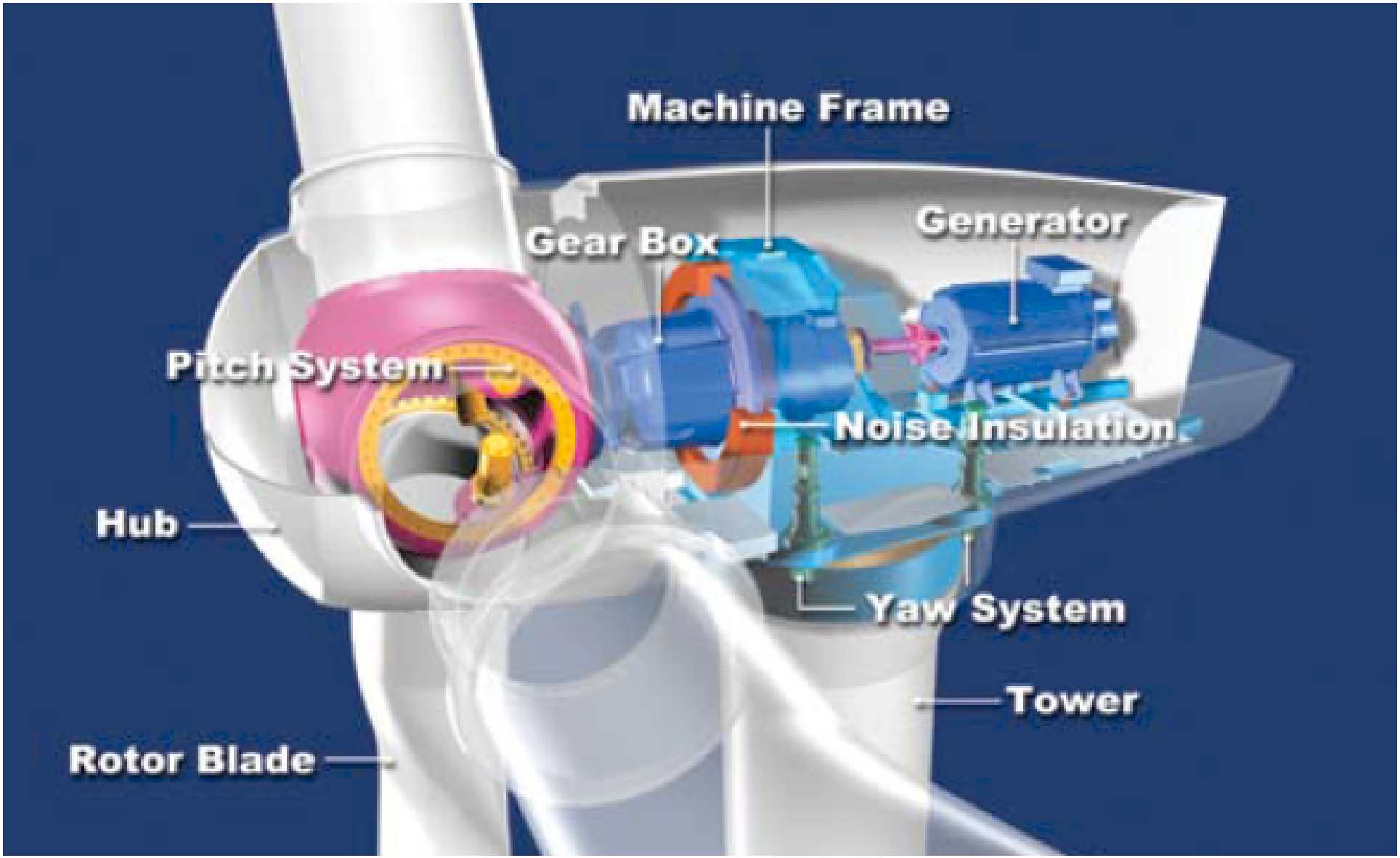
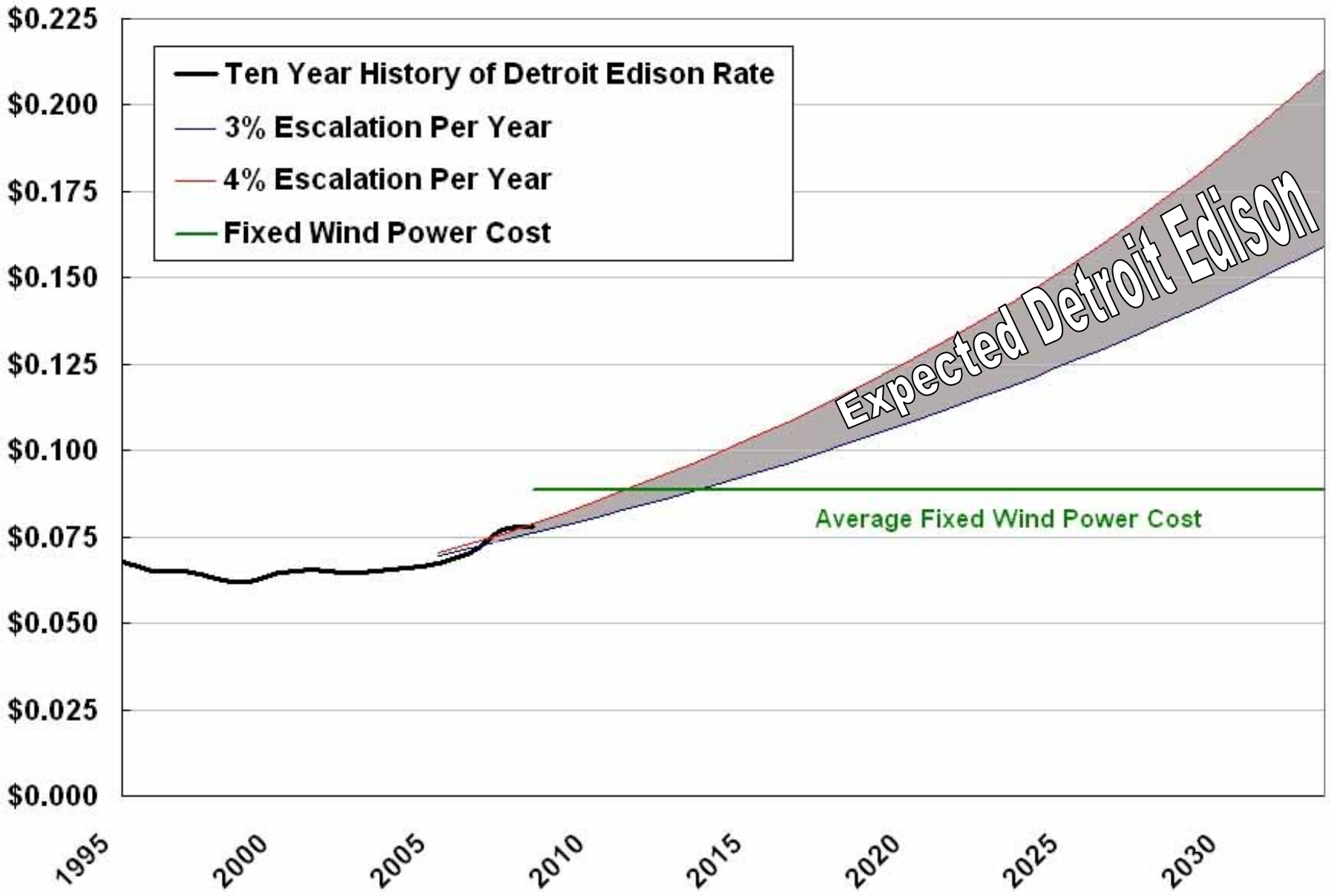


Illustration of turbine components

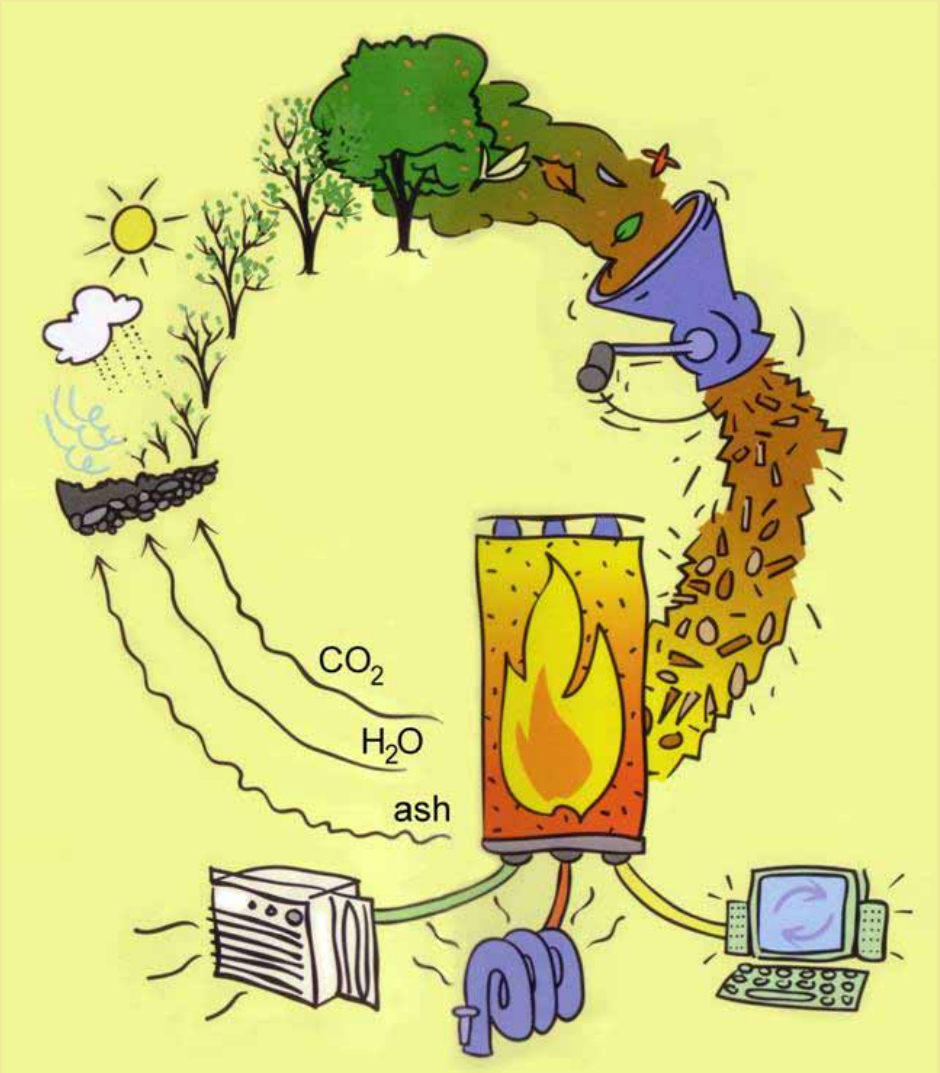


Projected Cost per kW-hr Electricity Over 25 Year Project

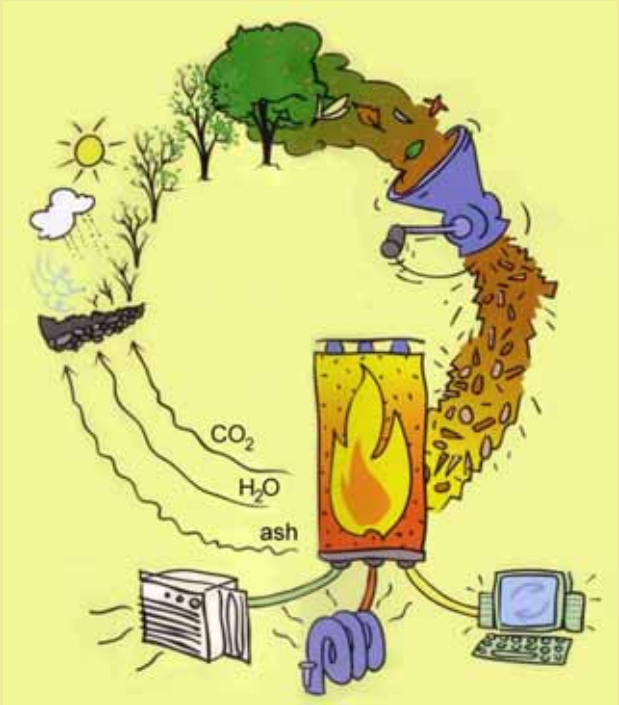
Biomass Power Option

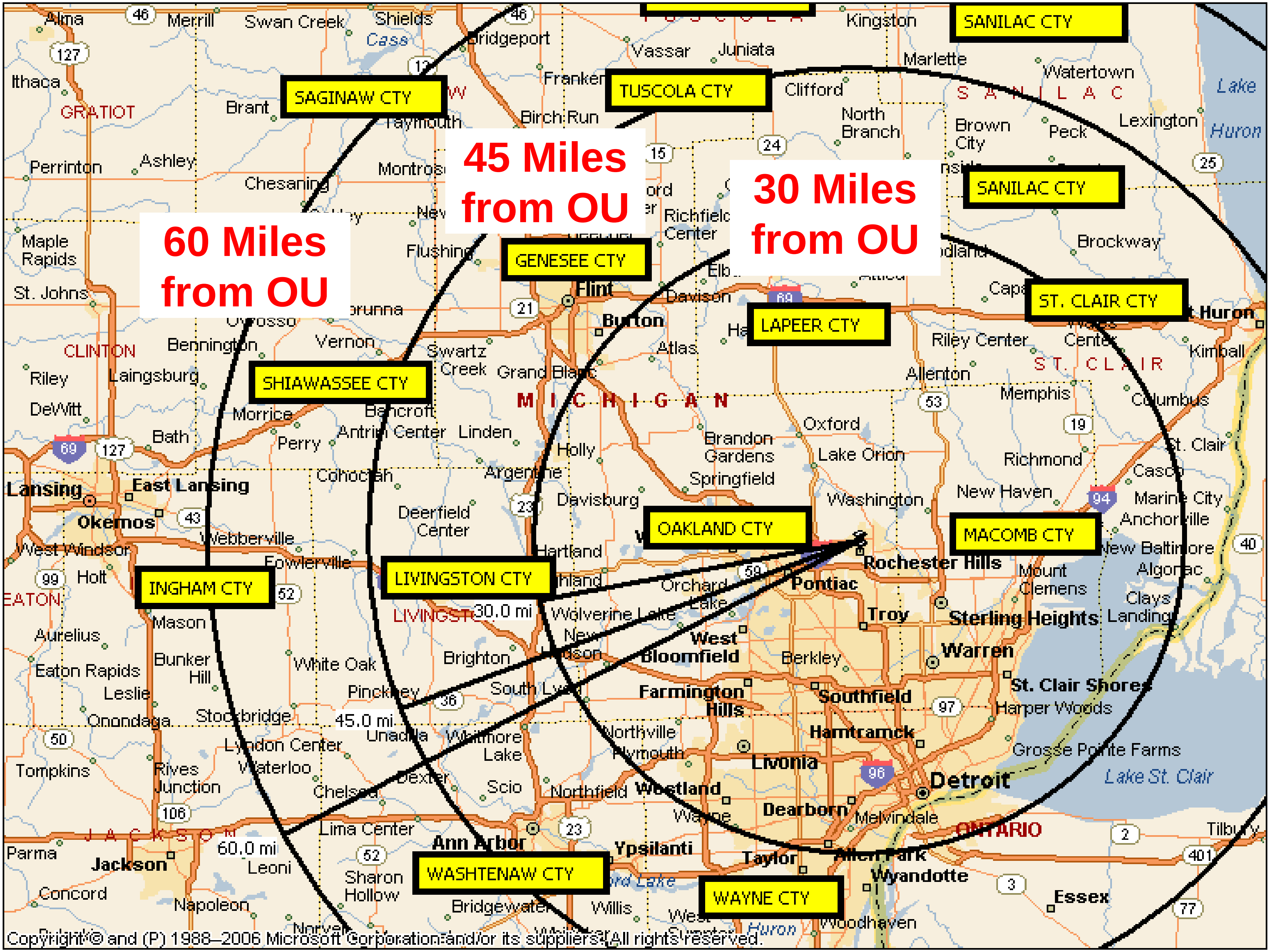
for Oakland University

- **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




60 Miles from OU
45 Miles from OU
30 Miles from OU
SAGINAW CTY
TUSCOLA CTY
SANILAC CTY
SANILAC CTY
GENESEE CTY
LAPEER CTY
ST. CLAIR CTY
SHIAWASSEE CTY
OAKLAND CTY
MACOMB CTY
LIVINGSTON CTY
INGHAM CTY
WASHTENAW CTY
WAYNE CTY
30.0 mi
45.0 mi
60.0 mi
MICHIGAN
Flint
Lansing
East Lansing
Okemos
Pontiac
Rochester Hills
Troy
Sterling Heights
Warren
Southfield
Livonia
Detroit
Ann Arbor
Ypsilanti
Jackson
Lake Huron
Lake St. Clair
ONTARIO
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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

d. National Renewable Energy Labs (2005)

4.3 MTPY for all of Michigan

0.9 MTPY for 14 county area

c. Oak Ridge National Labs (1999)

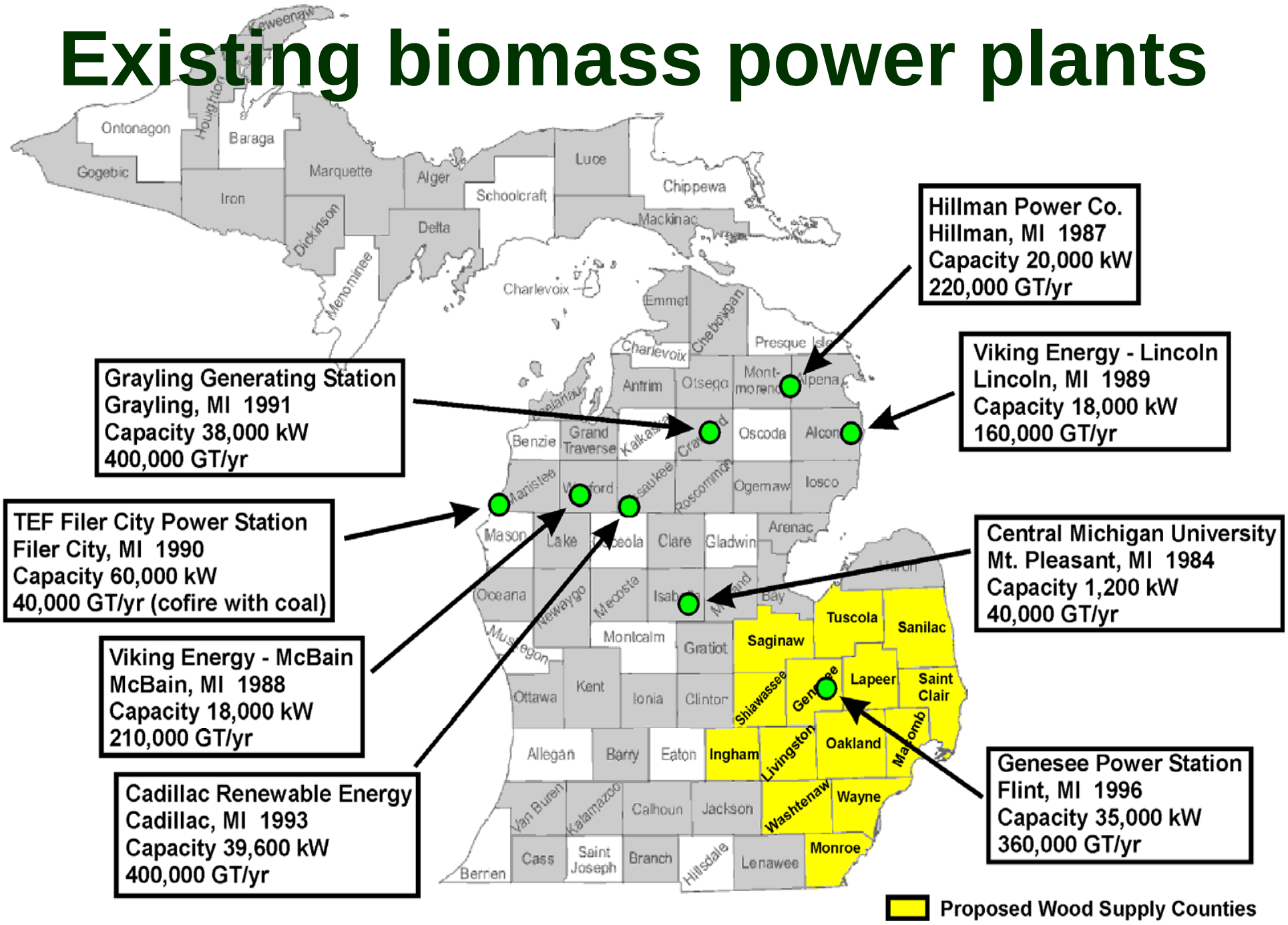
2-4 MTPY for all of Michigan (cost based)

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



Nearby wood recyclers could easily serve the new system

J.h.Hart urban FORESTRY

Oakland UNIVERSITY

Other campus's heat with wood:

- Central Michigan University
- Northern Michigan University is developing a plant

CMU Wood Boiler Plant

(heats most of campus)

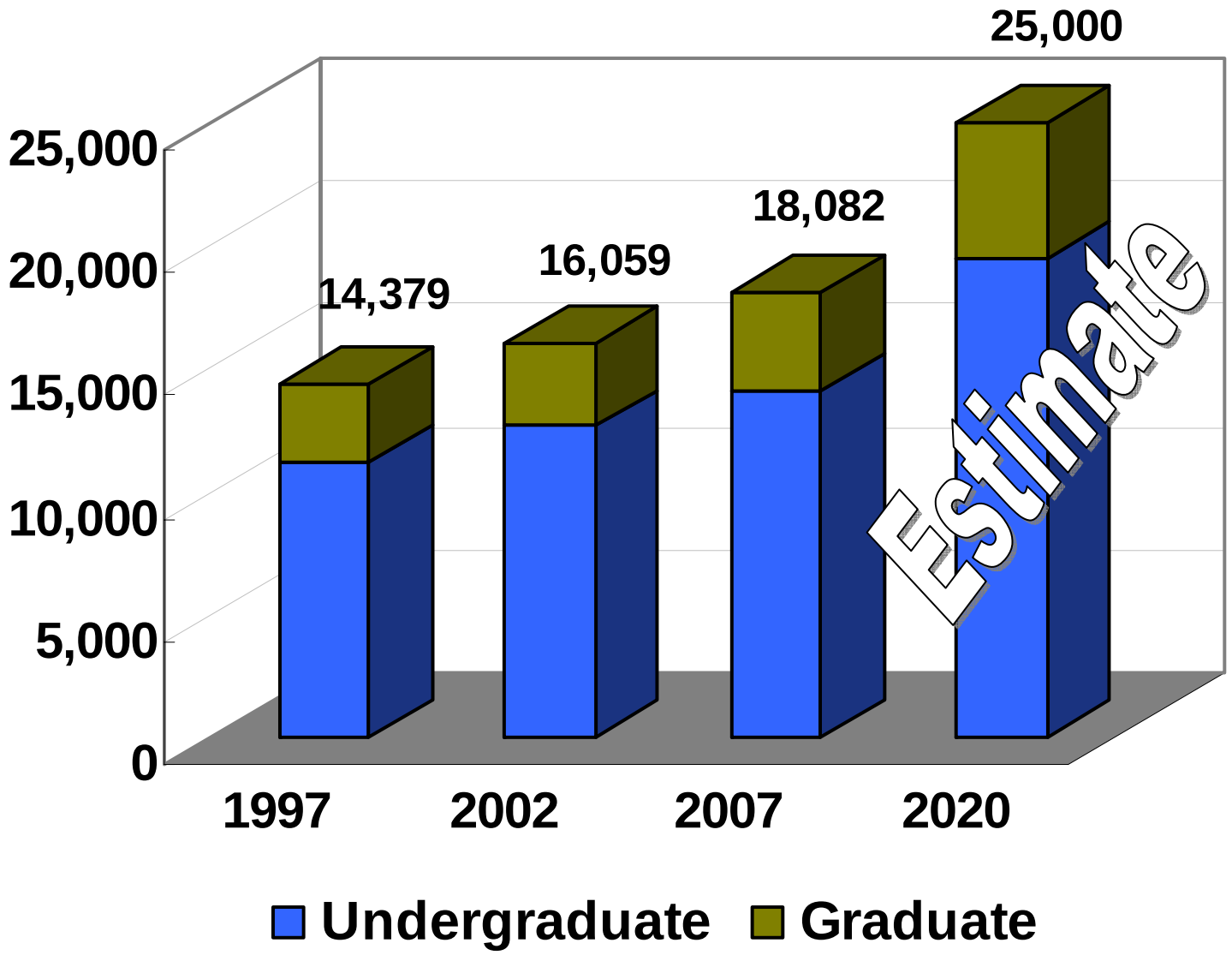
(note: only water vapor is coming from stack)
photo - Jim Leidel 2005

Next we look at the future needs for campus:

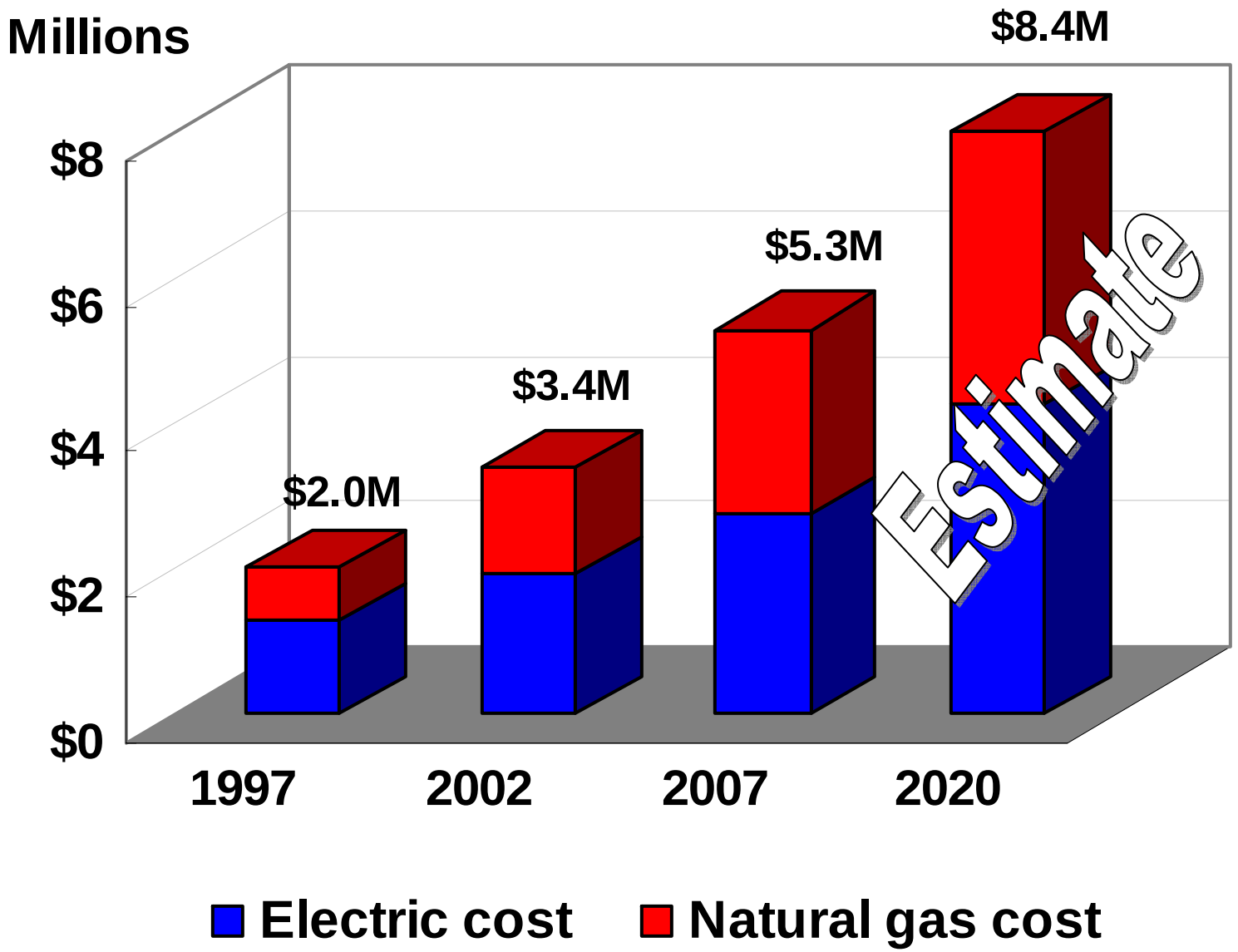
1. Replace aging boilers.
2. More capacity for future growth

Existing Central Heating Plant

Unit	Capacity (MMBTU/hr)	Year Installed	Age in years / Condition
B-1	100	1969	39 / good
B-2	100	1969	39 / good
B-3	34	1959	49 / fair
B-4	32	1957	51 / marginal
Total	**265**		



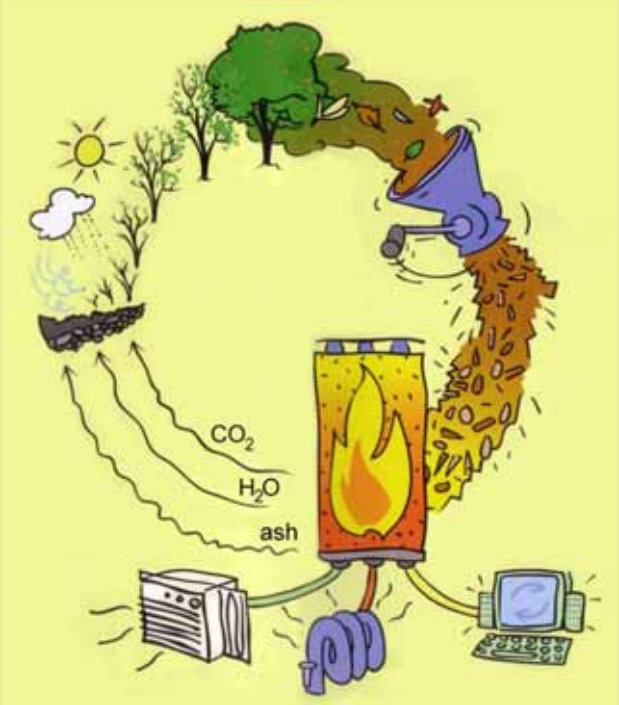
Oakland University Ten Year Fall Enrollment Growth with 2020 Vision

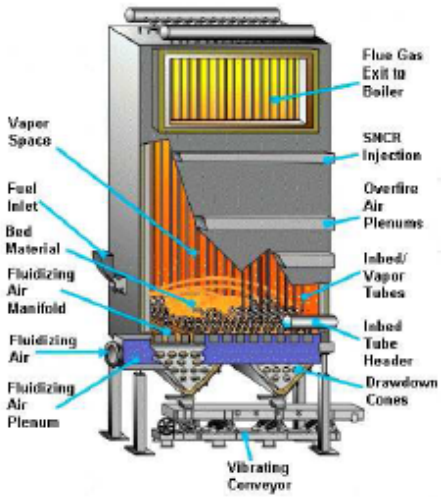


Oakland University Ten Year Energy Growth with 2020 Vision

2020 Projection based on $0.085/kWhr electricity and $11/MMBTU gas

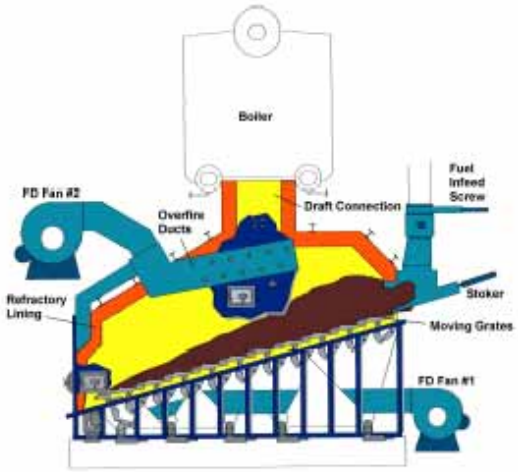
We then looked at various wood boiler systems





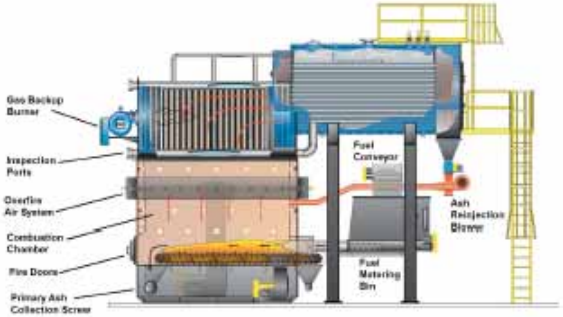
EPI Fluid Bed

(Steam & HW)



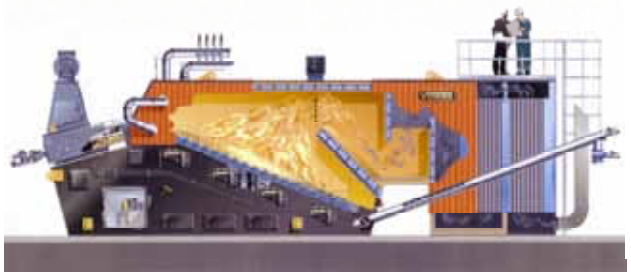
English Stoker

(Steam & HW)



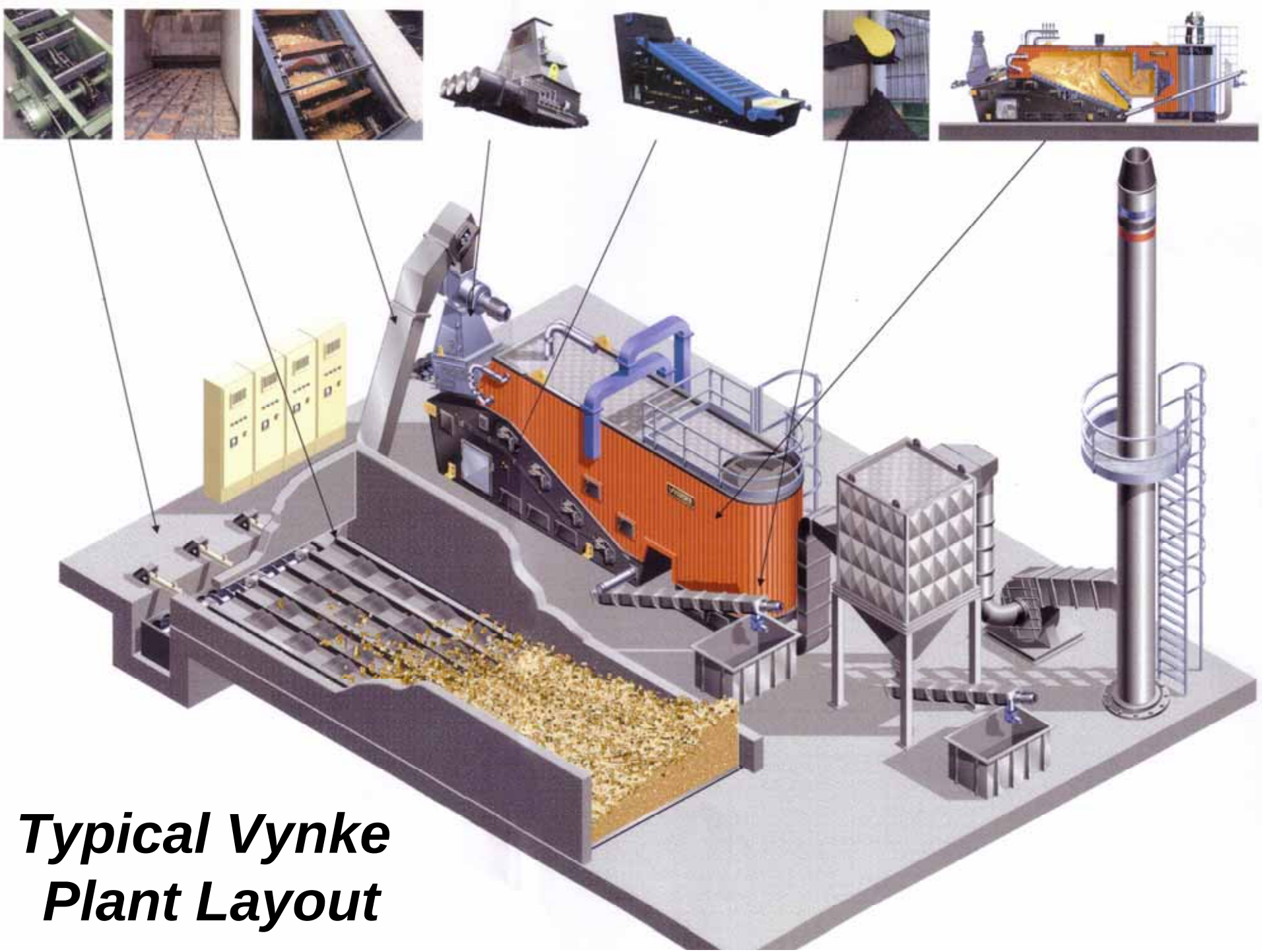
Hurst Stoker

(HW Only)

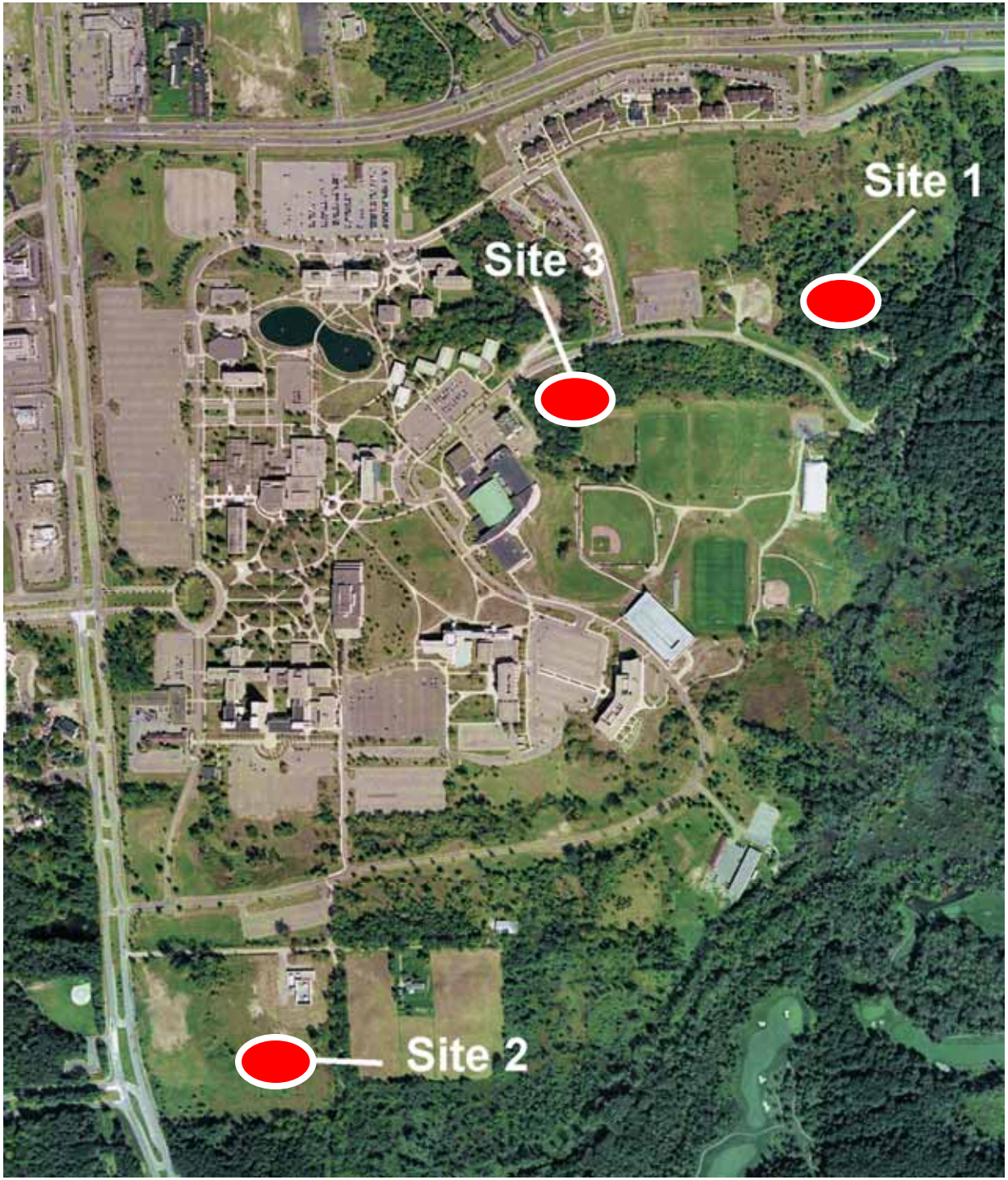


Vynke Stoker

(Steam & HW)

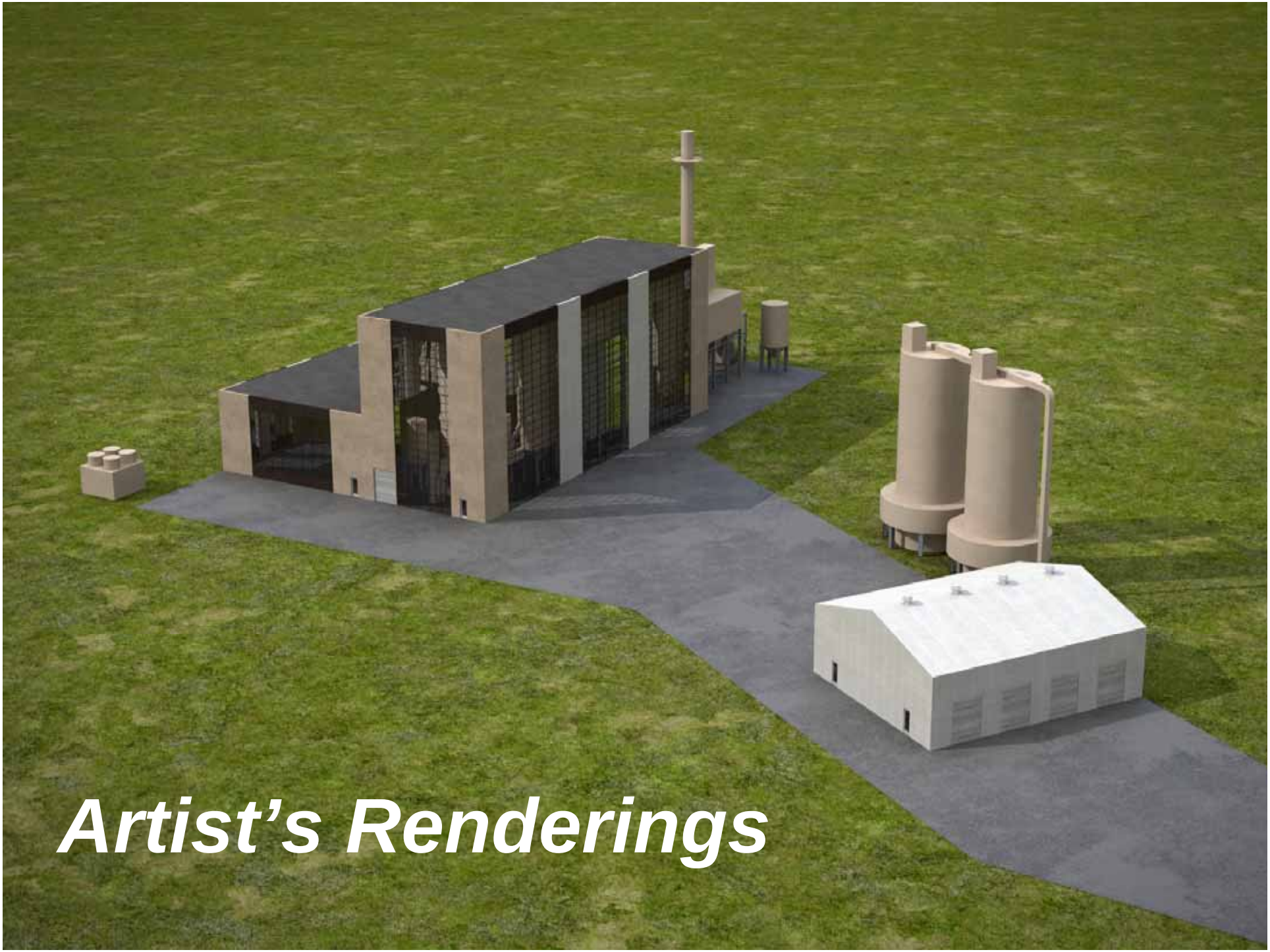


Typical Vynke Plant Layout



Oakland UNIVERSITY

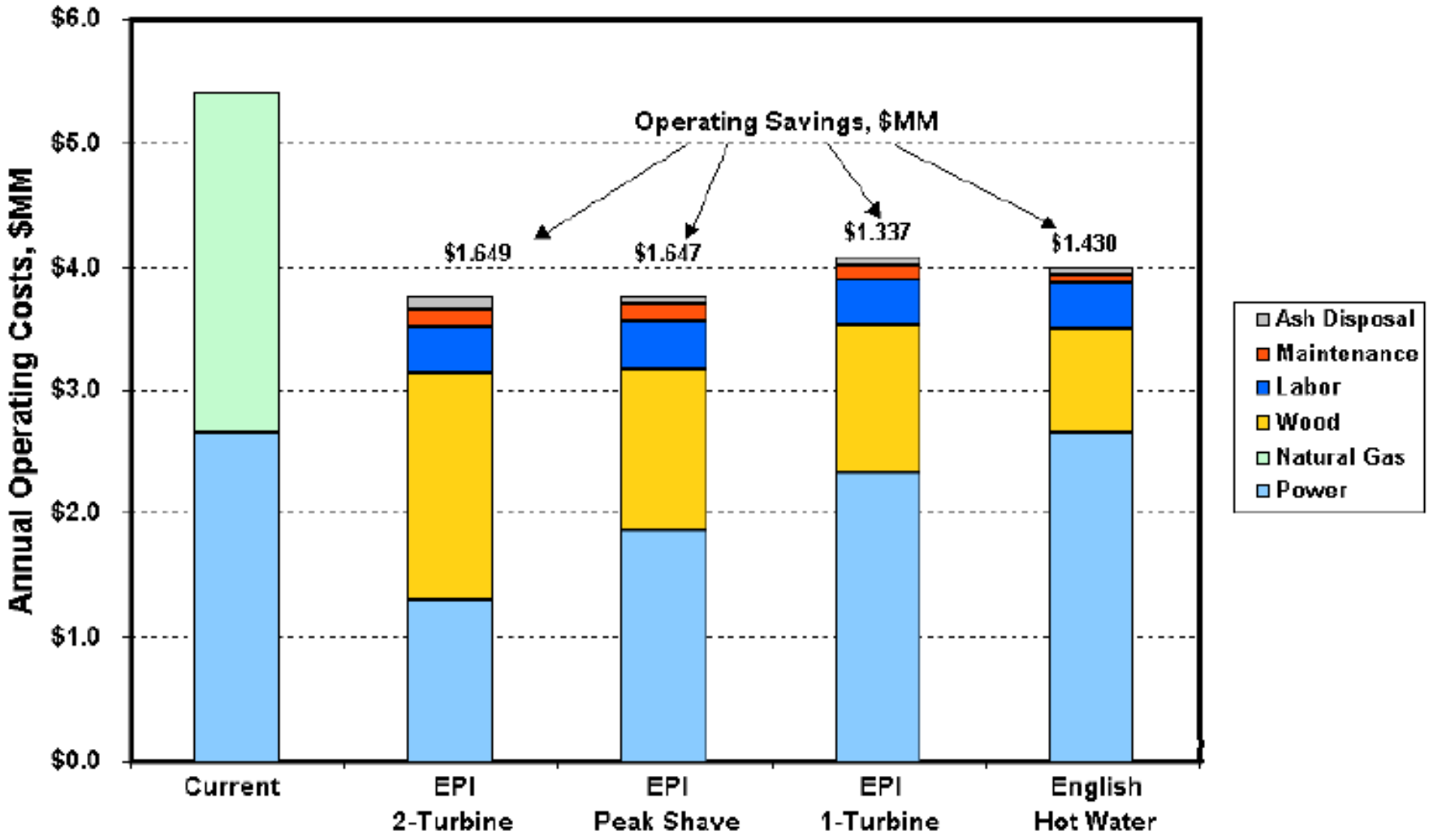
Three Proposed Site Locations


Artist’s Renderings

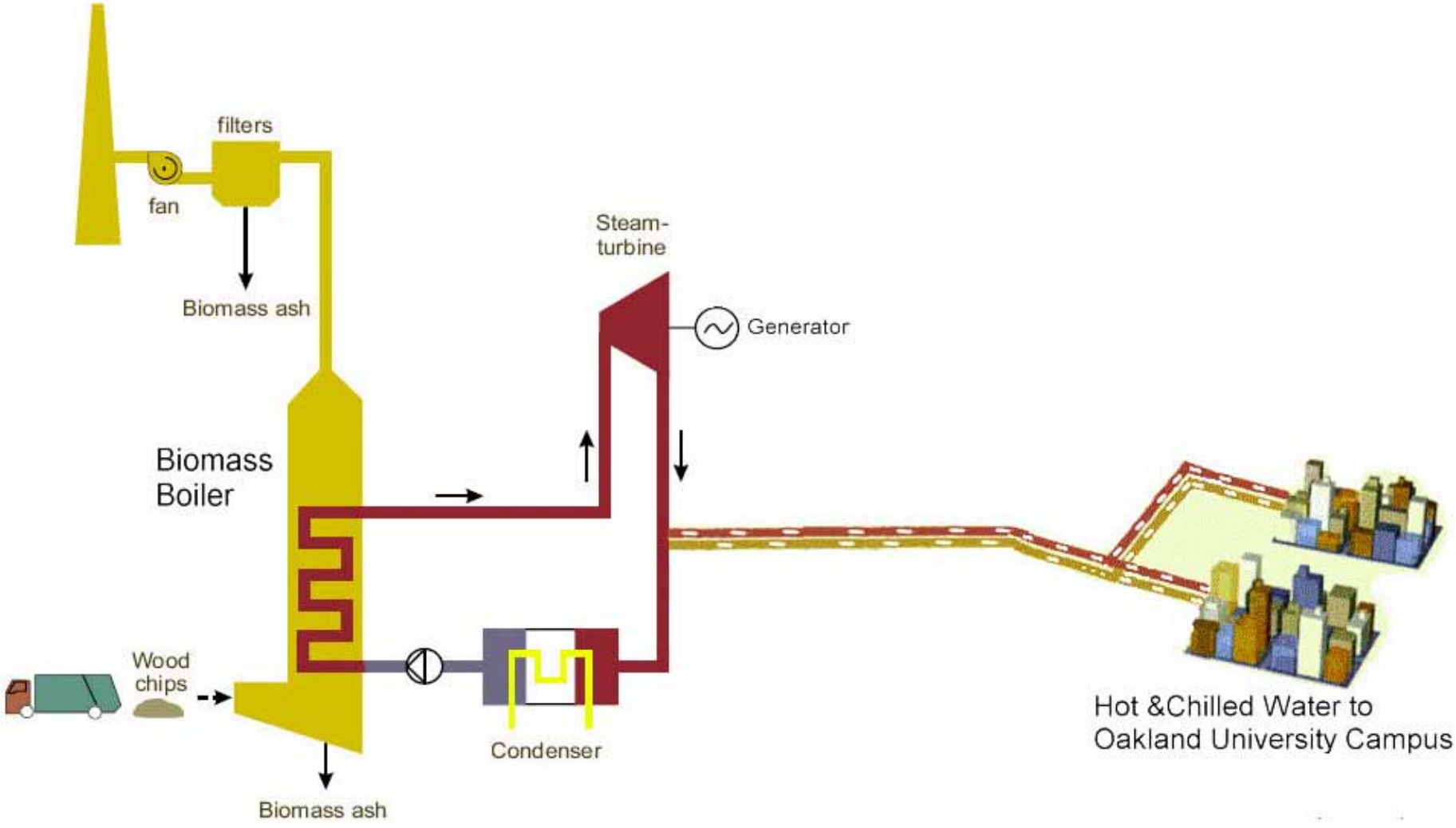
A typical wood storage building
(in Kingsville, Ontario)

Annual operating savings are in the range of $1.5 million

Operating Cost Estimates



Overview of an Integrated, Renewable Energy Supply Infrastructure



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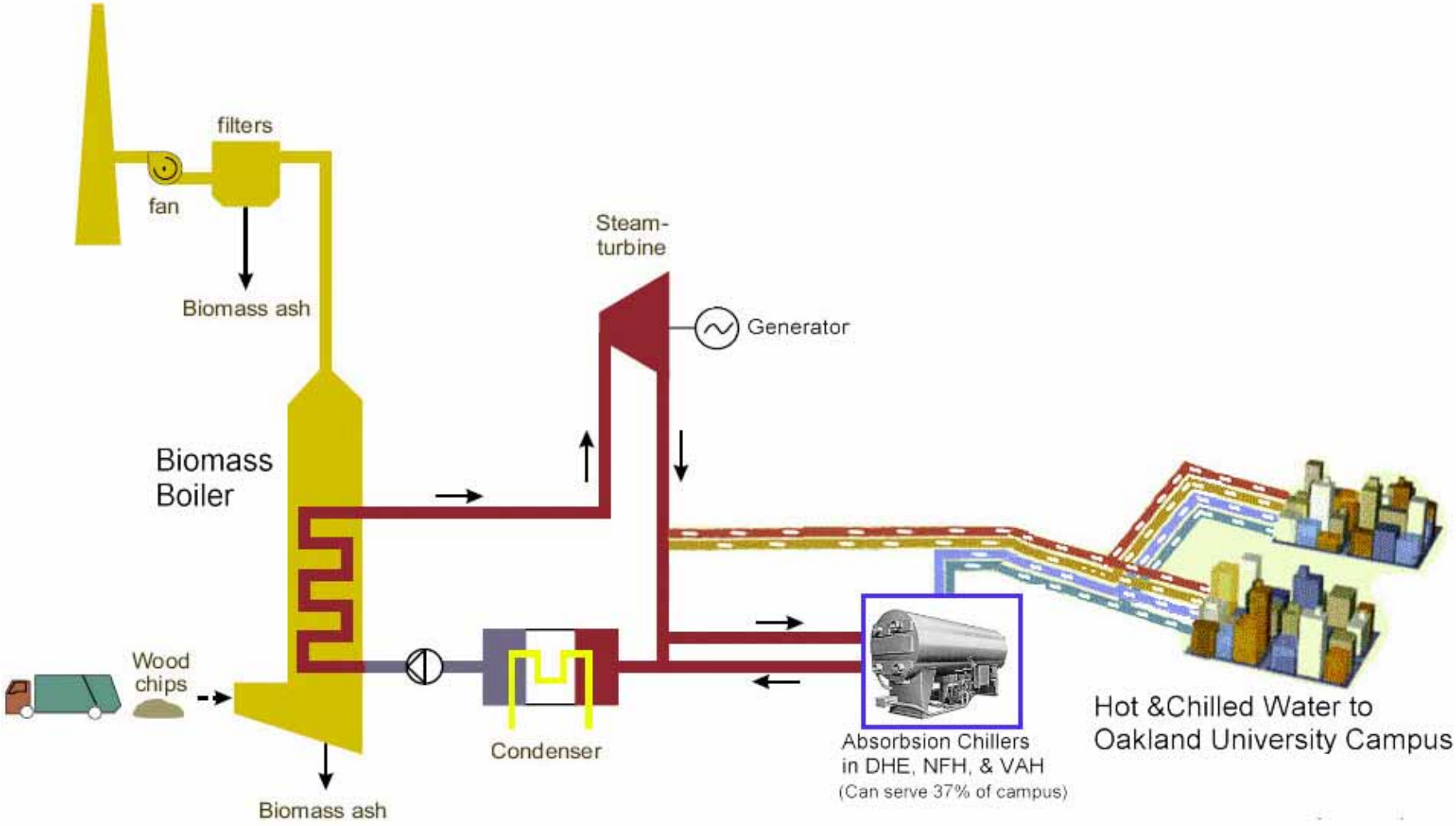

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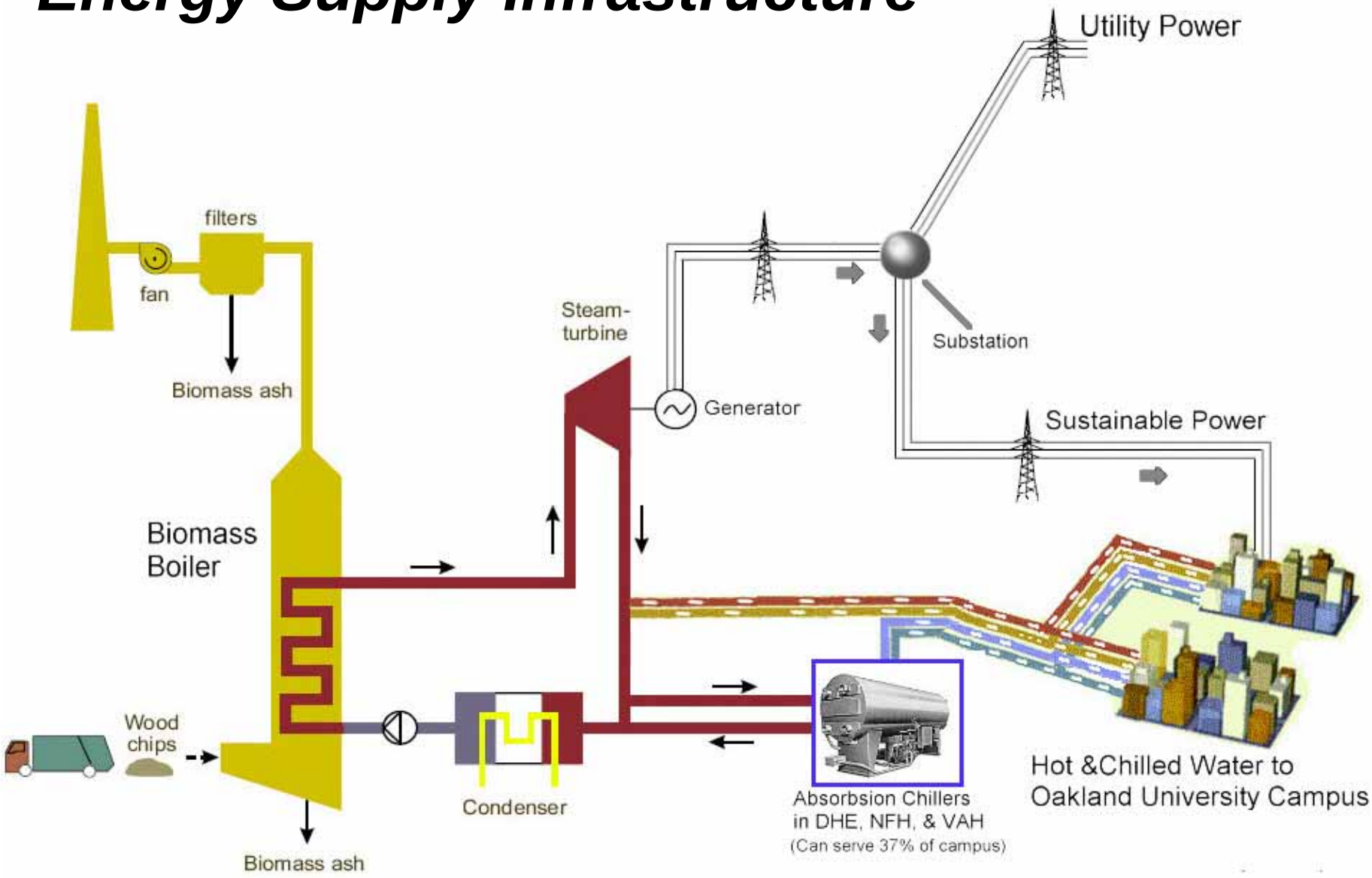
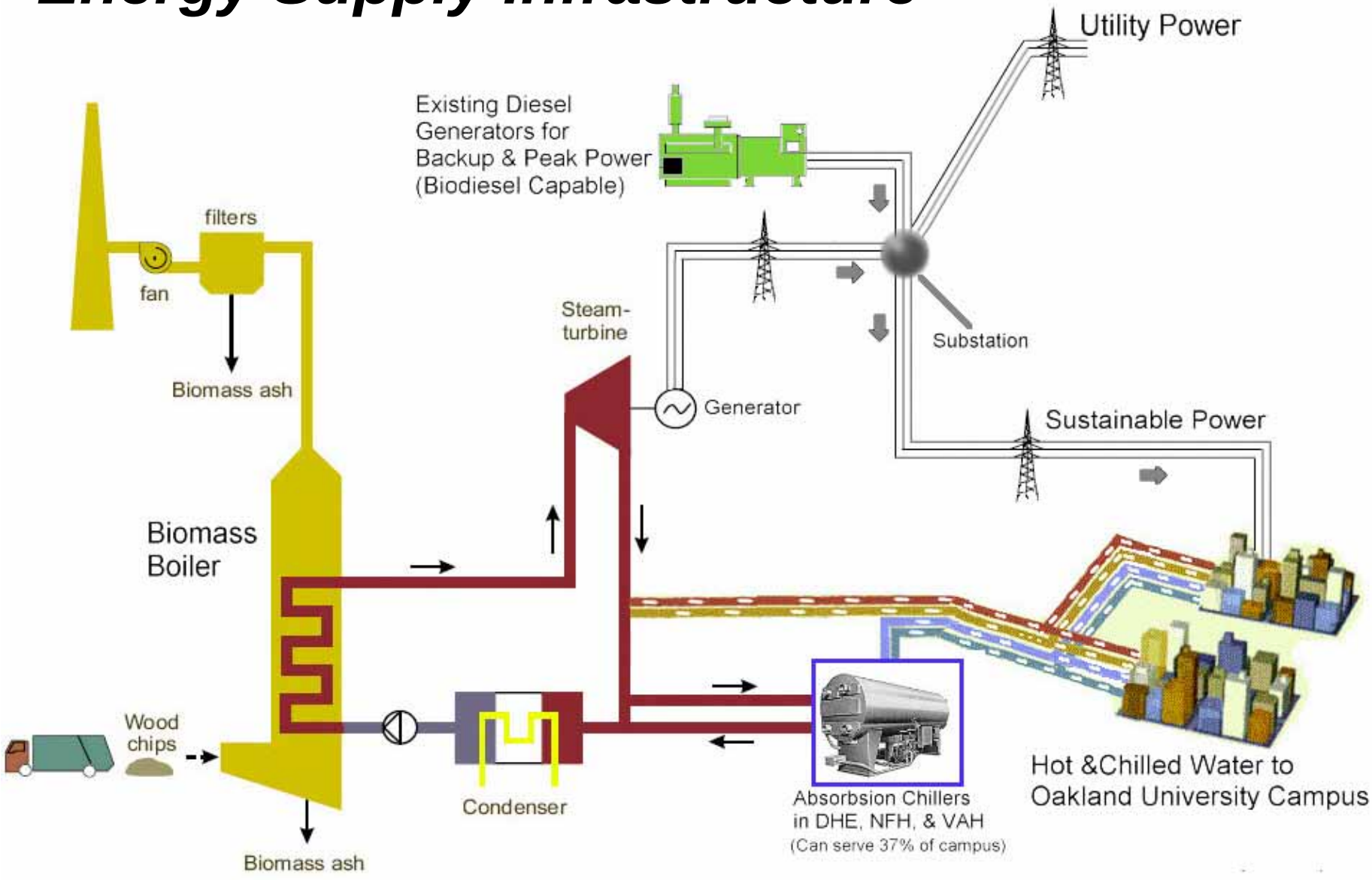


Overview of an Integrated, Renewable Energy Supply Infrastructure



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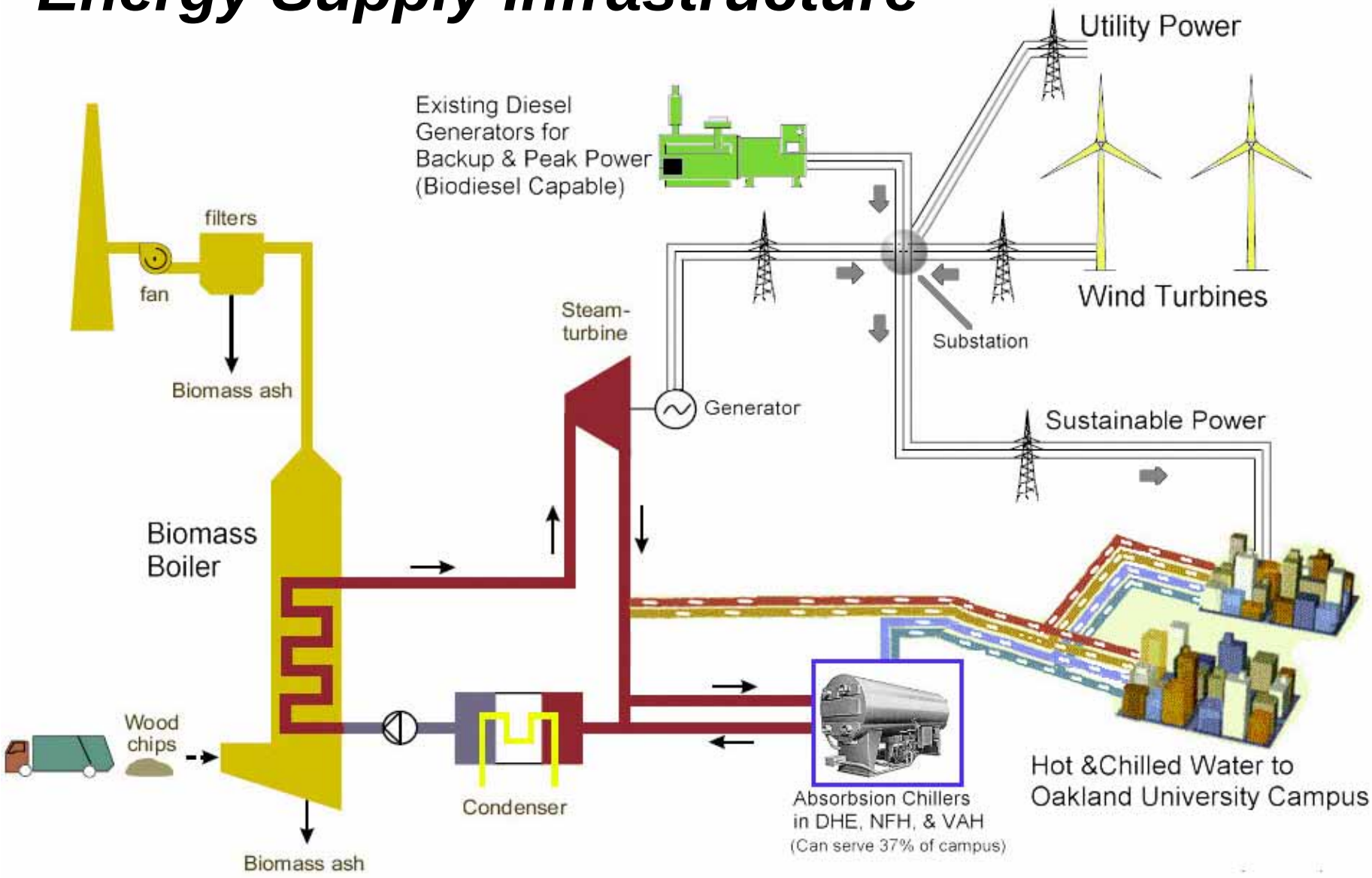
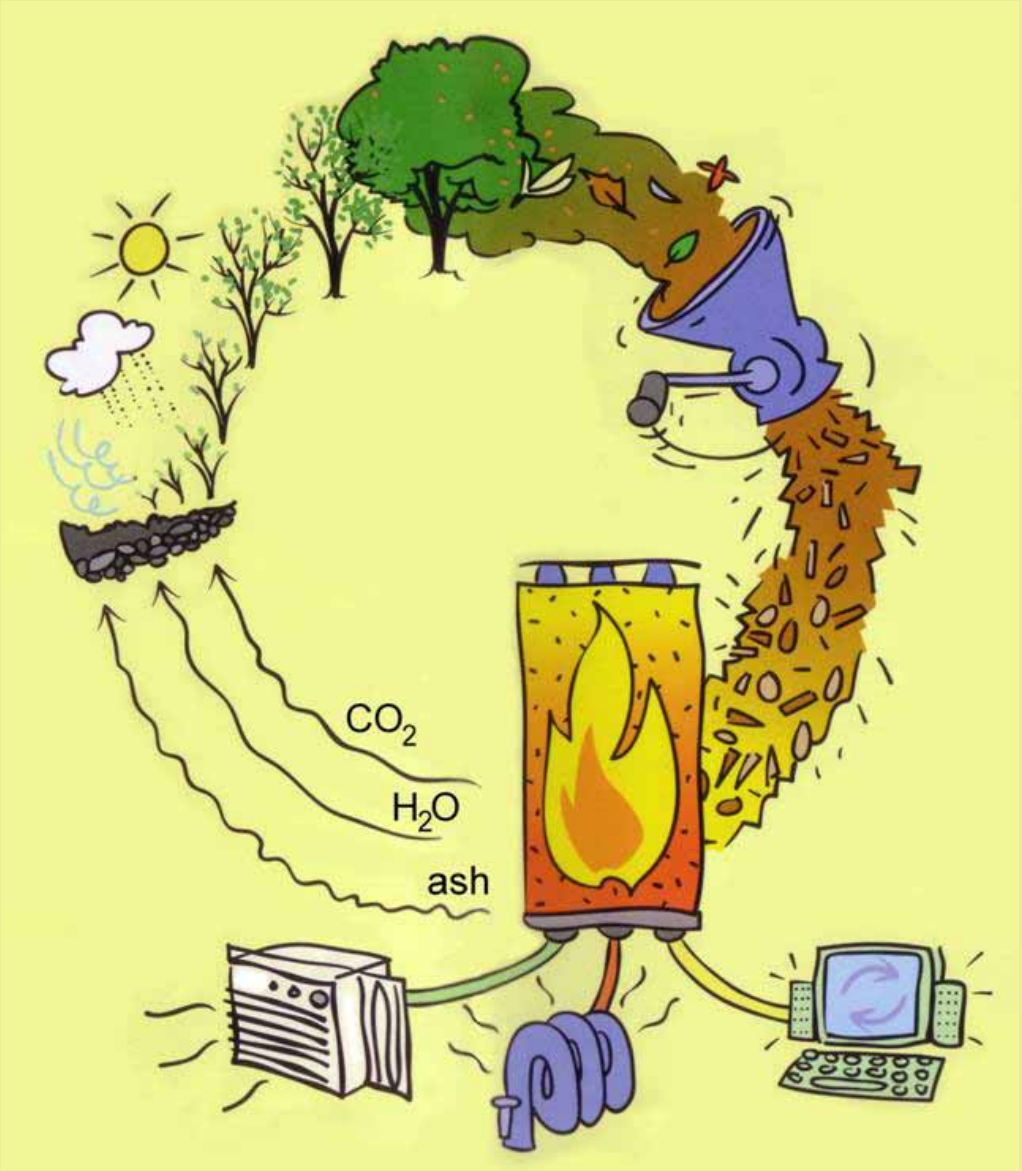


Overview of an Integrated Renewable Energy Supply Infrastructure

	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%

Biomass & Wind Power

Sustainable Energy Options for the Future of Oakland University



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