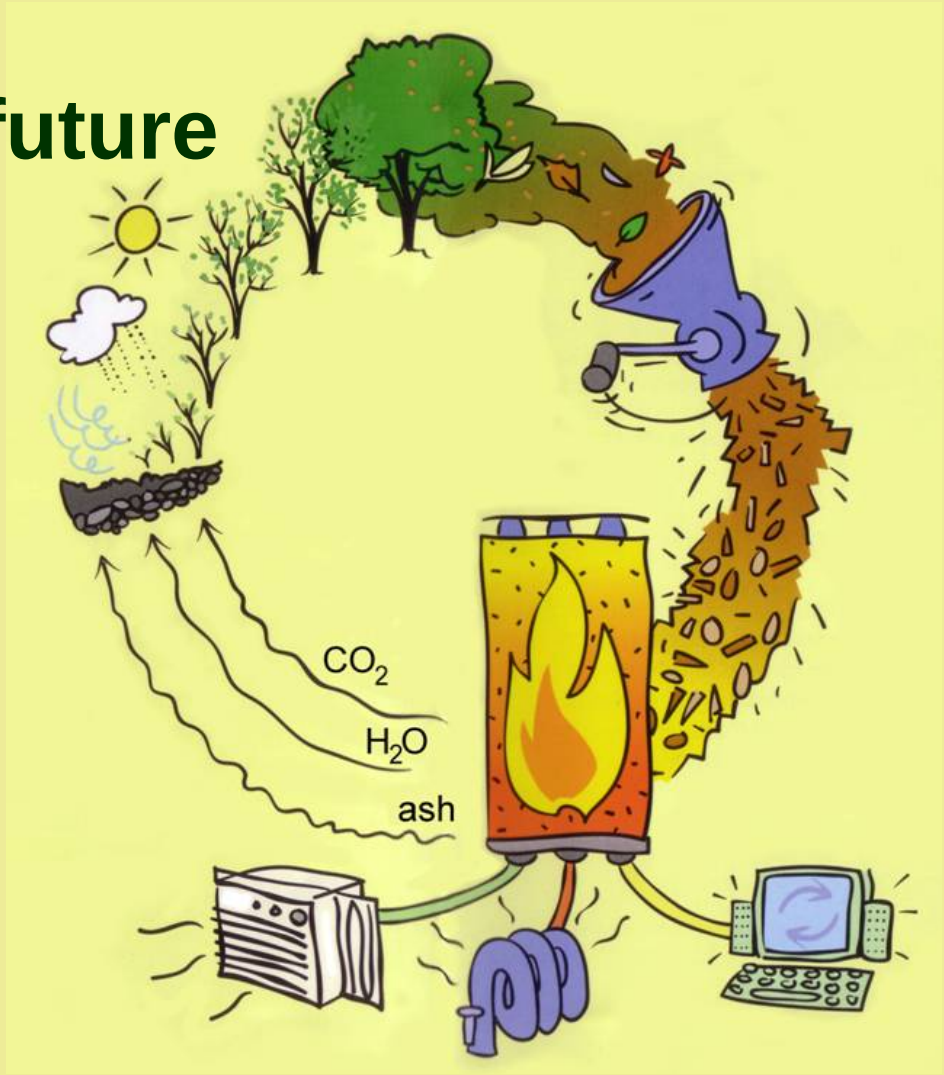
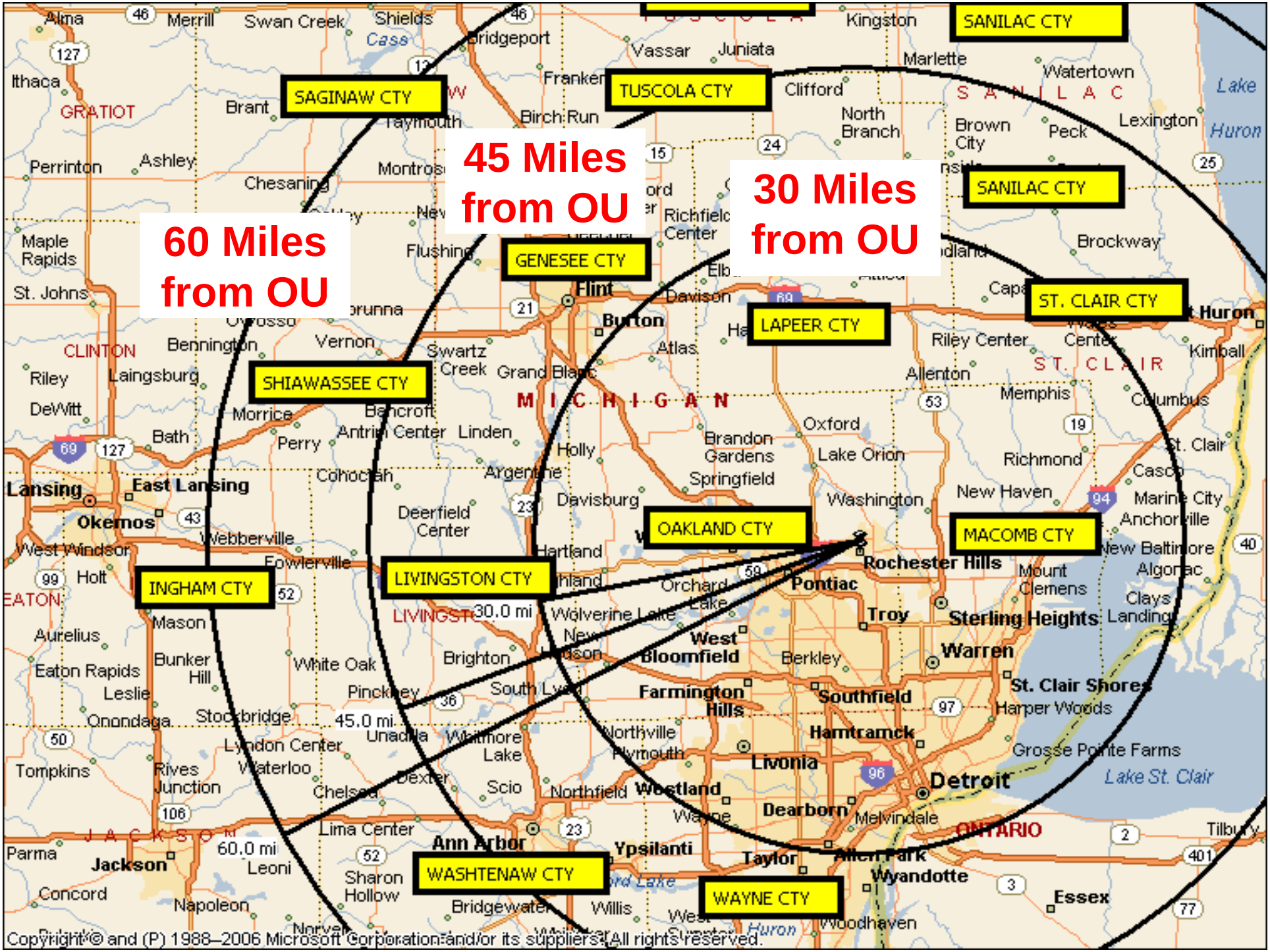
Biomass Power

Jim Leidel
Oakland University
April 2008

- **Wood supply**
- **Campus growth & future needs**
- **Wood boilers**
- **Proposed sites**
- **Costs & savings**
- **Funding**
- **Recommendations**




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
INGHAM CTY
LIVINGSTON CTY
WASHTENAW CTY
WAYNE CTY
30.0 mi
45.0 mi
60.0 mi
Lansing
East Lansing
Okemos
Mason
Jackson
Ann Arbor
Ypsilanti
Detroit
Dearborn
Livonia
Westland
Farmington Hills
West Bloomfield
Southfield
Troy
Sterling Heights
Warren
Pontiac
Rochester Hills
Flint
Burton
Grand Blanc
Brighton
Howell
Chelsea
Dexter
Saline
Milan
Tecumseh
Adrian
Monroe
Toledo
Windsor
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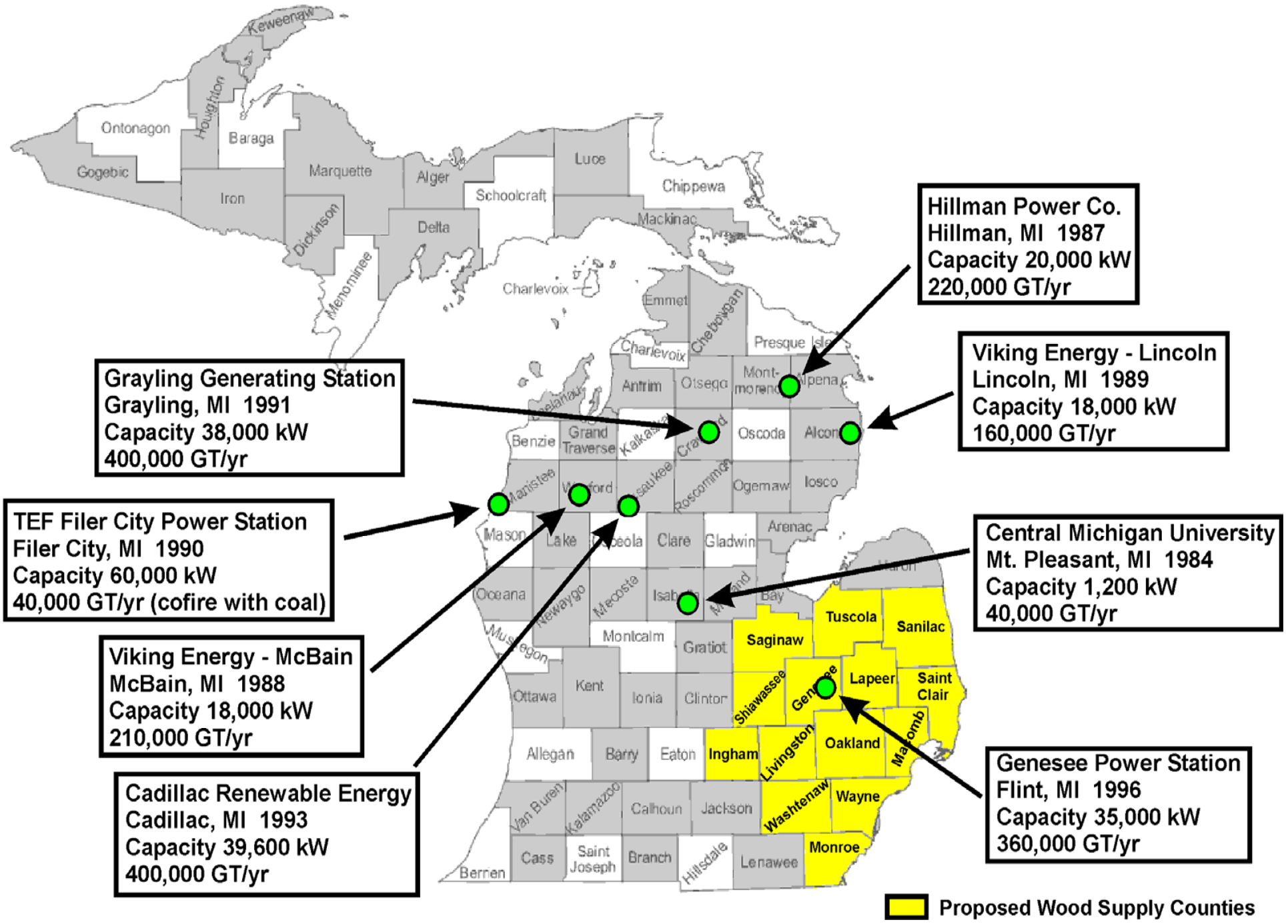
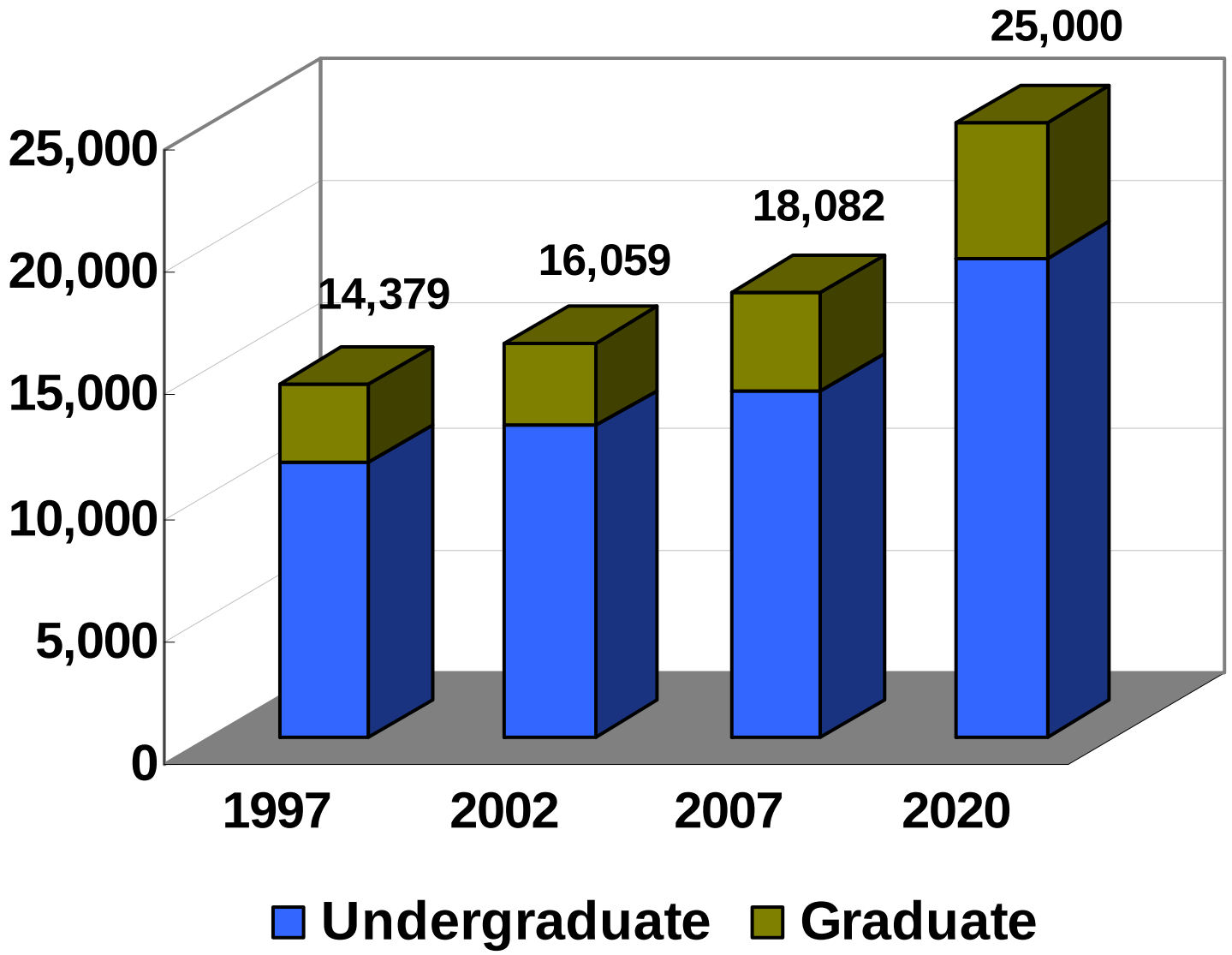

Hillman Power Co.
Hillman, MI 1987
Capacity 20,000 kW
220,000 GT/yr
Viking Energy - Lincoln
Lincoln, MI 1989
Capacity 18,000 kW
160,000 GT/yr
Grayling Generating Station
Grayling, MI 1991
Capacity 38,000 kW
400,000 GT/yr
TEF Filer City Power Station
Filer City, MI 1990
Capacity 60,000 kW
40,000 GT/yr (cofire with coal)
Central Michigan University
Mt. Pleasant, MI 1984
Capacity 1,200 kW
40,000 GT/yr
Viking Energy - McBain
McBain, MI 1988
Capacity 18,000 kW
210,000 GT/yr
Cadillac Renewable Energy
Cadillac, MI 1993
Capacity 39,600 kW
400,000 GT/yr
Genesee Power Station
Flint, MI 1996
Capacity 35,000 kW
360,000 GT/yr
Proposed Wood Supply Counties
Keweenaw
Ontonagon
Houghton
Baraga
Gogebic
Marquette
Alger
Luce
Chippewa
Iron
Schoolcraft
Mackinac
Dickinson
Delta
Menominee
Charlevoix
Emmet
Cheboygan
Presque Isle
Antrim
Otsego
Montmorency
Alpena
Benzie
Grand Traverse
Kalkaska
Crawford
Oscoda
Alcona
Manistee
Wexford
Missaukee
Roscommon
Ogemaw
Iosco
Mason
Lake
Osceola
Clare
Gladwin
Arenac
Oceana
Newaygo
Mecosta
Isabella
Midland
Bay
Muskegon
Montcalm
Gratiot
Saginaw
Tuscola
Sanilac
Ottawa
Kent
Ionia
Clinton
Shiawassee
Genesee
Lapeer
Saint Clair
Allegan
Barry
Eaton
Ingham
Livingston
Oakland
Macomb
Van Buren
Kalamazoo
Calhoun
Jackson
Washtenaw
Wayne
Berrien
Cass
Saint Joseph
Branch
Hillsdale
Lenawee
Monroe

CMU Wood Boiler Plant

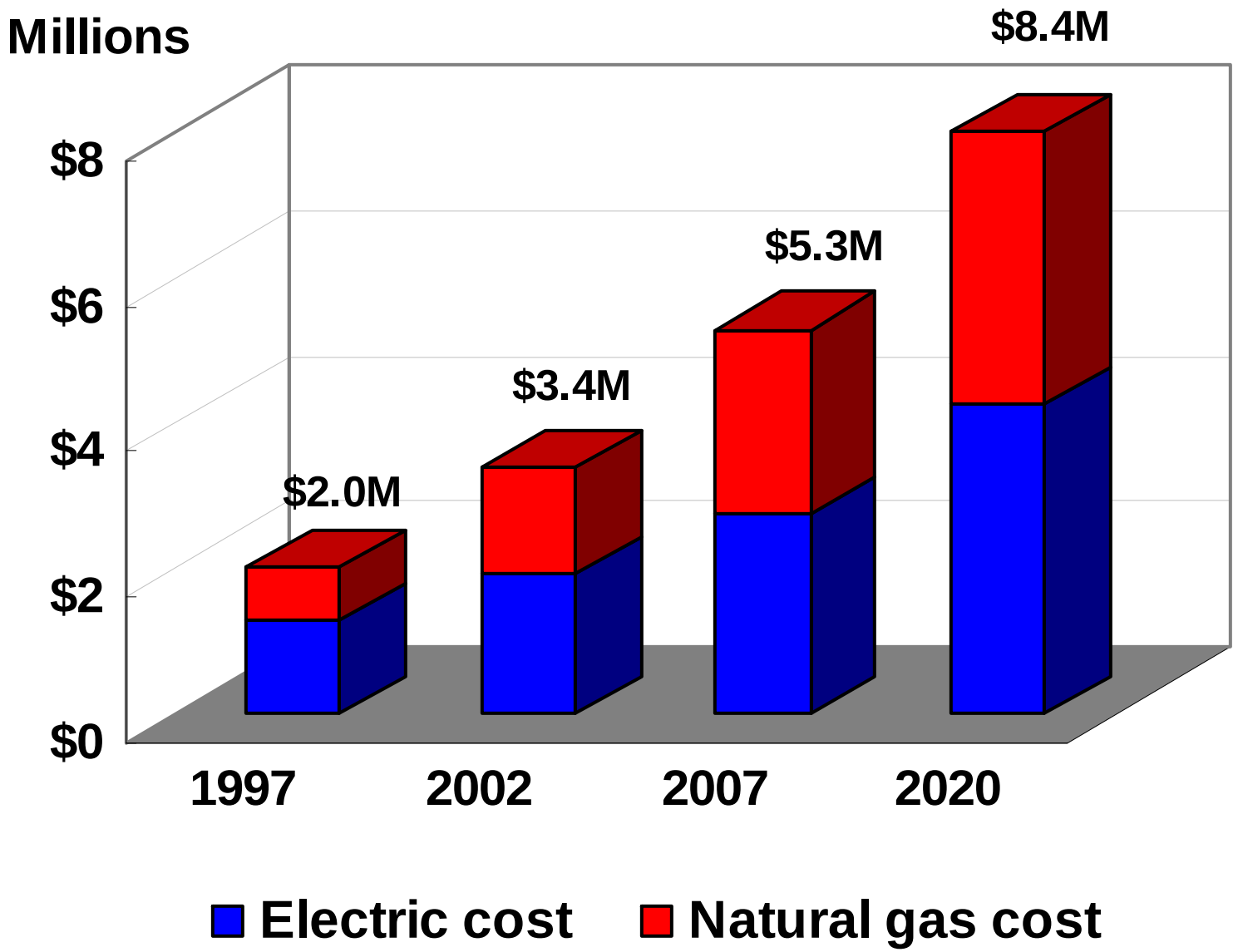
(note: only water vapor is coming from stack)
photo - Jim Leidel 2005

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**		

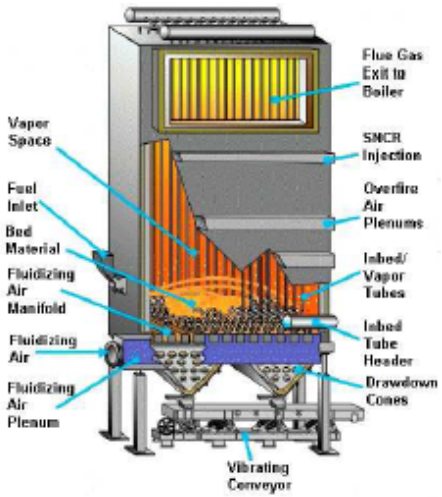


Oakland University Ten Year Fall Enrollment Growth with 2020 Vision



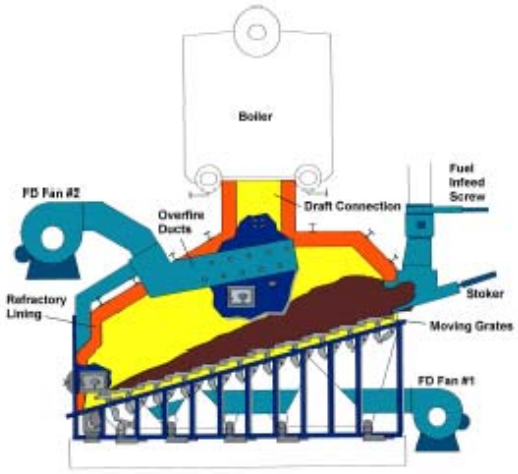
Oakland University Ten Year Energy Growth with 2020 Vision

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



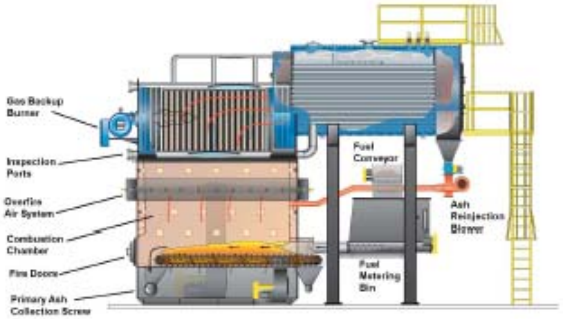
EPI Fluid Bed

(Steam & HW)



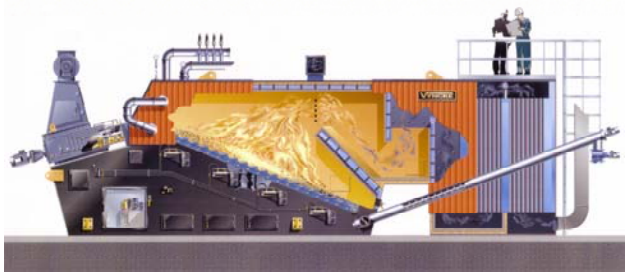
English Stoker

(Steam & HW)



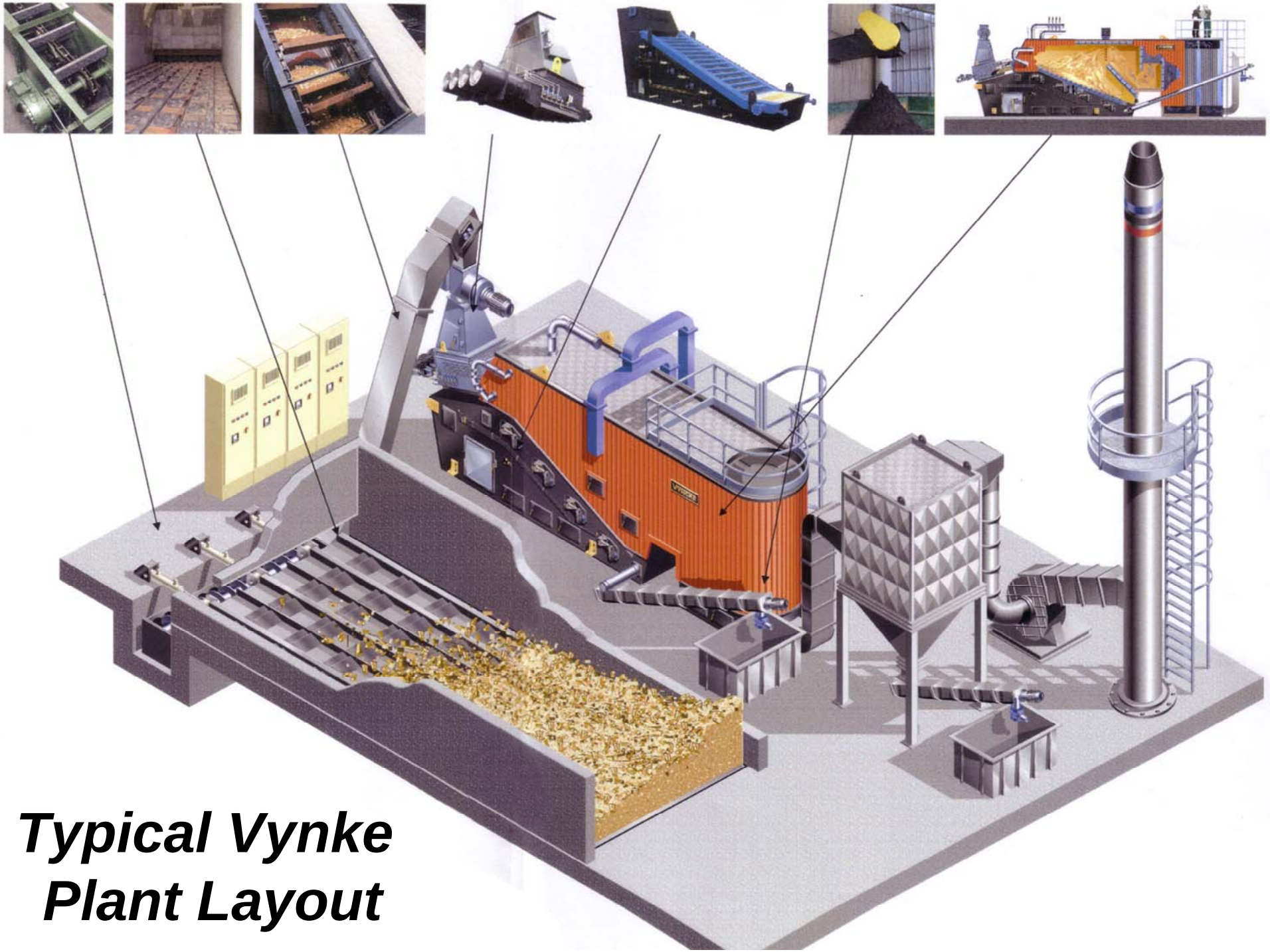
Hurst Stoker

(HW Only)

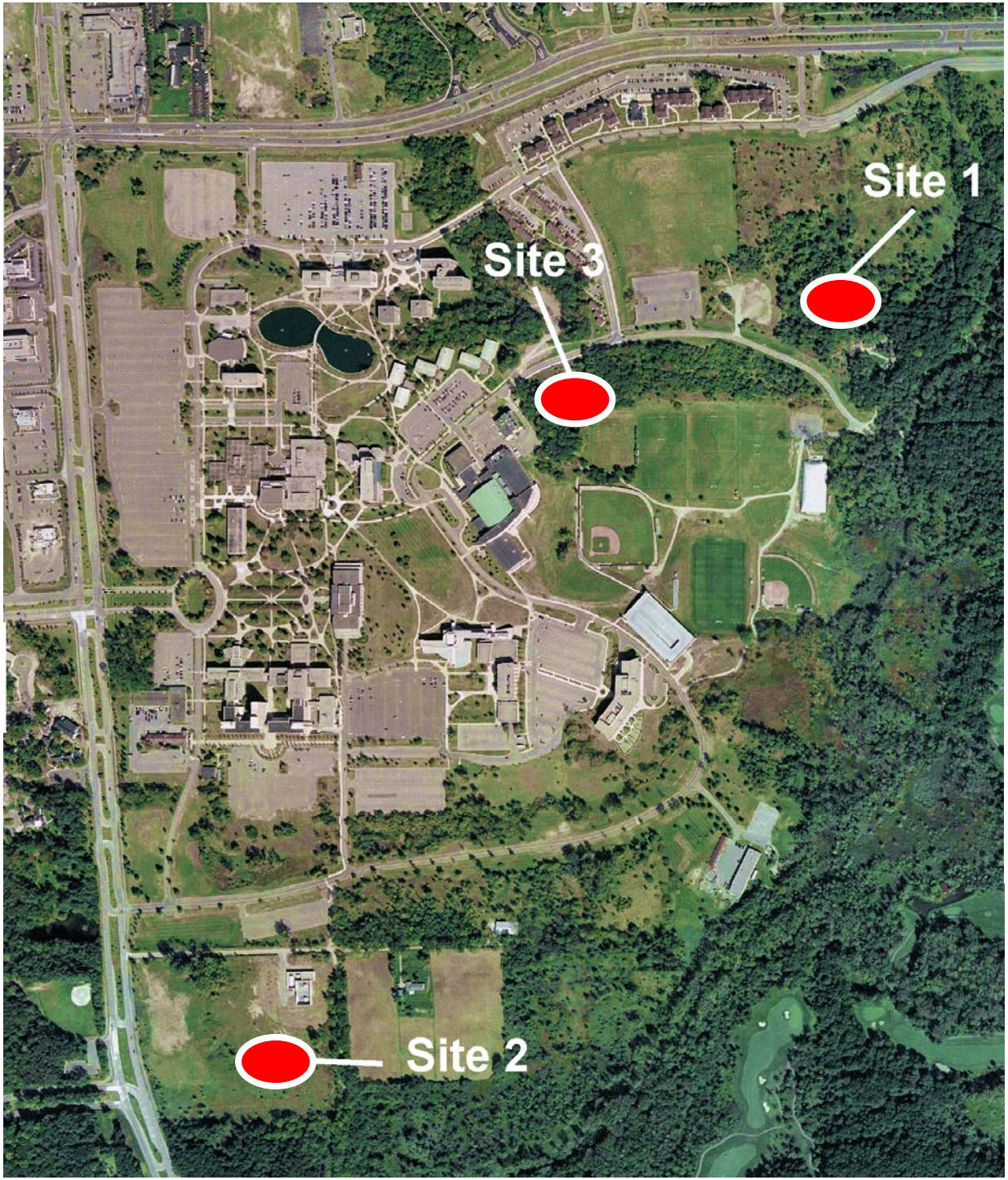


Vynke Stoker

(Steam & HW)



Typical Vynke Plant Layout



Oakland UNIVERSITY

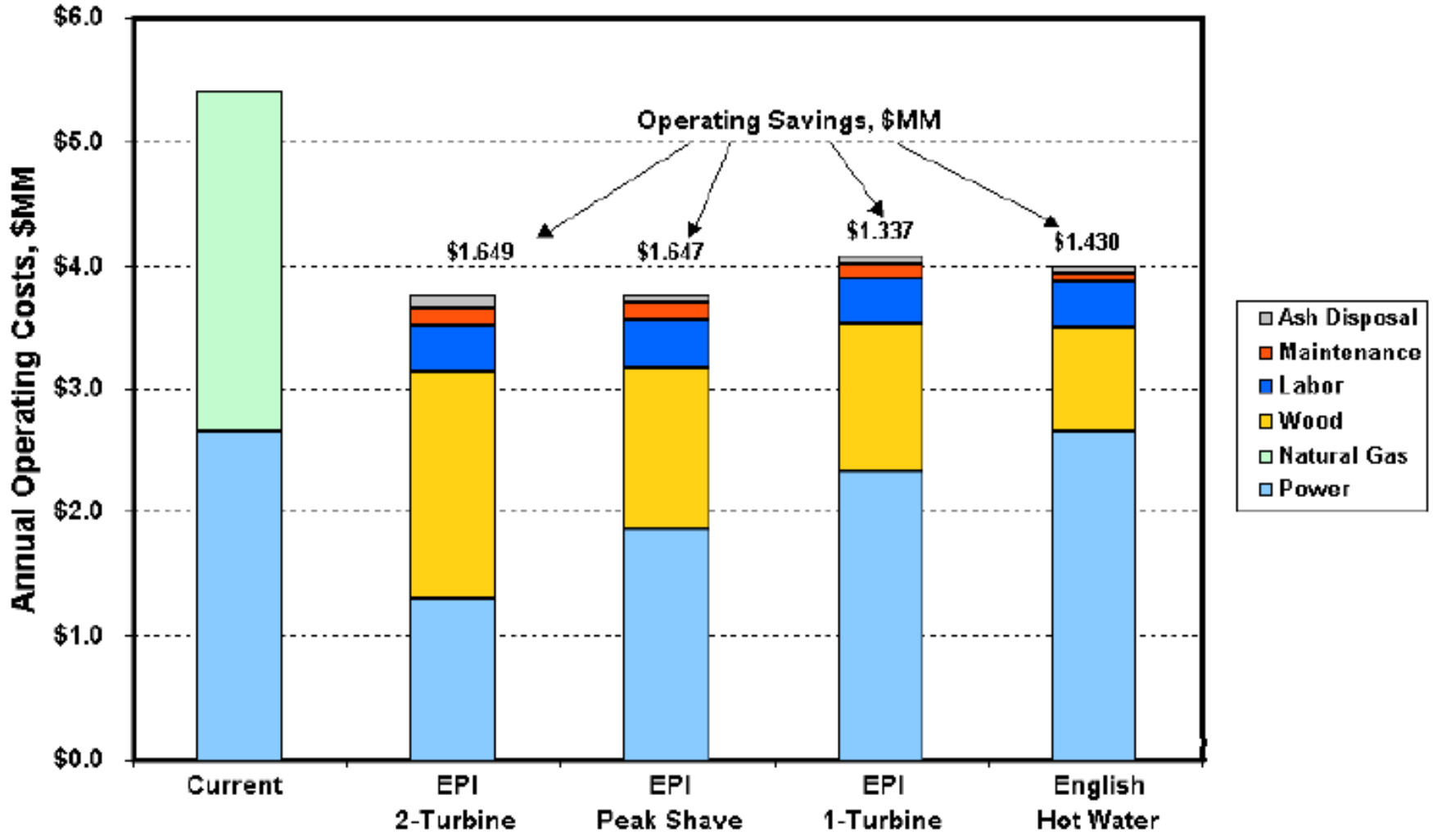
Three Proposed Site Locations

Estimated Project Budget for Site Two

Site #2 at Spencer Substation

CONSTRUCTION COSTS:	**Feet**	**Cost/ft**		**Cost**	**Notes**
HTHW connection	1,200	$2,750	$	3,300,000	
13.2kV electric connection	300	$250	$	75,000	
Sitework: development, parking, etc…			$	1,000,000	allowance
Roadways	1,300		$	2,250,000	estimate based on comparison to site #1 estimate
Storm water relocation			$	-	
Boiler Plant			$	25,540,000	EPI fluidized bed with steam cogeneration option
Subtotal			**$**	**32,165,000**	
Permits & agency reviews			$	50,000	allowance
Construction contingency			$	3,216,500	10%
Contractor fees, general conditions, insurance				n/a	all construcion cost included in boiler plant cost
Construction Subtotal			**$**	**35,431,500**	
OWNER COSTS:					
Architectural & engineering fees			$	2,125,890	6%
Furniture, fixtures, and equipment			$	55,000	allowance
Sound & video security			$	50,000	allowance
Telecommunications & data			$	80,000	allowance
Singe			$	30,000	allowance
Testing, survey, borings			$	75,000	allowance
Owner contingency			$	5,314,725	15%
Debt placement			$	708,630	2%
Total Project Cost			**$**	**43,870,745**	

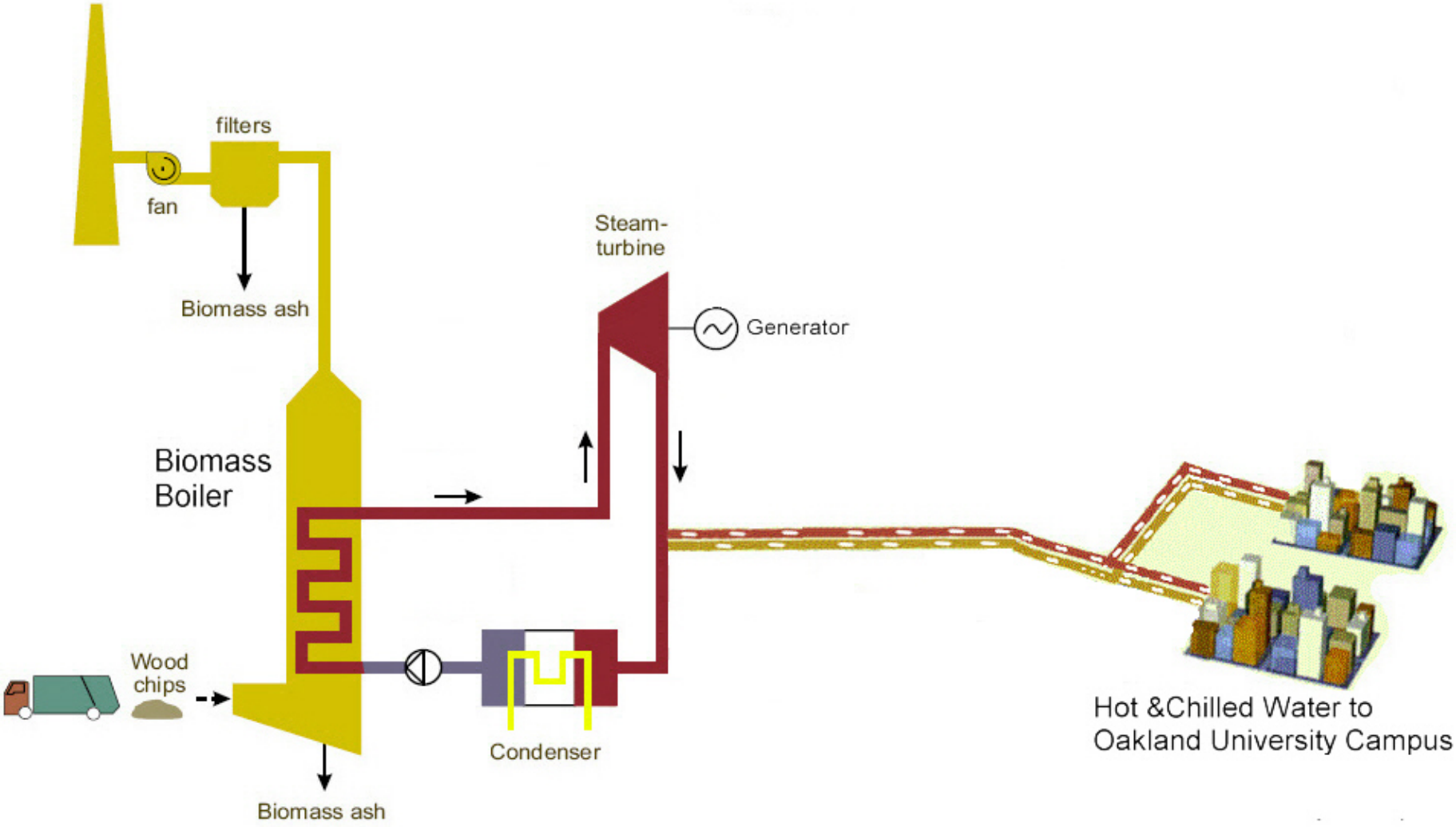
Operating Cost Estimates



Estimated Payback

Biomass boiler plant	**$43.9M**
Avoided cost for existing B-4	**($ 3.0M)**
Avoided cost for oil system	**($ 1.3M)**
Net biomass boiler plant cost	**$40.3M**
Net annual operating costs	**$ 1.7M**
Simple Payback	**23-24 yrs**

Overview of an Integrated, Renewable Energy Supply Infrastructure



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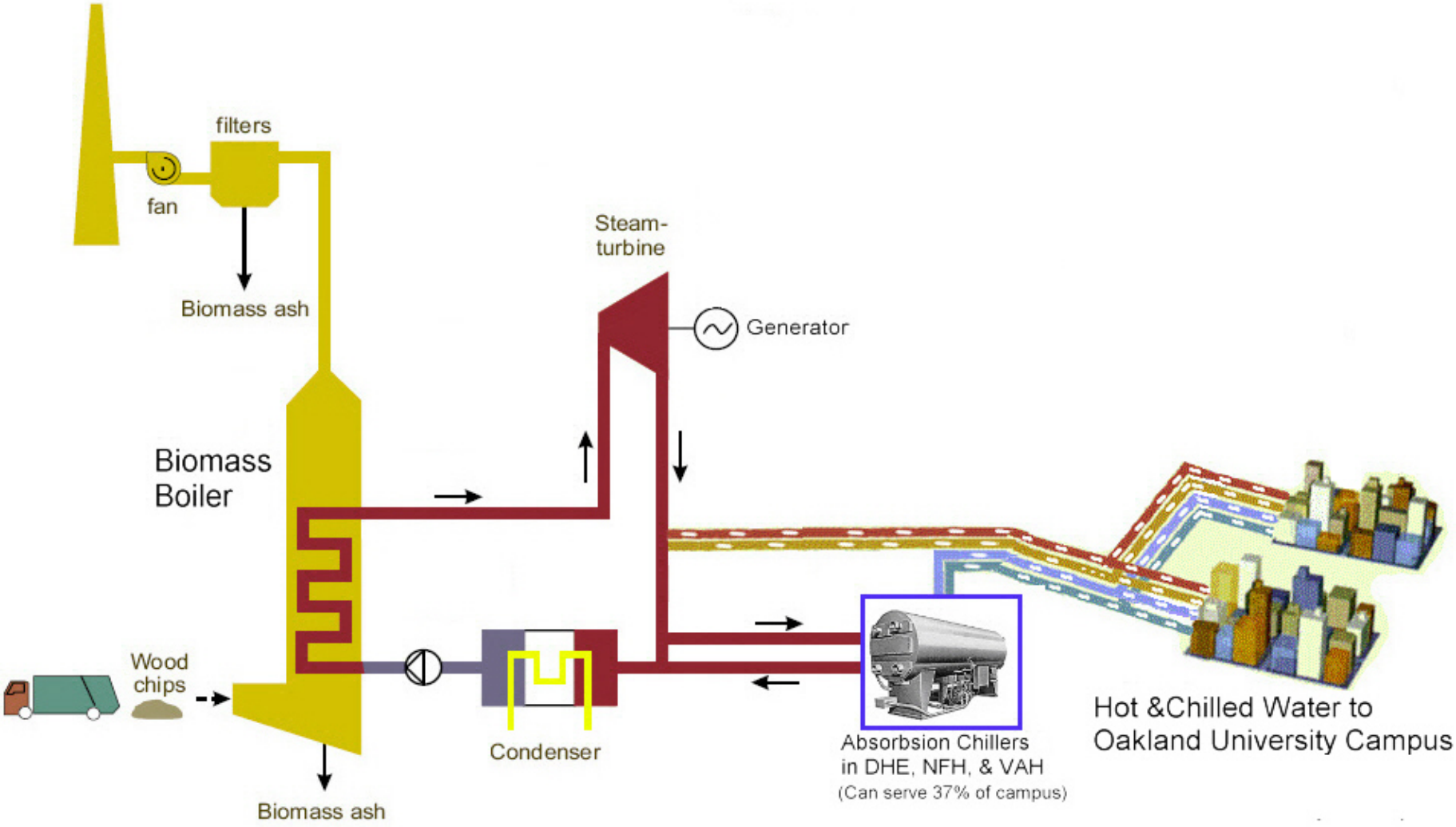

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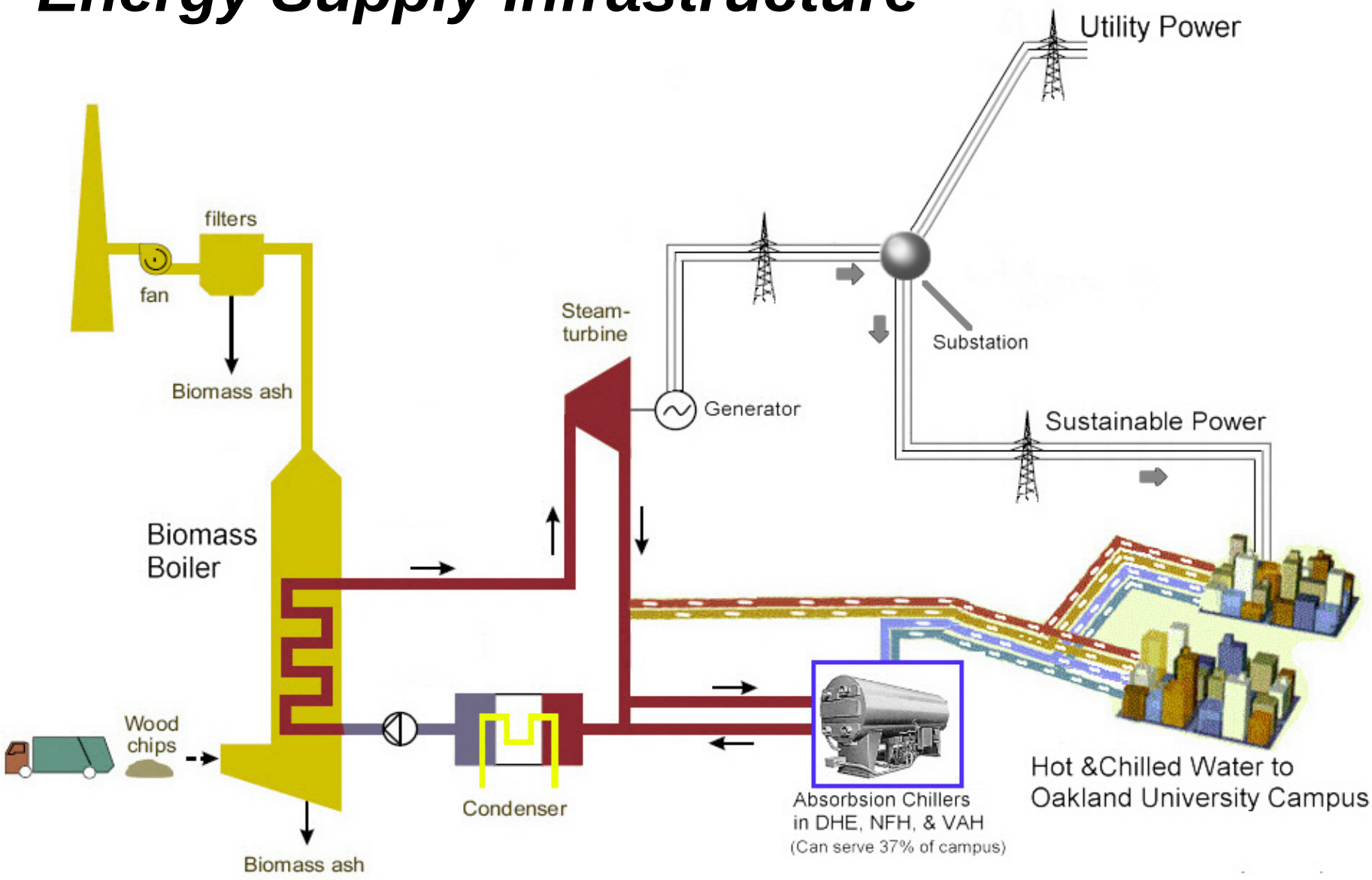

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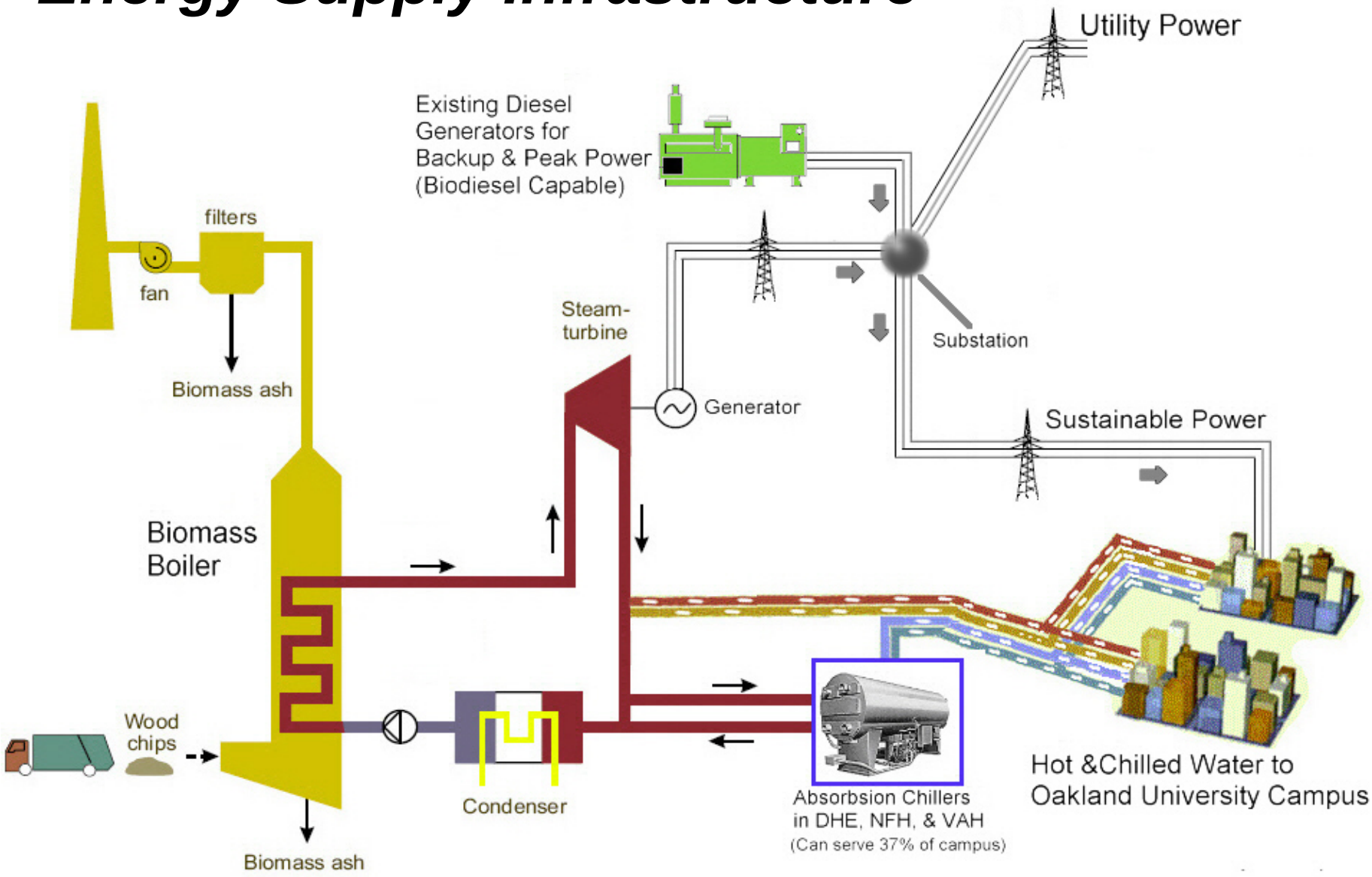

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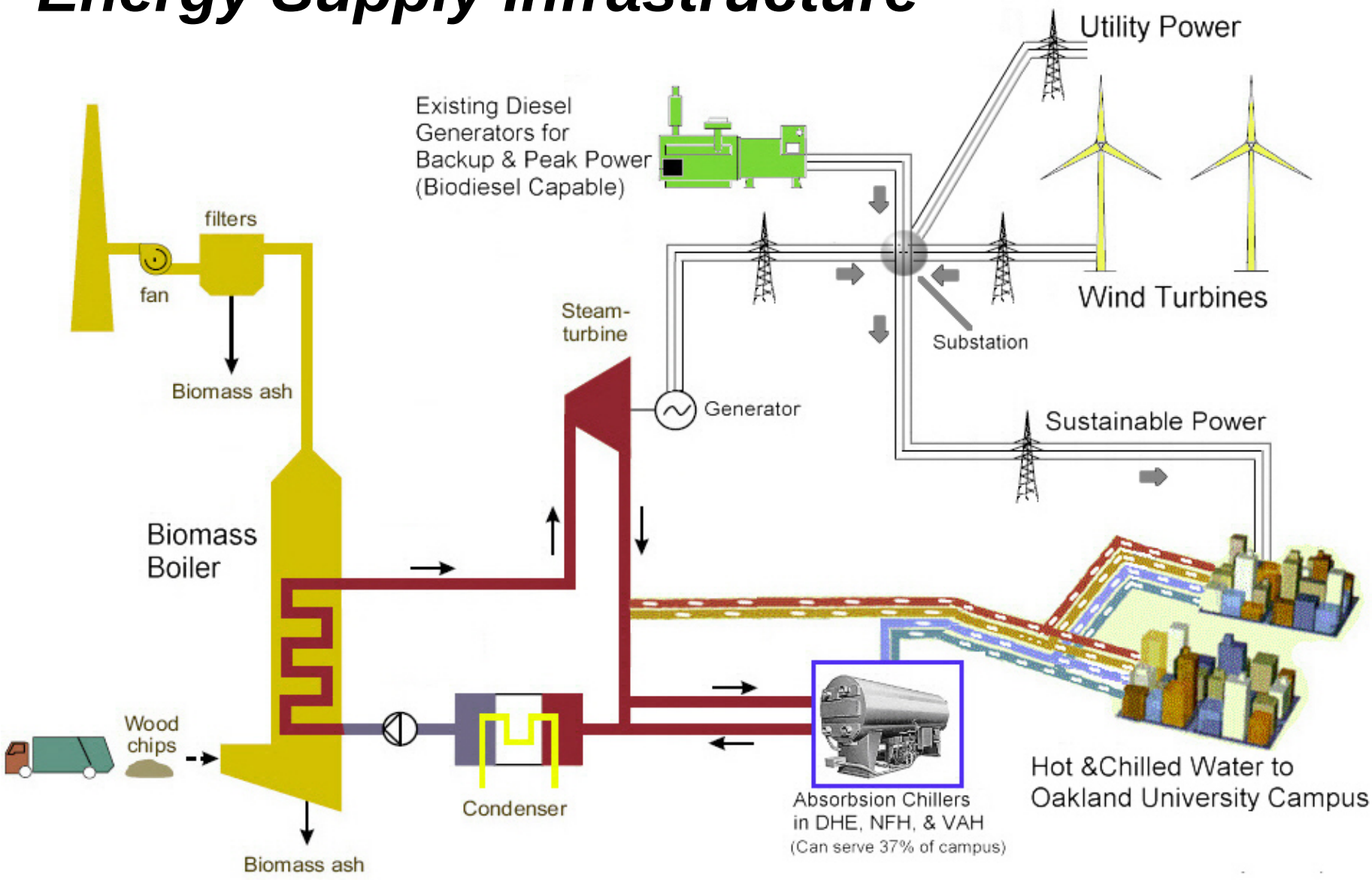

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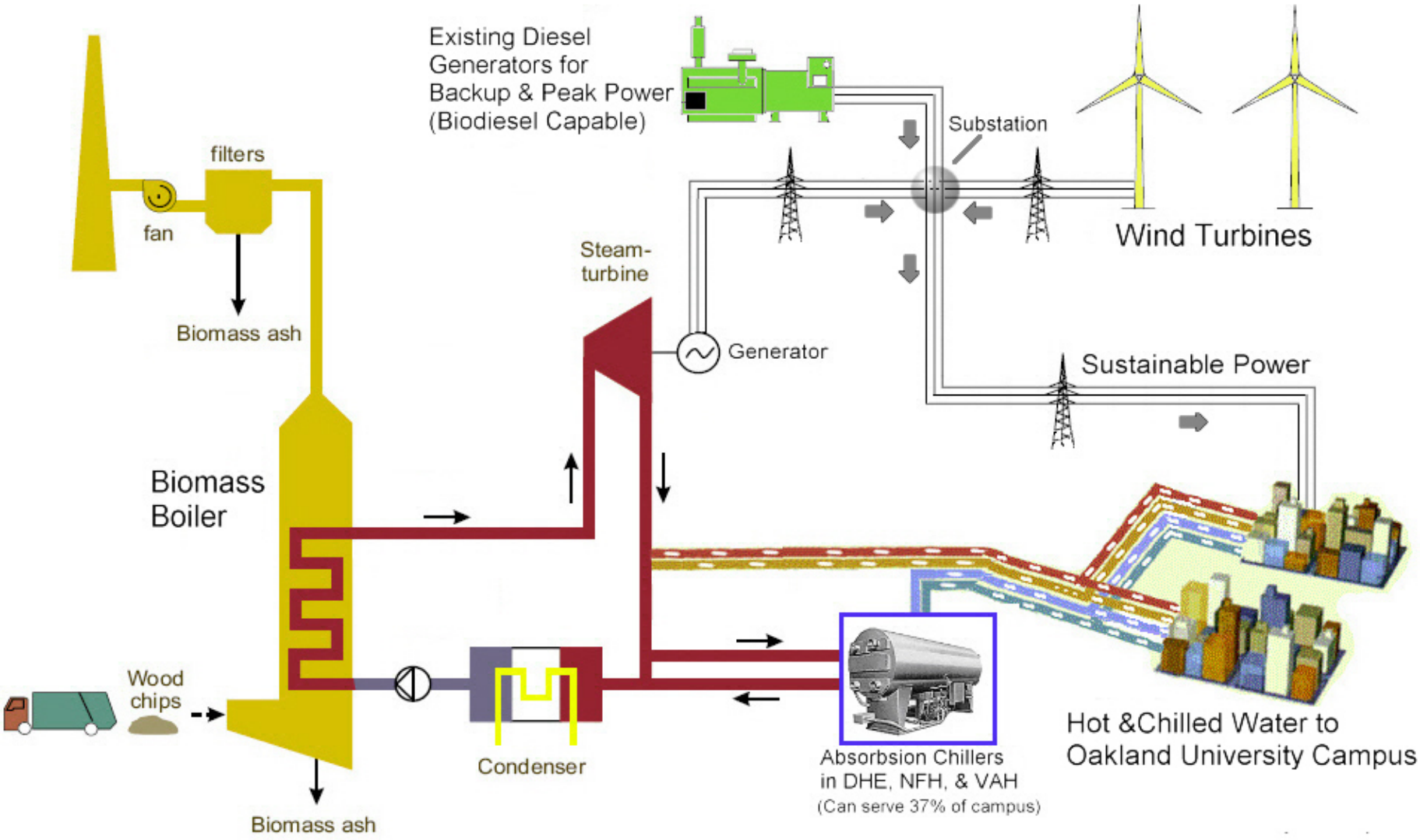

Overview of an Integrated Renewable Energy Supply Infrastructure

	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. Issue 15 to 20 year bonds

2. Seek partners willing to enter into a third party "owned & operated" arrangement. Several potential parties have been identified that could provide this option.

Recommendations

- **Select project site**
- **Select financing method**
- **Solicit bids for design/build contractor**
- **Begin the detailed engineering**
  for the boiler plant, building, roadways, and utility interconnections to the selected site
- **Begin permitting process**
- **Establish a utility interconnection agreement**

Biomass Power

A Sustainable Energy Option for the Future of Oakland University