

Campus Energy Independence at a Midwestern University

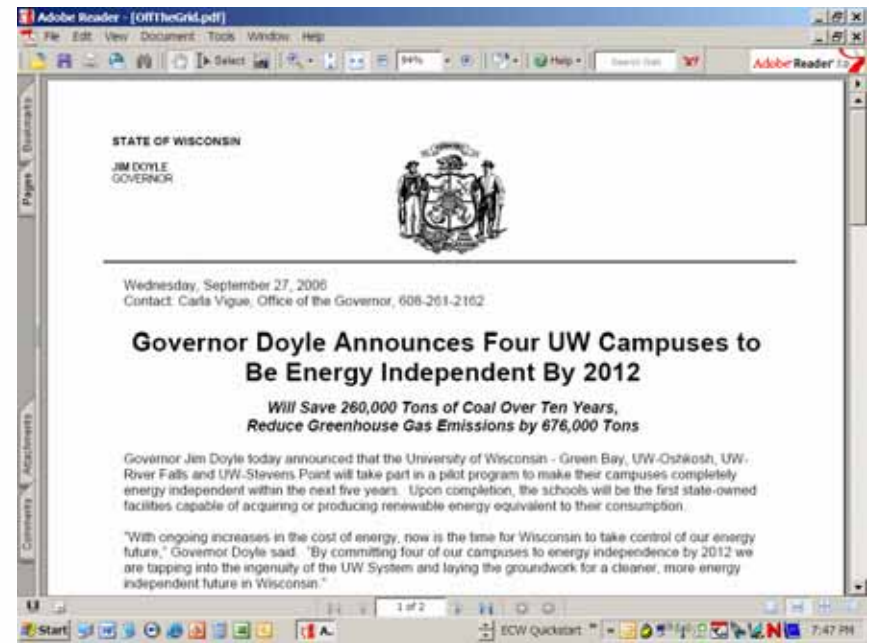
Lee DeBaillie – Energy Center of Wisconsin



Energy Independence

- Governor's Press Release 9/27/06
 - Four Campuses – “energy independent by 2012”

“facilities capable of acquiring or producing renewable energy equivalent to their consumption”



This Study

- Cast a wide net and narrow the options
 - Reduce consumption (building->distribution->central plant)
 - Replace with renewable energy (as local as possible)
 - What is the least-cost path? Financial only.
 - Use CO₂ reduction to quantify independence
- Evaluation model
 - Twelve independence measures
 - Ten possible variations over four groups
 - Interactive – play out scenarios

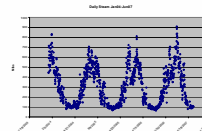
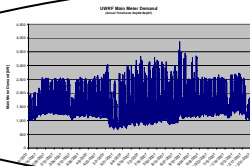
The Model

Independence Measures

Energy performance & capital costs



Hourly Campus Electric & Steam Loads



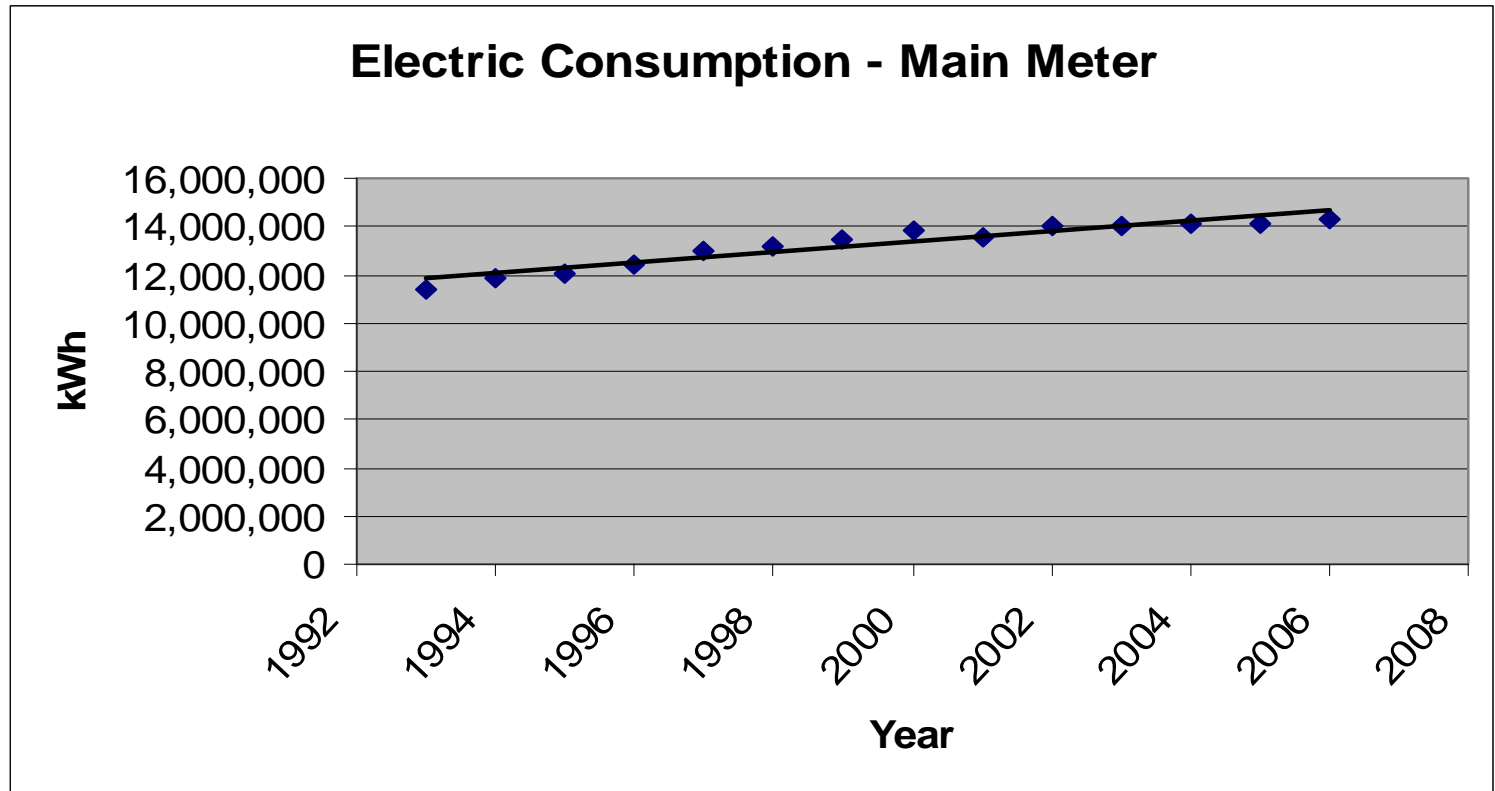
Life Cycle Cost & Emissions

Energy savings & cost escalation, operational & capital costs, emissions reductions, interactive effects

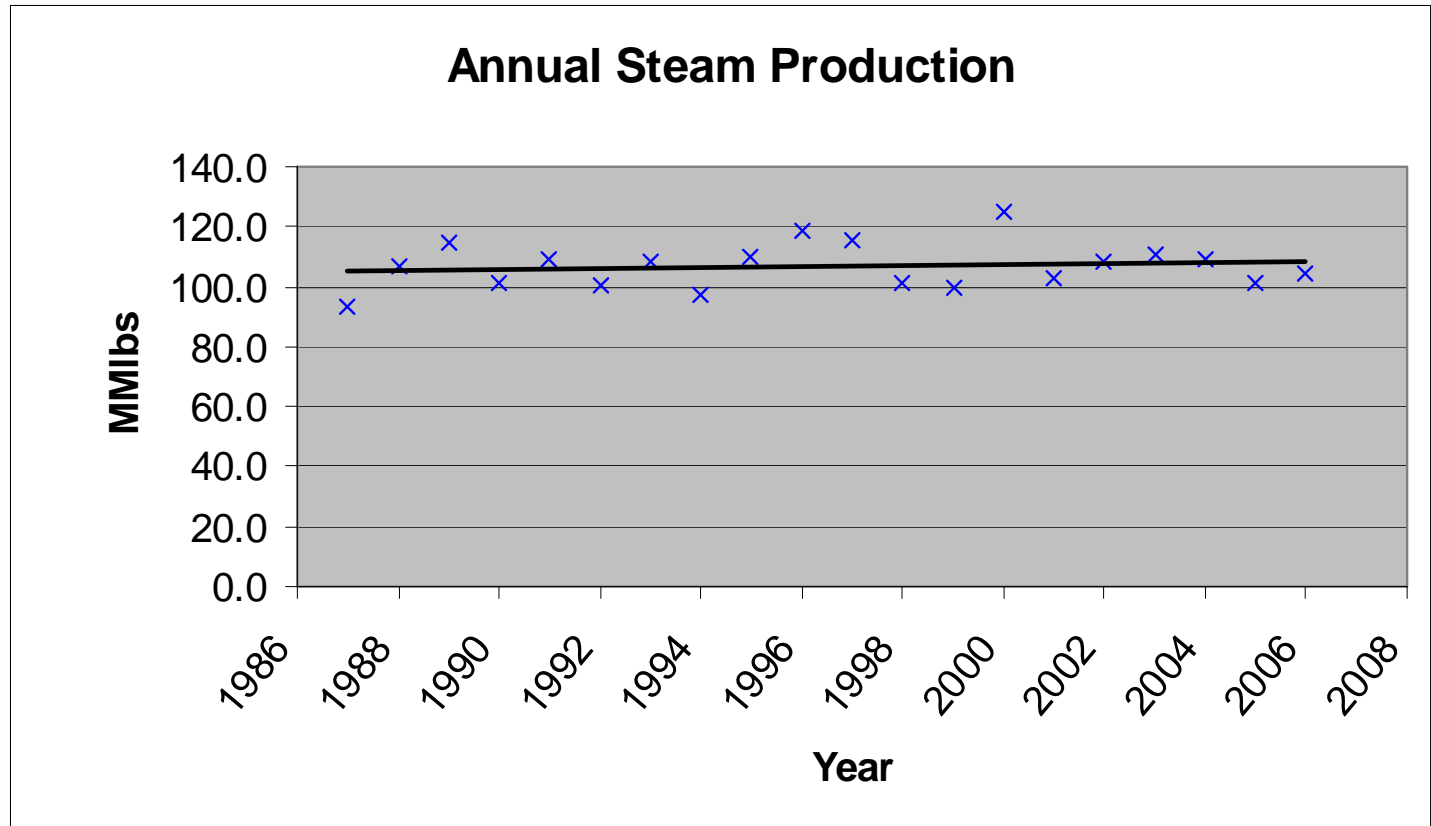
UW River Falls

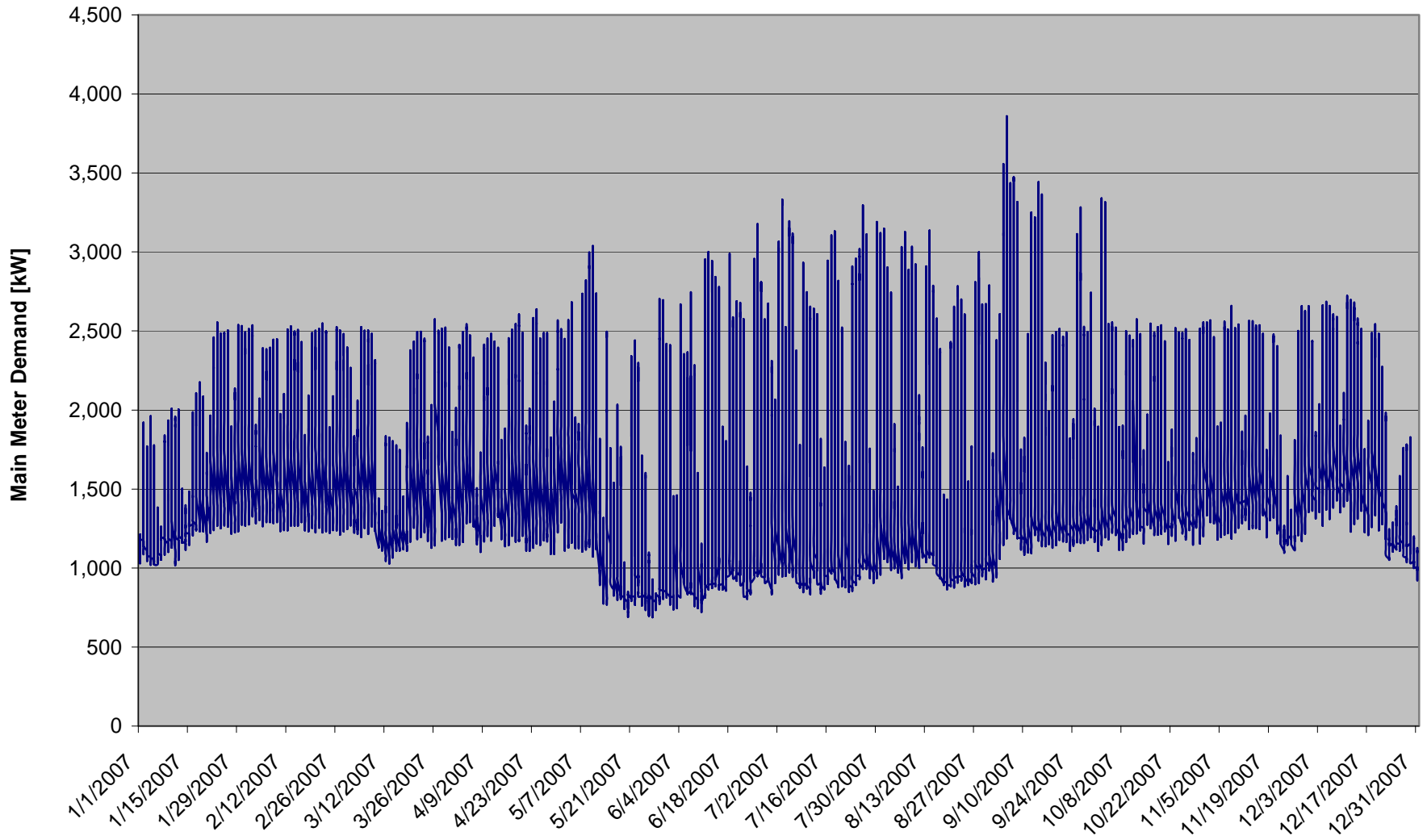
- Enrollment – 6,426 students
- Gross Area ~ 2 million square feet
- Central Steam Heating Plant
- Total Energy 2006
 - ~\$2.2 million
 - Electricity 16.3 million kWh
 - Natural Gas 635,781 therms
 - Coal 3,381 tons
 - Energy Use Intensity 106.4 kBtu/ft²

Historical Energy Consumption

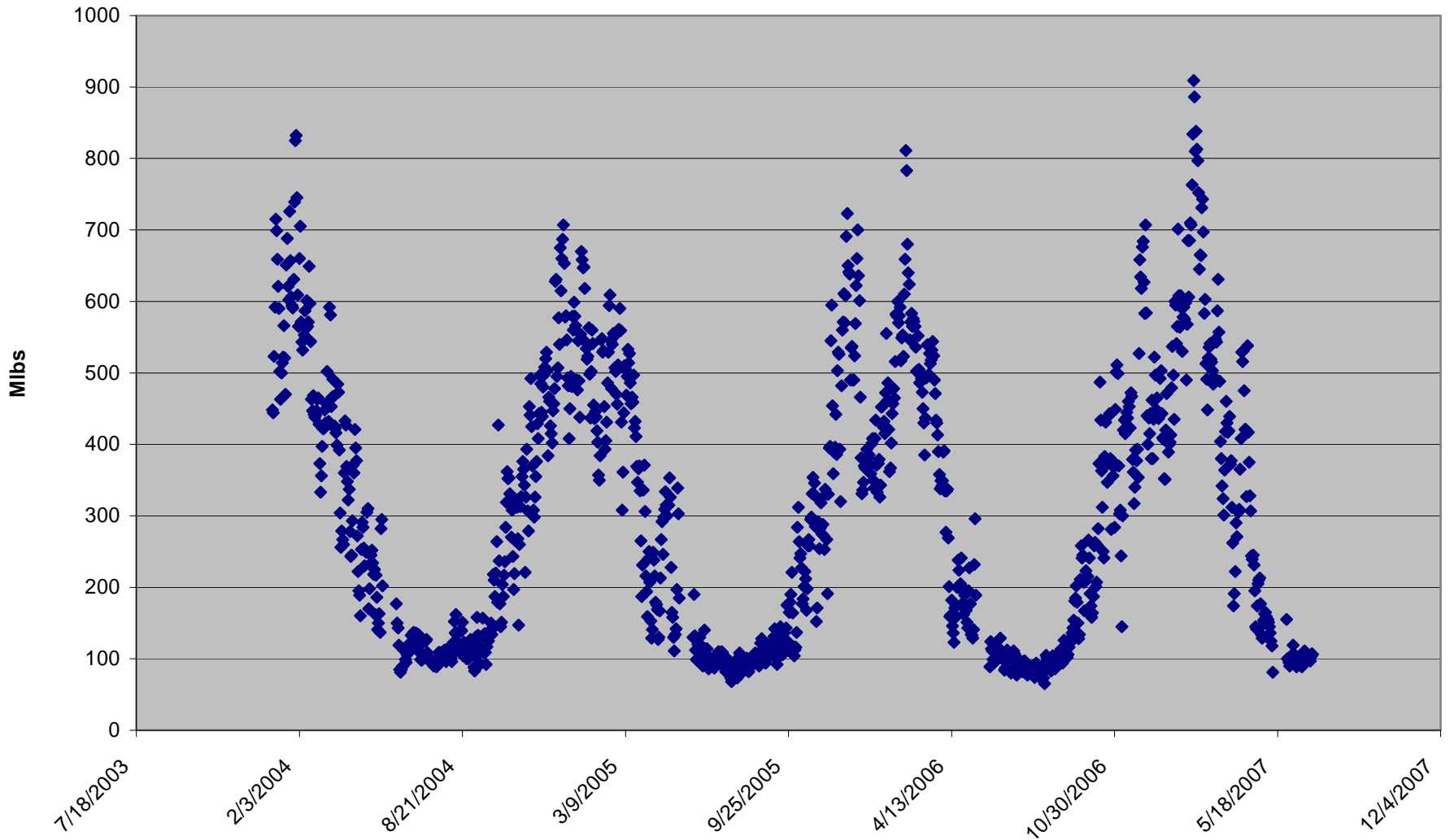


Historical Energy Consumption



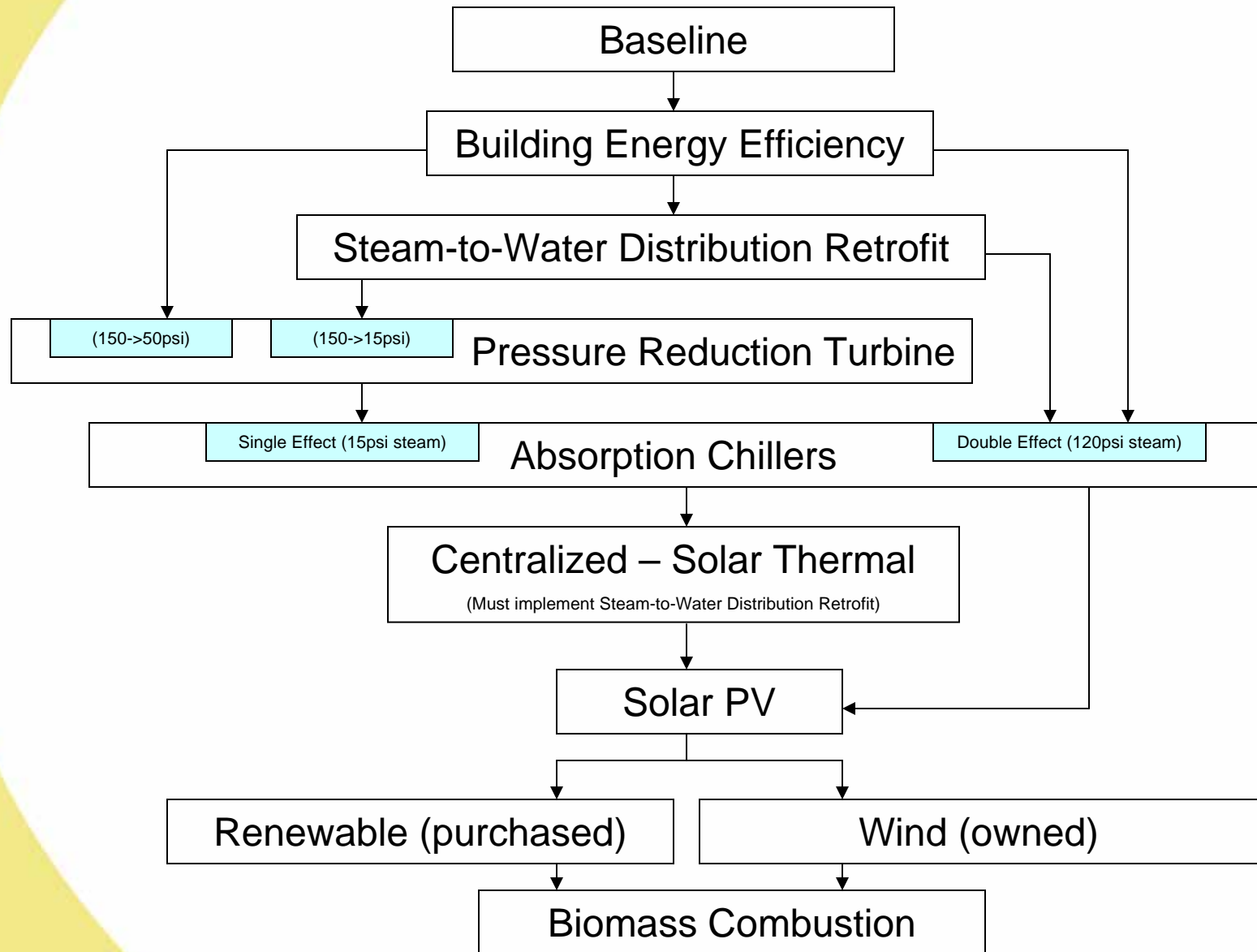


Daily Steam Jan04-Jun07

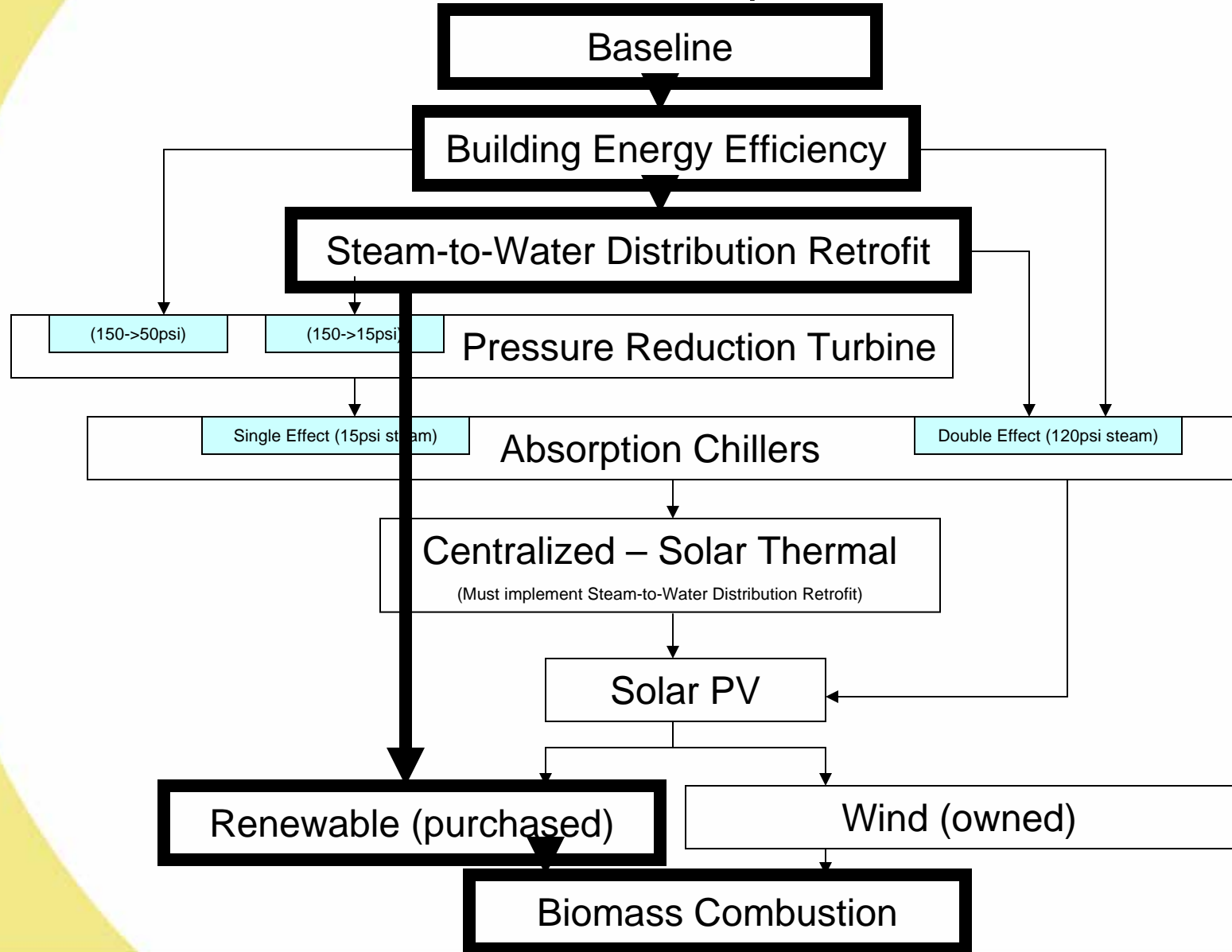


Scenarios

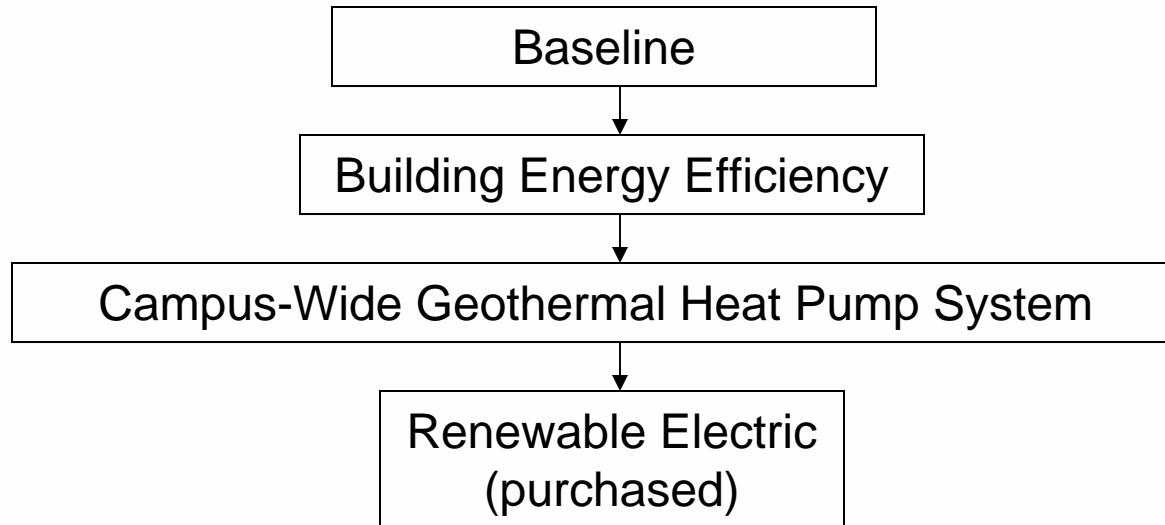
Standard Scenario



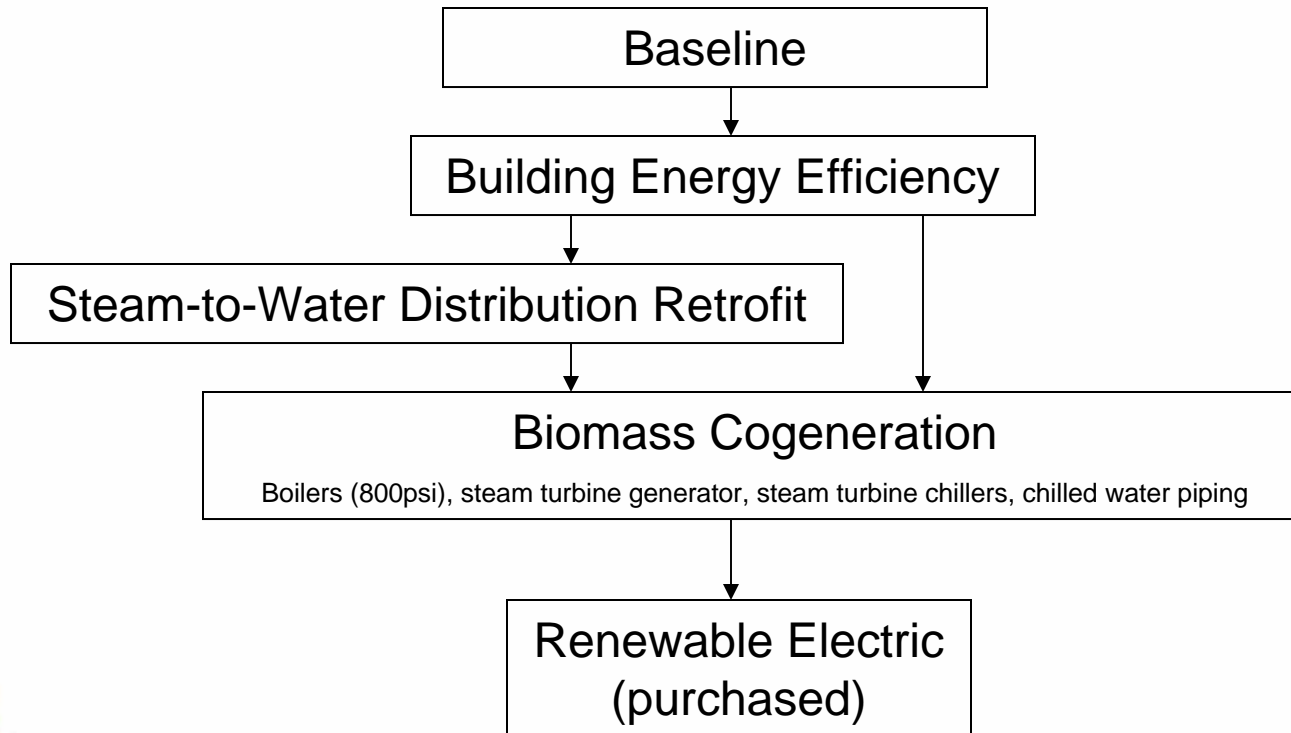
Standard Scenario – Optimal Path



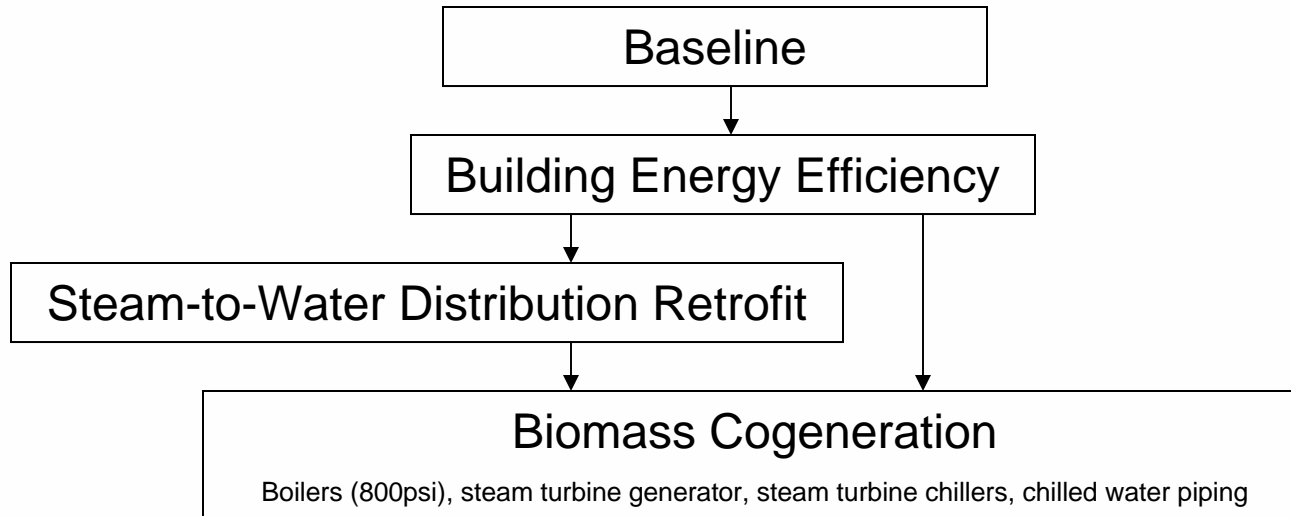
Geothermal Heat Pump Scenario



Cogeneration Scenario: Follow Thermal Load

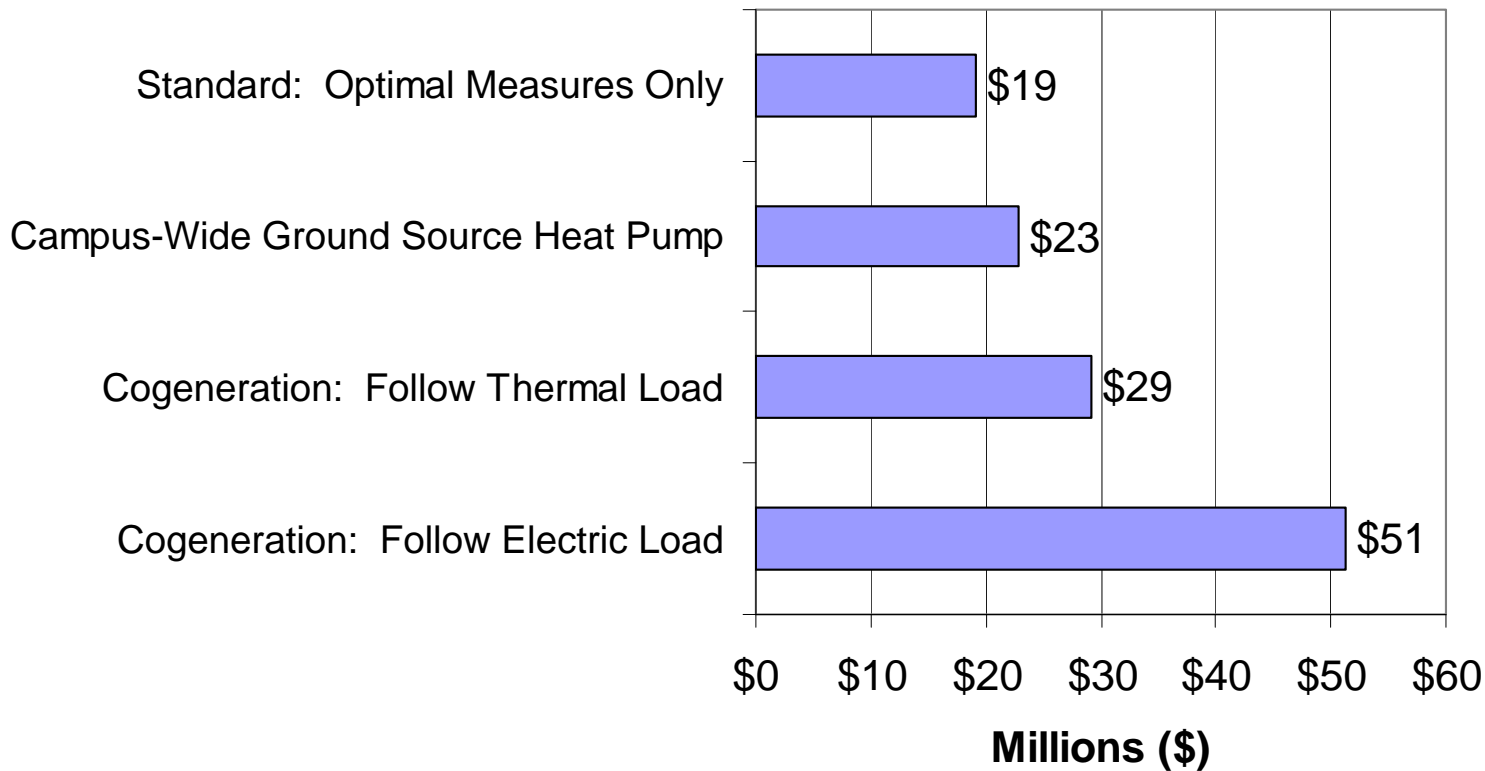


Cogeneration Scenario: Follow Electric Load



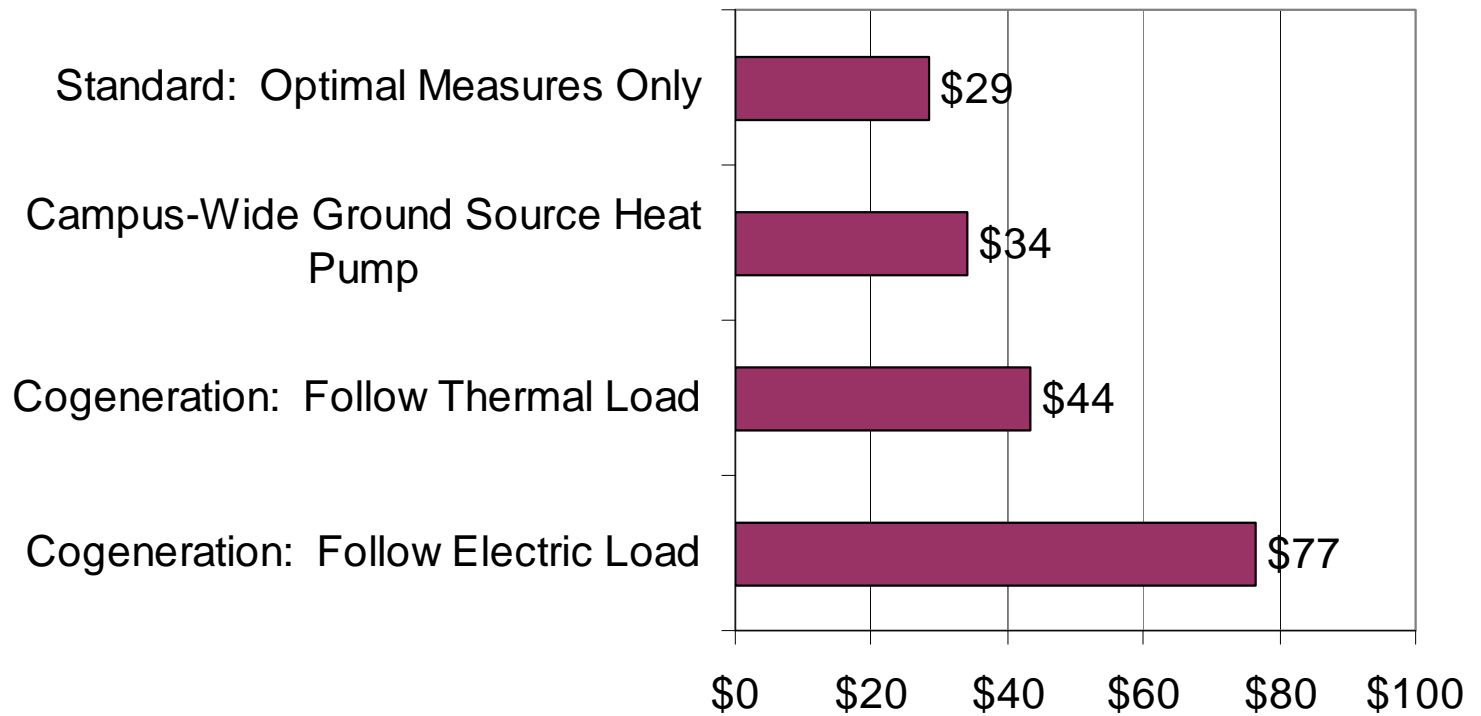
Results

Net Present Value Cost (100% Independence)

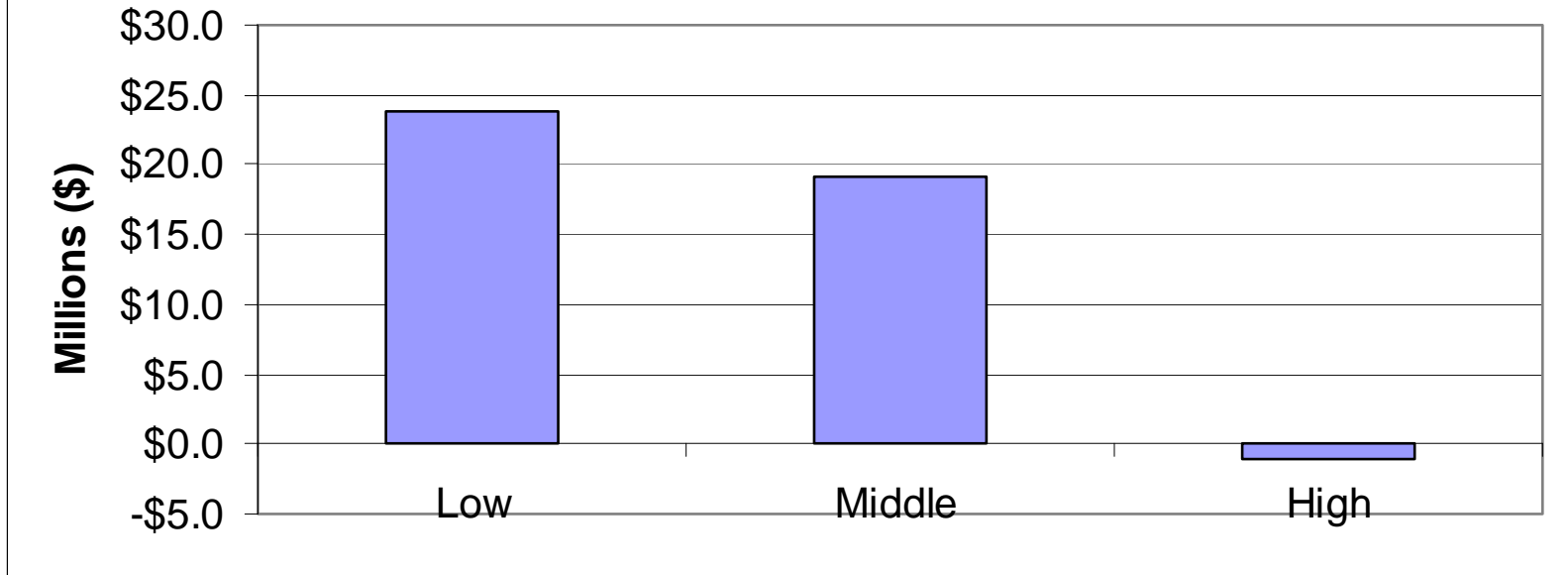


Energy Cost Escalation			
EIA 39 yr history			
Electricity	3.9%	Study Period [Years]	20
Coal	5.5%	Discount Rate	6.0%
Natural Gas	7.4%	General Inflation Rate	3.0%
Biomass	6.5%		

Cost of CO2 Reduction [\$/ton]

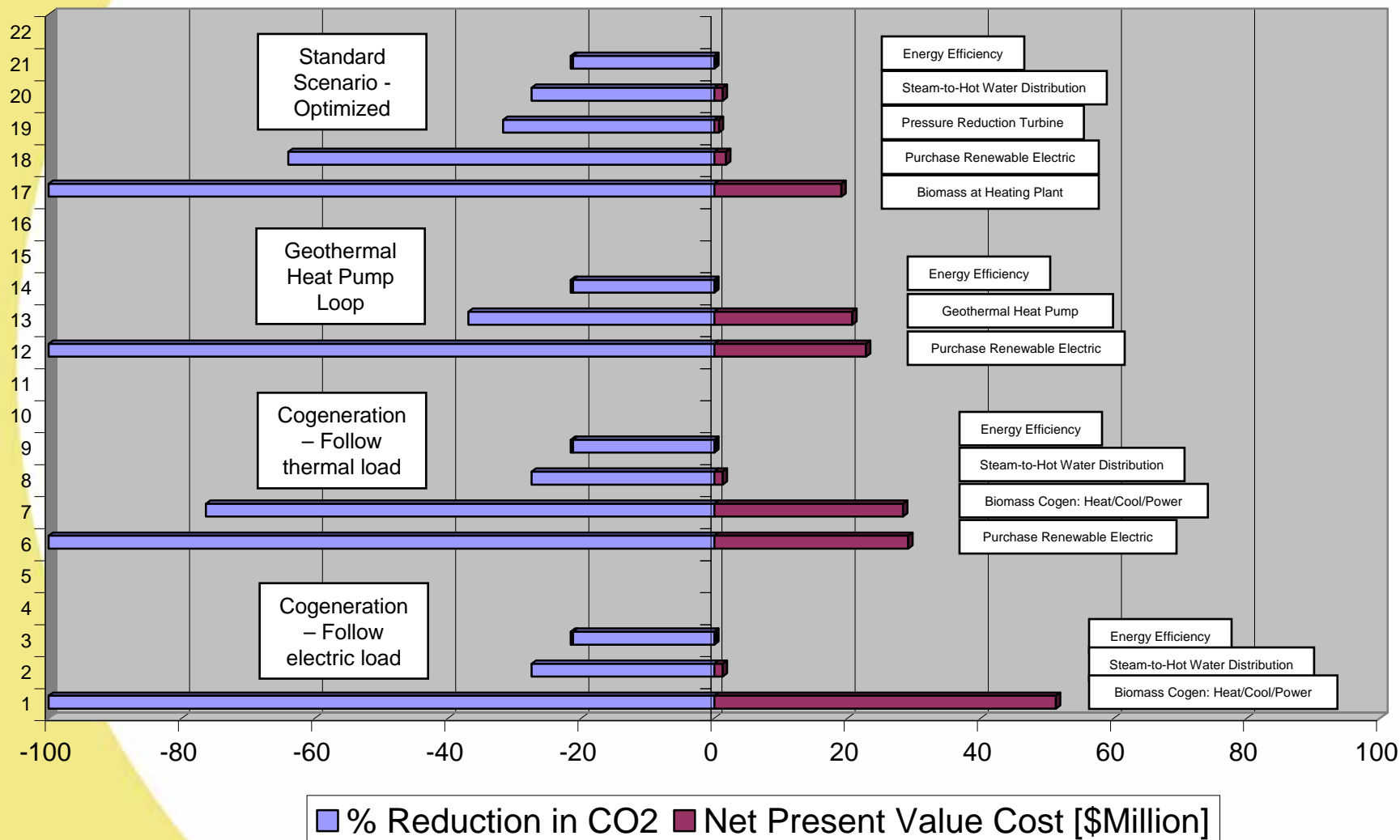


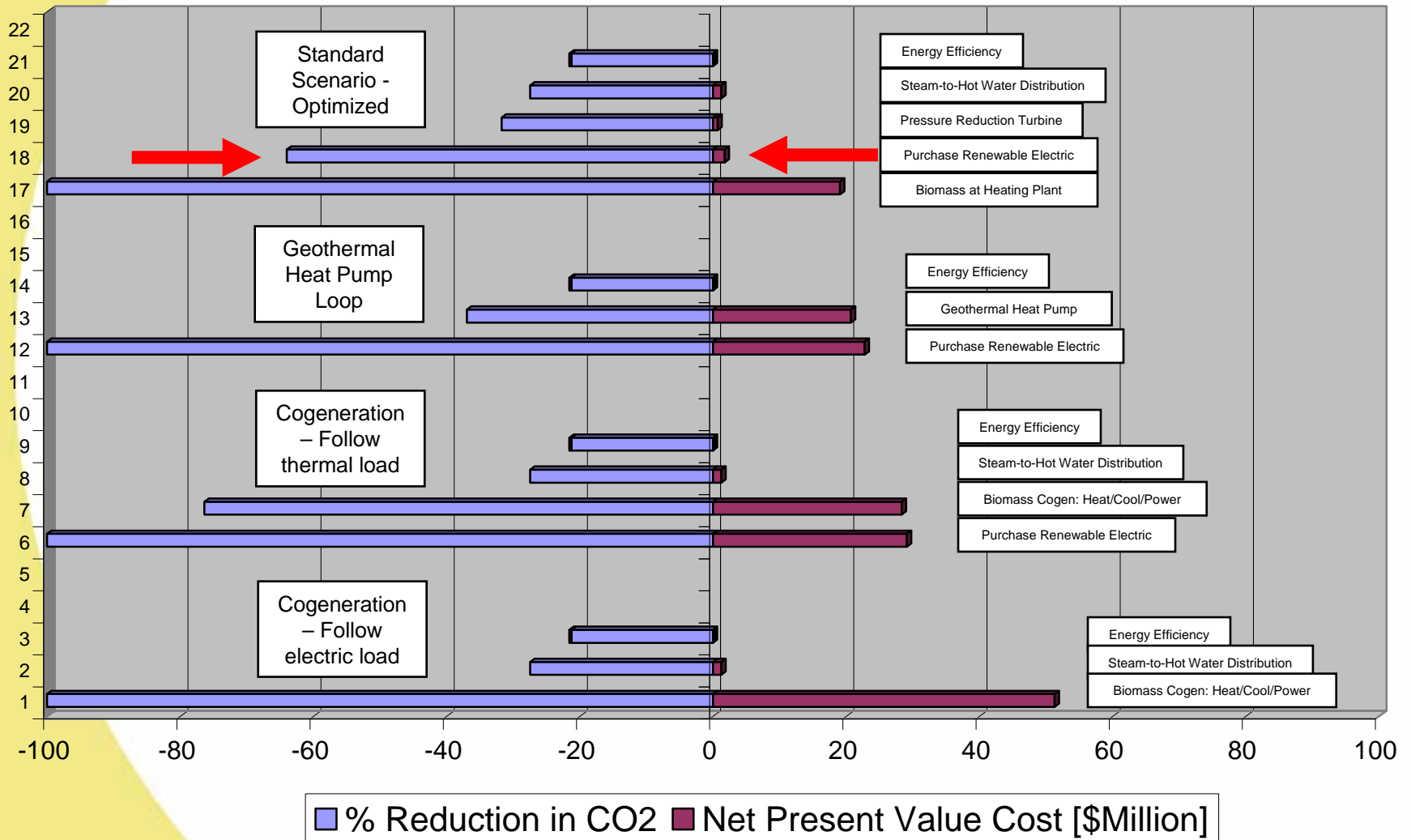
Standard Scenario: Optimal Measures
Net Present Value Cost - 100% Independence
Energy cost escalation scenarios



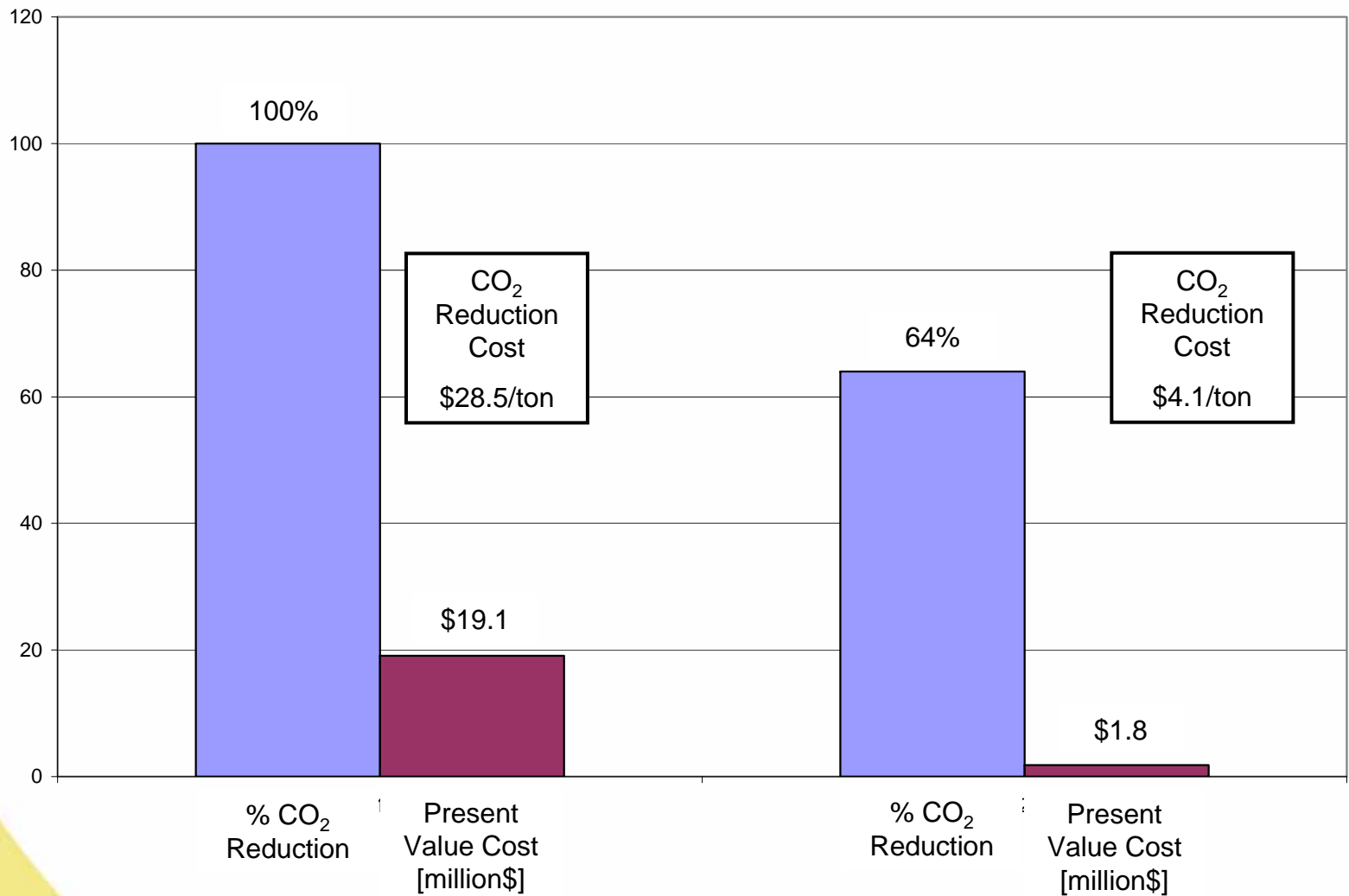
	Low	Middle	High
Electricity	1.9%	3.9%	6.3%
Coal	2.2%	5.5%	15.8%
Natural Gas	1.4%	7.4%	9.2%
Biomass	5.0%	6.5%	8.0%

EIA 2028 Projection EIA 39 yr history Actual 3.5 yr increase





Standard Scenario - Optimal Path



Summary

- Least cost path \$19.1 million
- Results are sensitive to energy cost escalation
- Partial independence costs much less
64% = \$1.8 million
- Future emissions credits have the potential to cut costs from 5% to 30%

Lee DeBaillie – Technical Director

Energy Center of Wisconsin

ldebaillie@ecw.org; 608-238-8276 x111