

Grunenwald Science and Technology Building

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Mechanical Option



Presentation Overview

- Building Overview
- Existing Mechanical System
- Geothermal Heat Pump Analysis
 - Sizing Geothermal Wells
 - Construction
 - Energy Consumption & Payback
- DOAS with Parallel System Analysis
 - Sizing System
 - Energy Consumption & Payback
- Recommendations

** Architectural Breadth Covered Only in Final Report

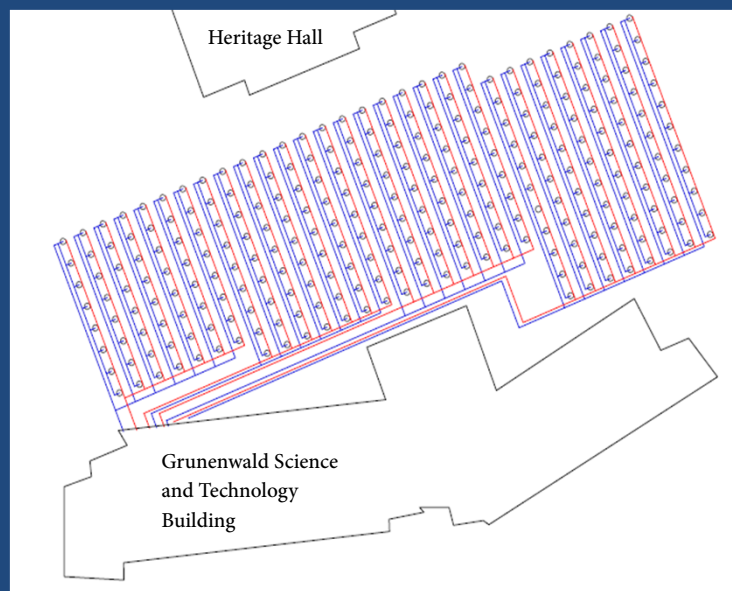
Energy Used Geothermal Heat Pumps vs. VAV with Chillers

	Original Design (VAV)	Geothermal High Efficiency	Geothermal Regular Efficiency
Energy Consumption (kWh)	2,962,304	2,400,184	2,445,493
Electricity Cost	\$138,141	\$111,158.38	\$113,333.77
Total Saving (Energy)		562,120 kWh	516,811 kWh
Total Cost Saving per Year		\$26,982.62	\$24,807.23
Payback Period (years)		27.28	29.67

- Total Energy Savings
 - High Efficiency Saves 562,120 kWh each year
 - Regular Efficiency Saves 516,811 kWh each year

- Calculated Payback Periods
 - High Efficiency- 27.23 years
 - Regular Efficiency- 29.67 years

Pie Charts to Show where energy was saved per specific parts of the energy model (Such as Pumps, Fans, Cooling, Heating, etc.)



Construction of Geothermal System

- Schedule
 - Dependent on the Bore Hole Depth
 - Installation of Pipes & Grout 1 week after Drilling
 - Not on Critical Path
 - Total: 15.6 weeks, over Summer Semesters(14 weeks)

- Increased Initial Cost by \$ 736,019

- Location of Wells
 - Lowest Impact on Student Life
 - North Quad

Schedule and Location Optimization

Length (ft)	# of Bores	Bore Depth	ft/day	day/Bore	Days	Weeks	Drilling Cost	Location of Site
87458	170	514	900	0.572	97.2	19.4	\$329,619.48	N Quad
87458	210	416	900	0.463	97.2	19.4	\$329,619.48	N Quad
87458	250	350	900	0.389	97.2	19.4	\$329,619.48	N Quad
87458	270	324	1200	0.270	72.9	14.6	\$216,312.79	N Quad
87458	310	282	1200	0.235	72.9	14.6	\$216,312.79	N&S Quad
87458	350	250	1200	0.208	72.9	14.6	\$216,312.79	N&S Quad
87458	380	230	1200	0.192	72.9	14.6	\$216,312.79	N&S Quad
87458	390	224	1800	0.125	48.6	9.7	\$118,457.00	N&S Quad
87458	430	203	1800	0.113	48.6	9.7	\$118,457.00	N&S Quad

Initial Cost

Equipment/Material	Cost for Location	Equipment	Cost for Location
Drilling	\$216,312.79	(2) Centrifugal Chillers	\$209,244.00
Grout	\$196,019.48	Cooling Tower	\$54,000.00
Heat Pumps	\$448,800.00		
Piping	\$78,967.52		
Pumps (Hydraulic)	\$55,389.50		
Welding	\$3,774.10		
		Initial Cost Increased by	\$736,019.37