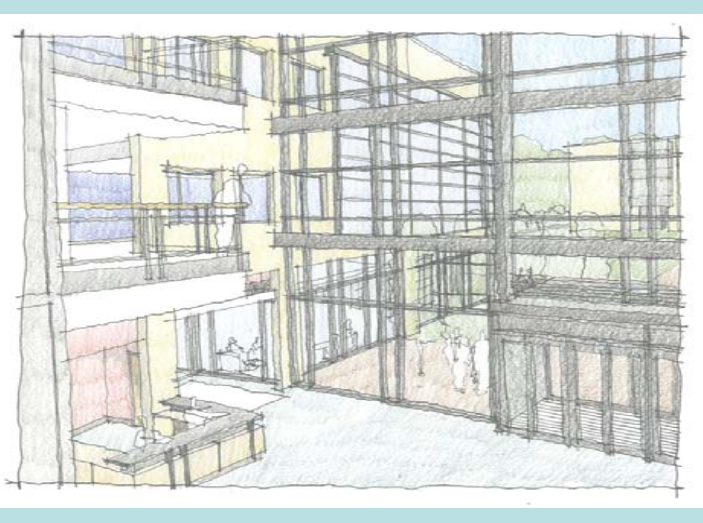
Howard Community College
Student Services Building
Columbia, MD

Jason Paul Fair

Mechanical Option



Presentation Overview

- Building Summary
- Existing Mechanical System
- Depth Topic: Proposed Geothermal
- Breadth Topic: Constructability/Cost
- Summary
- Acknowledgements

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Columbia, MD

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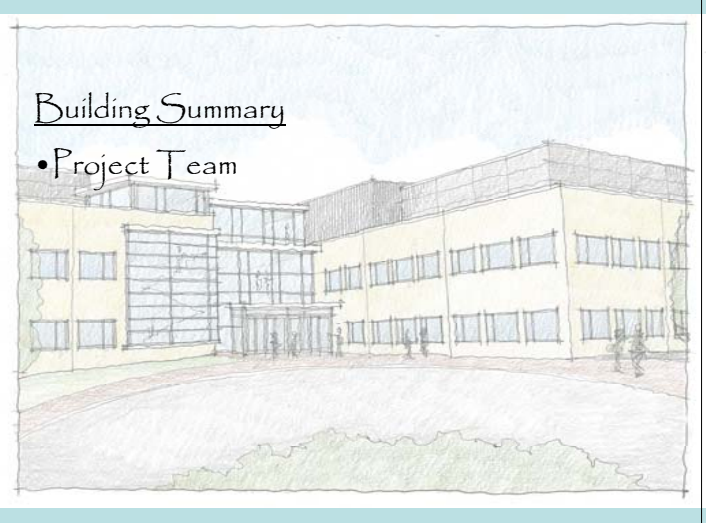
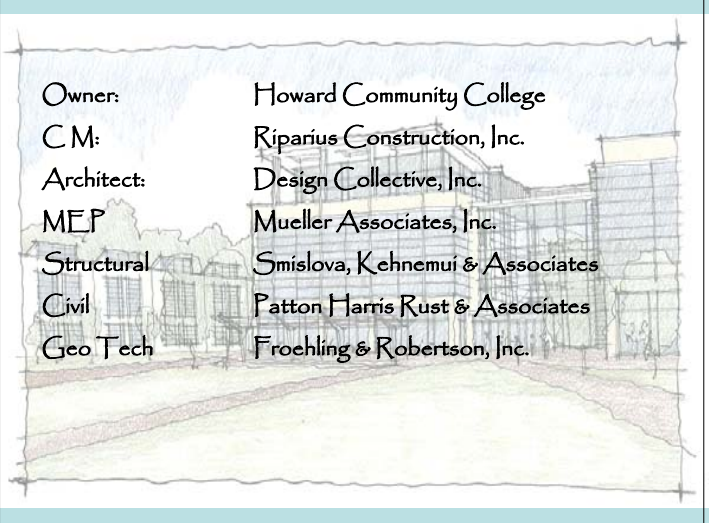
Mechanical Option

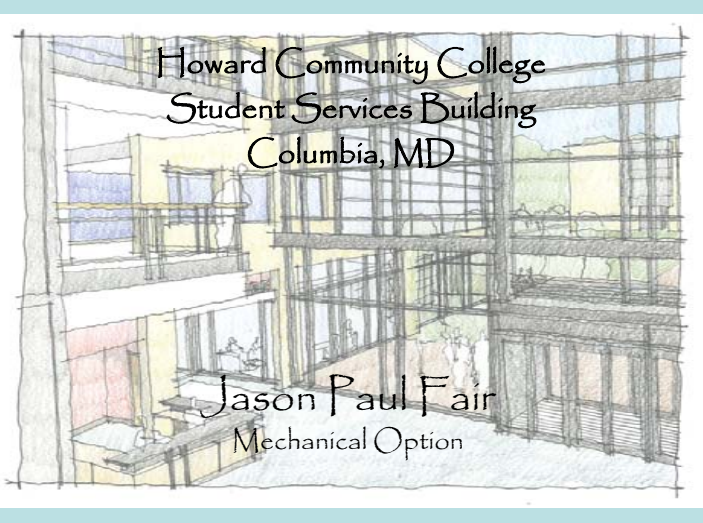


Building Summary

- Project Team



Owner:	Howard Community College
C M:	Riparius Construction, Inc.
Architect:	Design Collective, Inc.
MEP	Mueller Associates, Inc.
Structural	Smislova, Kehnemui & Associates
Civil	Patton Harris Rust & Associates
Geo Tech	Froehling & Robertson, Inc.



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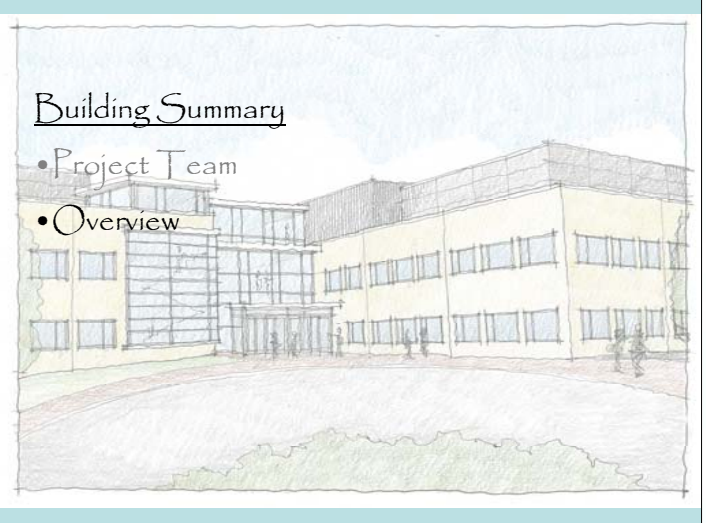
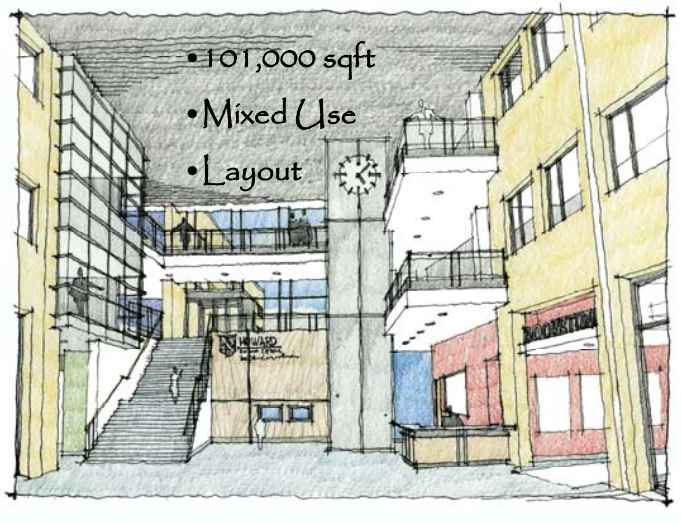


Building Summary

- Project Team
- Overview



- 101,000 sqft
- Mixed Use
- Layout

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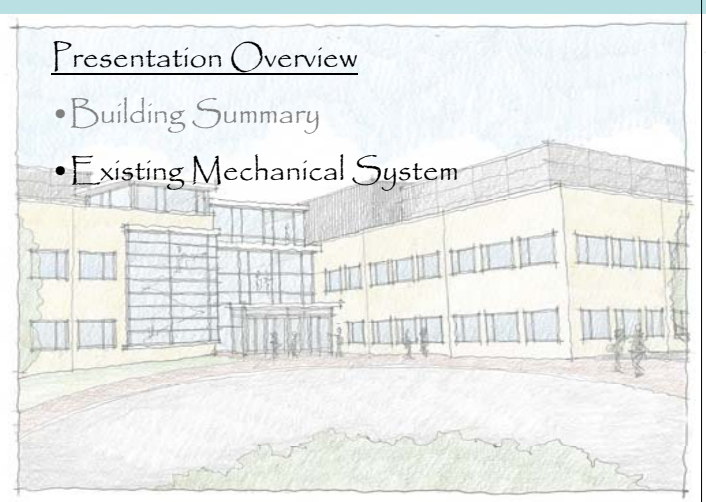
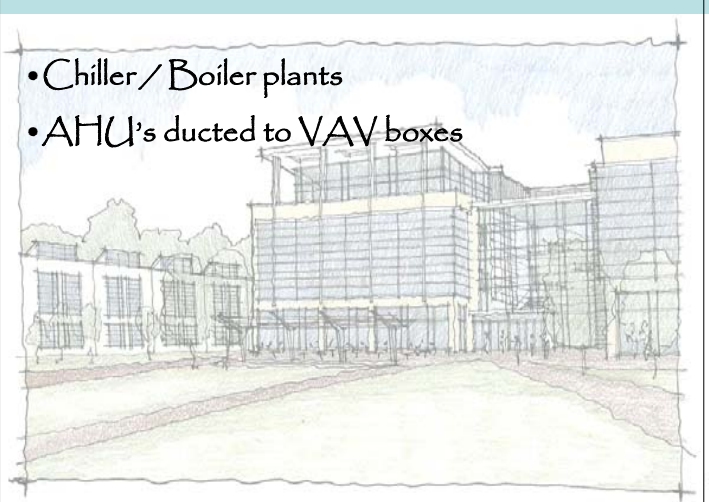
Mechanical Option



Presentation Overview

- Building Summary
- Existing Mechanical System



- Chiller / Boiler plants
- AHU's ducted to VAV boxes

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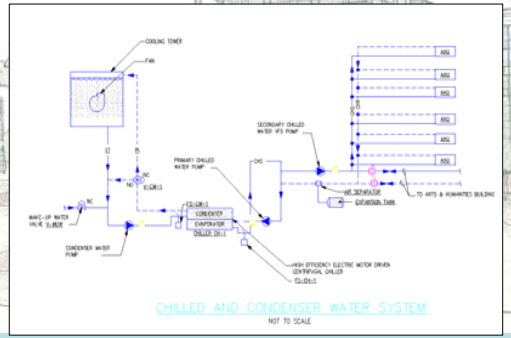
Mechanical Option

Existing Mechanical Systems

- Chilled Water

- Primary / Secondary Configuration
- 500 ton Chiller & Cooling Tower



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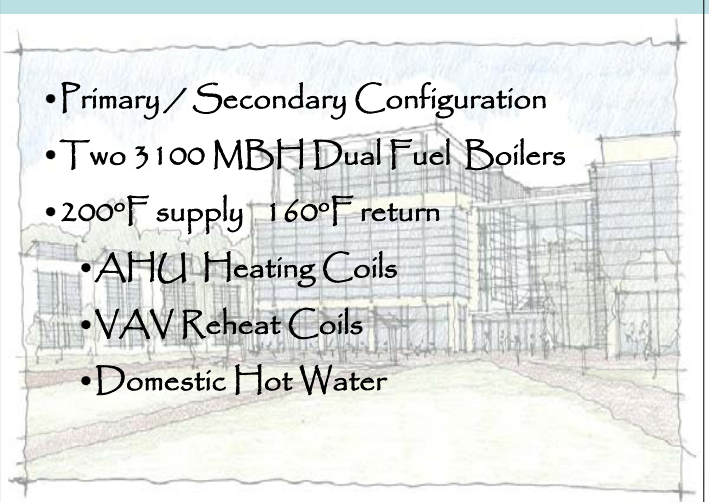
Mechanical Option

Existing Mechanical Systems

- Chilled Water
- Heating Water

- Primary / Secondary Configuration
- Two 3100 MBH Dual Fuel Boilers
- 200°F supply 160°F return
  - AHU Heating Coils
  - VAV Reheat Coils
  - Domestic Hot Water



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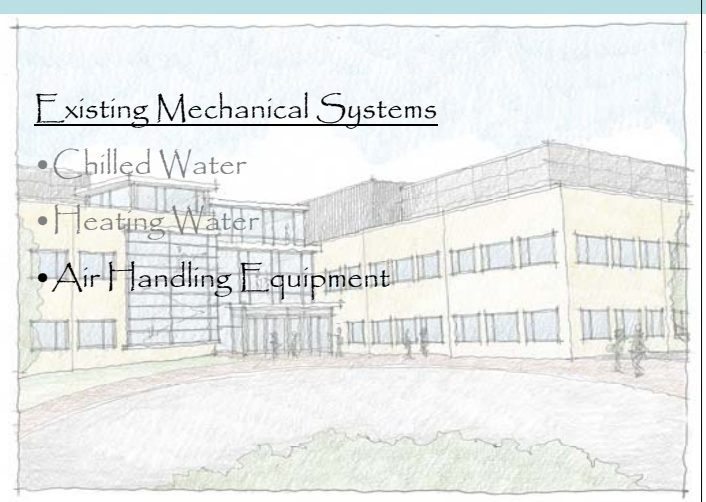
Mechanical Option

Existing Mechanical Systems

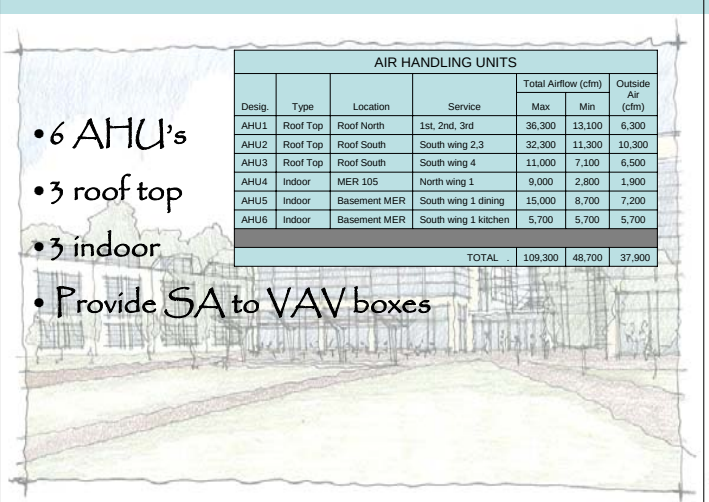
- Chilled Water
- Heating Water
- Air Handling Equipment



- 6 AHU's
- 3 roof top
- 3 indoor
- Provide SA to VAV boxes

AIR HANDLING UNITS

Desig.	Type	Location	Service	Total Airflow (cfm) Max	Total Airflow (cfm) Min	Outside Air (cfm)
AHU1	Roof Top	Roof North	1st, 2nd, 3rd	36,300	13,100	6,300
AHU2	Roof Top	Roof South	South wing 2,3	32,300	11,300	10,300
AHU3	Roof Top	Roof South	South wing 4	11,000	7,100	6,500
AHU4	Indoor	MER 105	North wing 1	9,000	2,800	1,900
AHU5	Indoor	Basement MER	South wing 1 dining	15,000	8,700	7,200
AHU6	Indoor	Basement MER	South wing 1 kitchen	5,700	5,700	5,700
			TOTAL .	109,300	48,700	37,900



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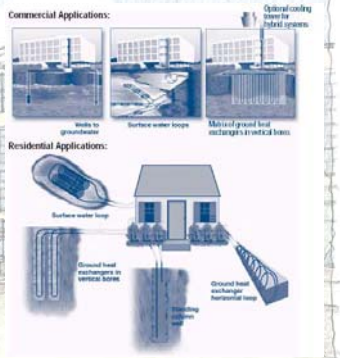
Mechanical Option

Presentation Overview

- Building Summary
- Existing Mechanical System
- Depth Topic: Proposed Geothermal

- Plenum mounted Heat Pumps
- Interconnected run-around loop
- Geothermal loop connection



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Mechanical Option

Mechanical Depth: Geothermal

- Ground Source Heat Exchanger

- Open Loop Extraction & Injection Wells
- Strict EPA Regulations
- Equipment fouling due to minerals

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Mechanical Option

Mechanical Depth: Geothermal

- Ground Source Heat Exchanger

- Closed Loop Surface Water
- Deep water required
- Fluctuation in water temp

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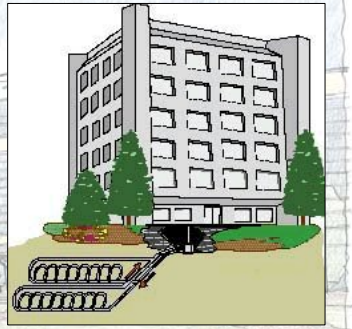
Mechanical Option

Mechanical Depth: Geothermal

- Ground Source Heat Exchanger

- Closed Loop Horizontal
- Large Area
- Fluctuation in surface temperature



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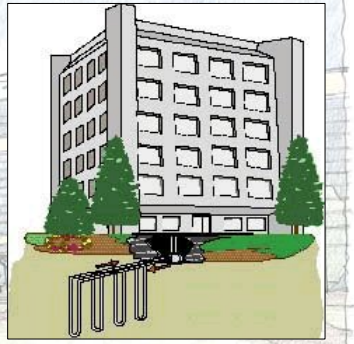
Mechanical Option

Mechanical Depth: Geothermal

- Ground Source Heat Exchanger

- Closed Loop Vertical
- Minimal area
- Constant loop temperature
- Expensive Drilling Costs



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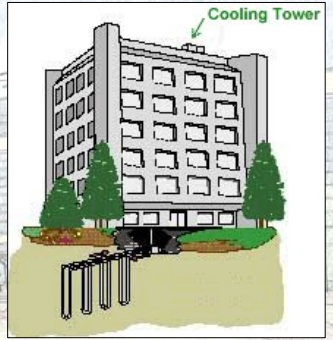
Mechanical Option

Mechanical Depth: Geothermal

- Basis For Proposed Design

- Hybrid System
- Heating / Cooling load balance
- Cooling Tower meets peak cooling loads
- Reduced Drilling Costs



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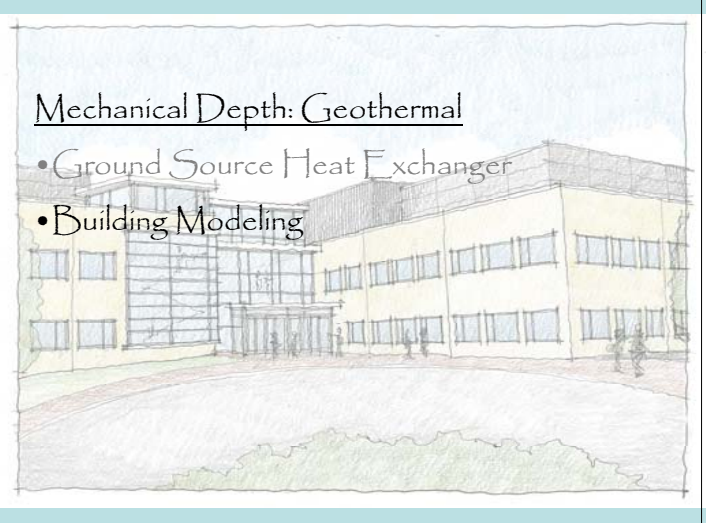
Mechanical Option

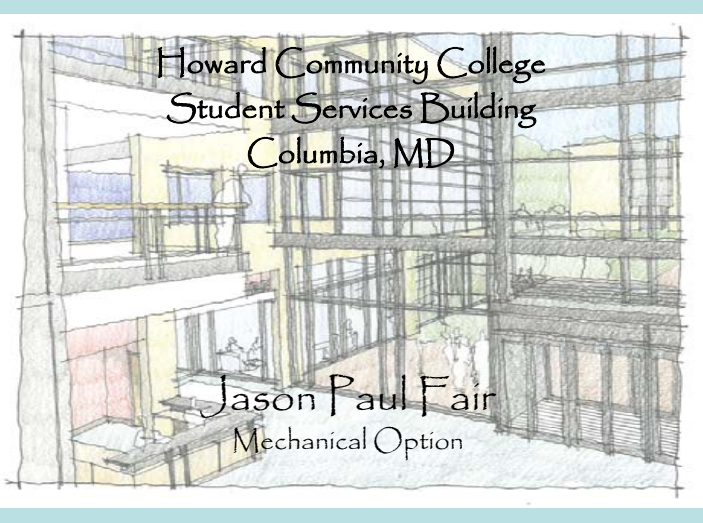


Mechanical Depth: Geothermal

- Ground Source Heat Exchanger
- Building Modeling

Design Parameters

- Baltimore, MD
- Summer Design Temperatures
  - 91°F DBT
  - 77°F WBT
- Winter Design Temperature
  - 13°F



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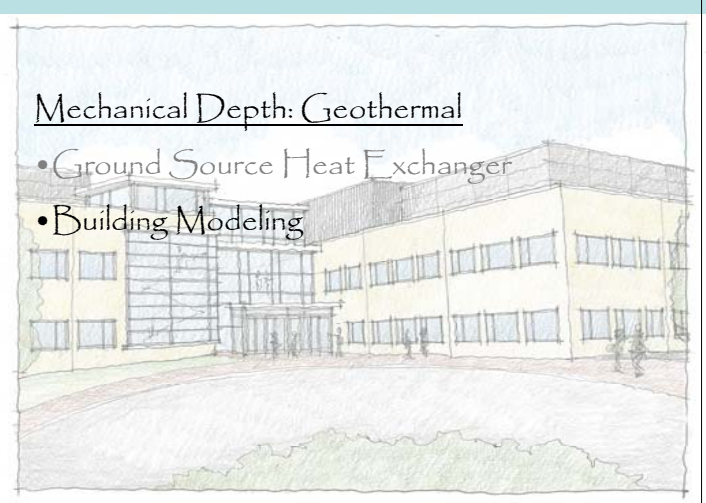
Mechanical Option

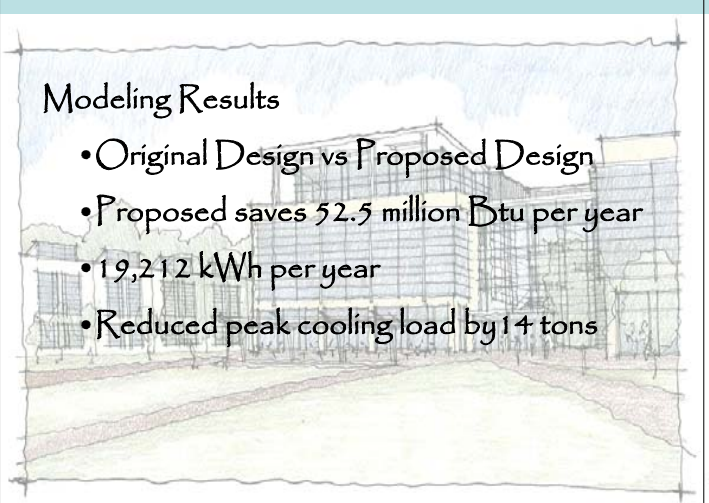
Mechanical Depth: Geothermal

- Ground Source Heat Exchanger
- Building Modeling



Modeling Results

- Original Design vs Proposed Design
- Proposed saves 52.5 million Btu per year
- 19,212 kWh per year
- Reduced peak cooling load by 14 tons



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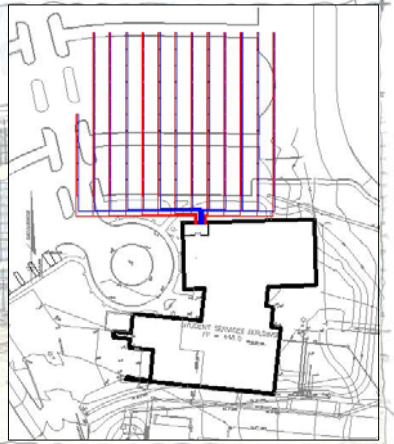
Mechanical Option

Mechanical Depth: Geothermal

- Ground Source Heat Exchanger
- Building Modeling
- Well Field Sizing

Peak Cooling

- 138 boreholes
- 300 ft deep
- $17.00/foot
- $703,800.00



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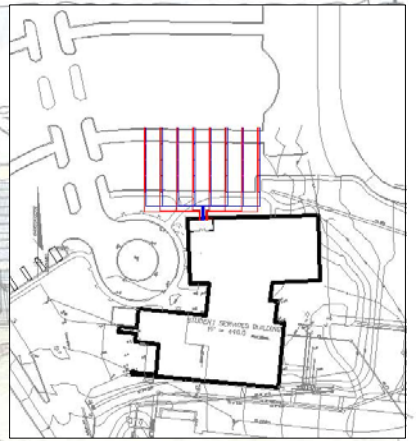
Mechanical Option

Mechanical Depth: Geothermal

- Ground Source Heat Exchanger
- Building Modeling
- Well Field Sizing

Peak Heating

- 40 boreholes
- 300 ft deep
- $17.00/foot
- $204,000.00
- Additional 270 tons Cooling



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Mechanical Option

Breadth Topic Constructability / Cost

- Scheduling

Drilling Time

- 700 ft/day
- 2 boreholes / day
- 4 weeks drilling
- 1 week piping connections

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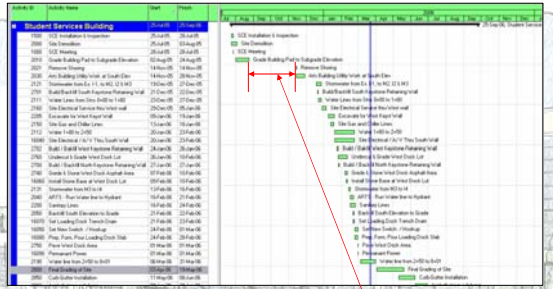
Mechanical Option

Breadth Topic Constructability / Cost

- Scheduling



2.5 month Site Schedule window

5 week estimated installation time

Extra time for unforeseen drilling conditions

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Mechanical Option

Breadth Topic Constructability / Cost

- Scheduling
- Cost

Equipment & Material Initial Costs			
Description	Geo Thermal cost		As Designed cost
Heat Exchange Fluid	$ 1,677.00		$ -
Circulation Pumps	$ 19,227.00		$ 25,462.00
Air Handling Units	$ 110,000.00		$ 738,167.00
VAV boxes	$ -		$ 41,000.00
Water Source Heat Pumps	$ 331,145.00		$ -
Drilling & Grout	$ 203,524.00		$ -
Ground loop piping	$ 24,887.00		$ -
Fittings and Valves	$ 16,008.00		$ -
Building HVAC Piping	$ 901,500.00		$ 655,500.00
Chiller	$ -		$ 250,000.00
Cooling tower	$ 29,200.00		$ 44,700.00
Plate heat exchanger	$ 47,300.00		$ -
Sheet metal	$ 132,755.00		$ 879,400.00
Totals	$ 1,817,223.00		$ 2,634,229.00

Savings of $ 817,000.00

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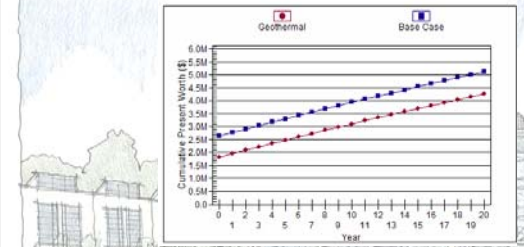
Breadth Topic Constructability / Cost

- Scheduling
- Cost



20 YEAR LIFE CYCLE COST

Design Cases Ranked by First Cost

Design Case Name	Design Case Short Name	Total Present Worth ($)	Annual Operating Cost ($/yr)	First Cost ($)
Geothermal	Geothermal	$4,275,799	$137,120	$1,817,223
Original Design Base Case	Base Case	$5,116,437	$138,438	$2,634,229

Present worth difference $841,000.00

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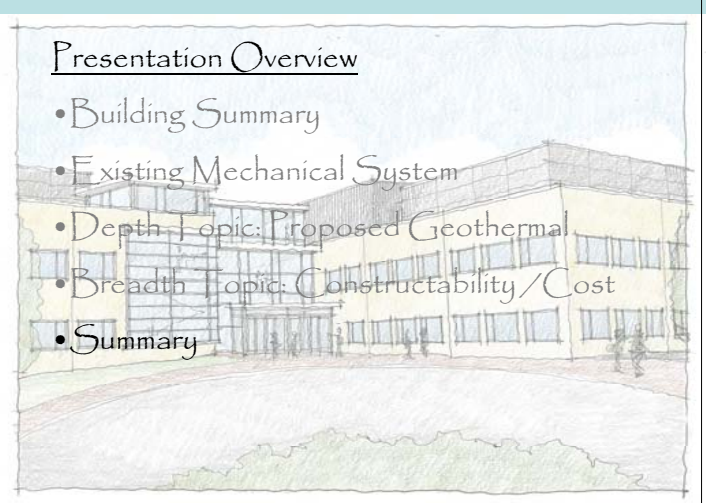
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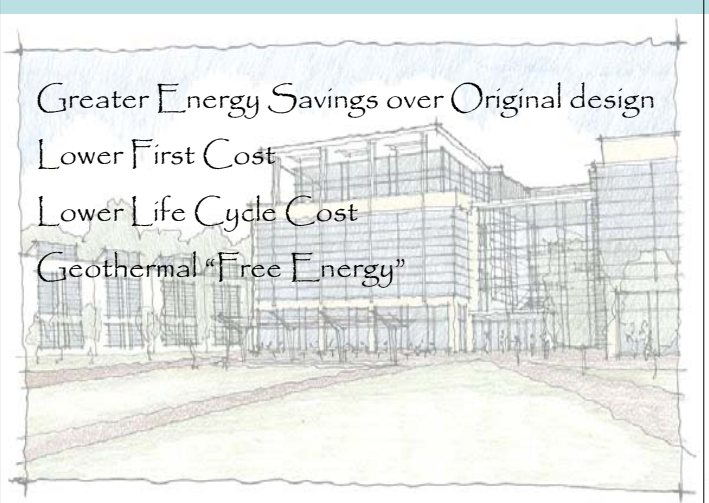
Greater Energy Savings over Original design
Lower First Cost
Lower Life Cycle Cost
Geothermal "Free Energy"


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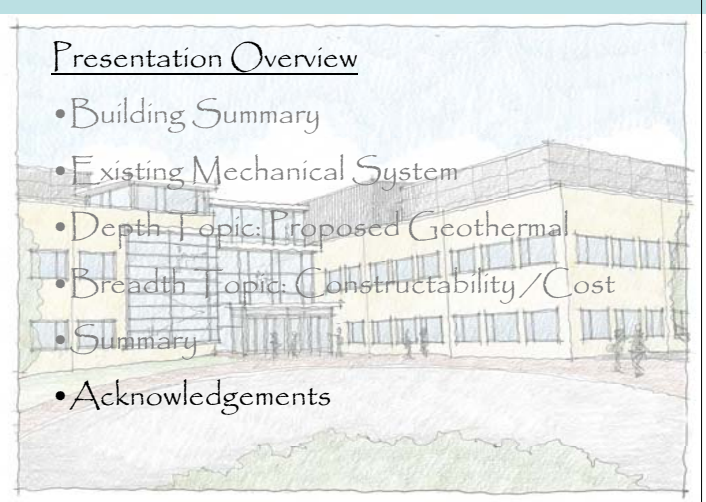

Advisor Dr. Bahnfleth

Professor Moses Ling

Mueller Associates

Parents & Siblings

My Beautiful Wife

THANK YOU JESUS!

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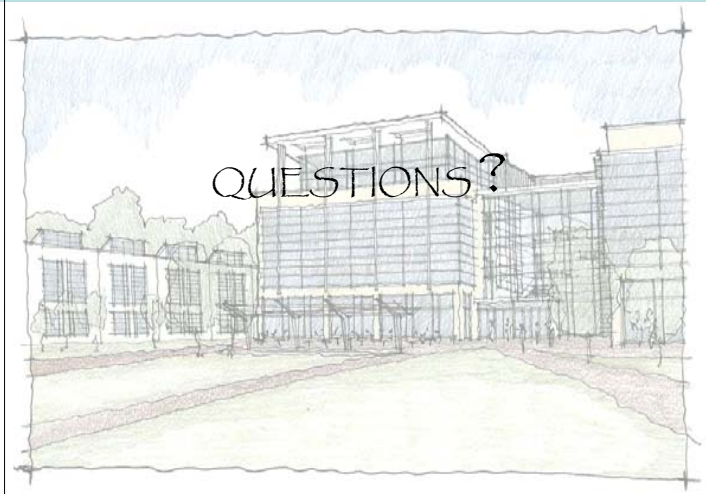

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