

# Walter Reed National Military Medical Center

Bethesda, Maryland



Justin Herzing – Mechanical Option  
Advisor – James Freihaut, Ph D

WRNMMC  
The Pennsylvania State University

# Walter Reed National Military Medical Center

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## Presentation Outline

### Building Overview

- Cooling System Overview
  - Heating System Overview
  - Air Distribution System Overview
- Mechanical System Redesign  
Acoustic Analysis

### Solar Shading Analysis

### LCC and Conclusion



Location – Bethesda, Maryland

Building Use – Office/Hospital

Building Size – 598,595 sf

Building A – 6 Stories

Building B – 4 Stories

Overall Project Cost - \$641 Million

Delivery Method – Design/Build

Construction Start – July 2008

Construction End – November 2010

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- (3) 1,000 Ton Centrifugal Chillers
- (2) Heat Recovery Chillers
- (3) 1,000 Ton Induced Draft Cooling Towers Located Off Site
- Variable Primary Pumping

## Presentation Outline

### Building Overview

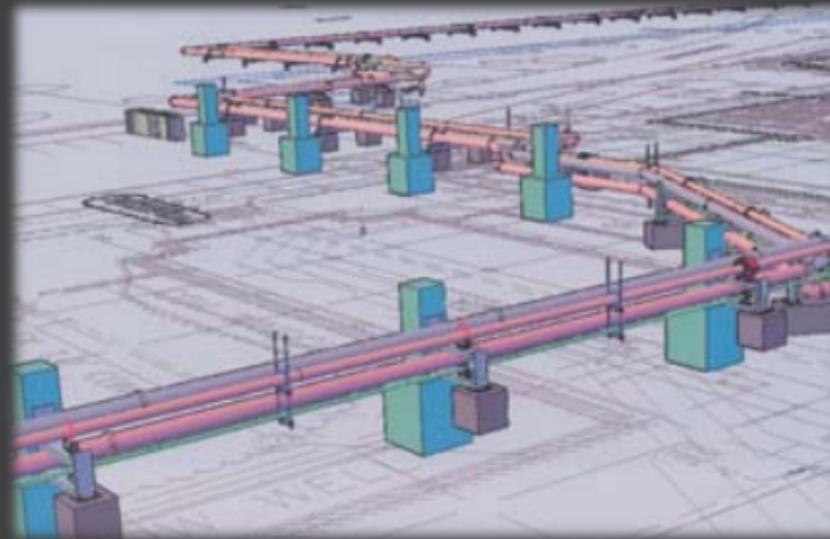
- Cooling System Overview
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- High Pressure Steam is Delivered from Campus Plant (125 psig)
- Steam Pressure Reducing Stations (75 and 15 psig)
- Humidification Steam Generators
- Shell and Tube Heat Exchangers

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- (11) 50,000 cfm Air Handling Units
- (11) Total Energy Wheels
- Constant Volume Supply

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  - Decentralized Supply Fan Analysis
  - Backpressure Steam Turbine Analysis
  - Combined Heat and Power Analysis
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LCC and Conclusion

- Utilize Tech
- Reduce Sta
- Reduce Bu

	\$/Mbtu
Electricity	0.0357
Campus Steam	0.0299
Natural Gas	0.0089

Life Cycle Cost  
Campus Plant  
ption

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Building Overview

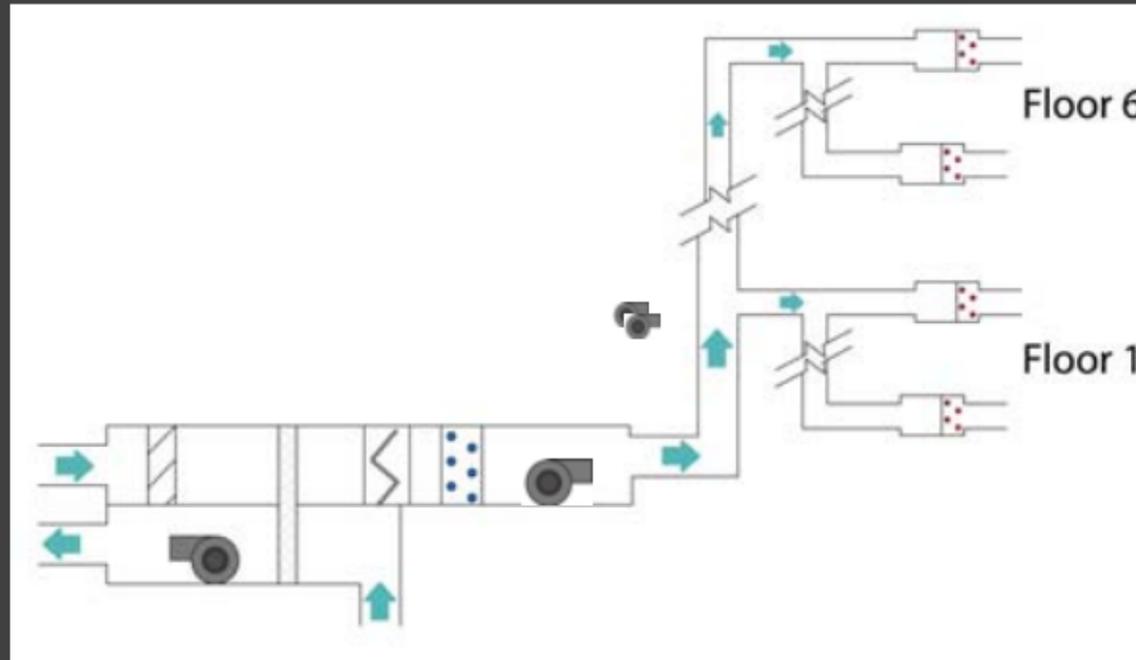
### Mechanical System Redesign

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Total Yearly Savings - \$59,944

Initial Cost - \$297,896

Yearly O/M Cost – \$21,600

Simple Payback – 8 Years

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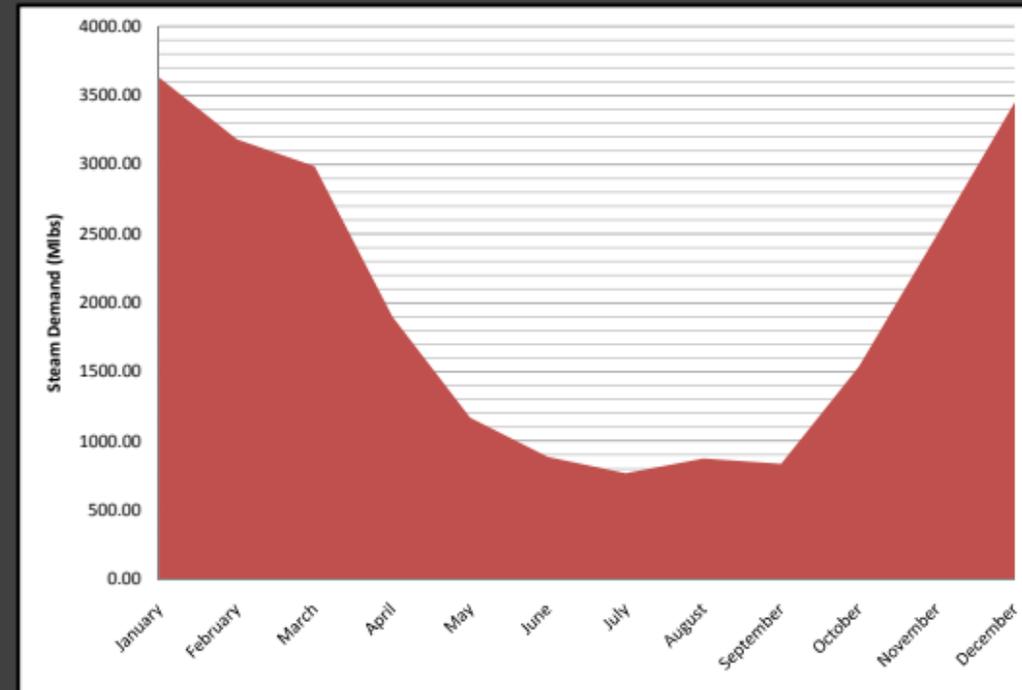
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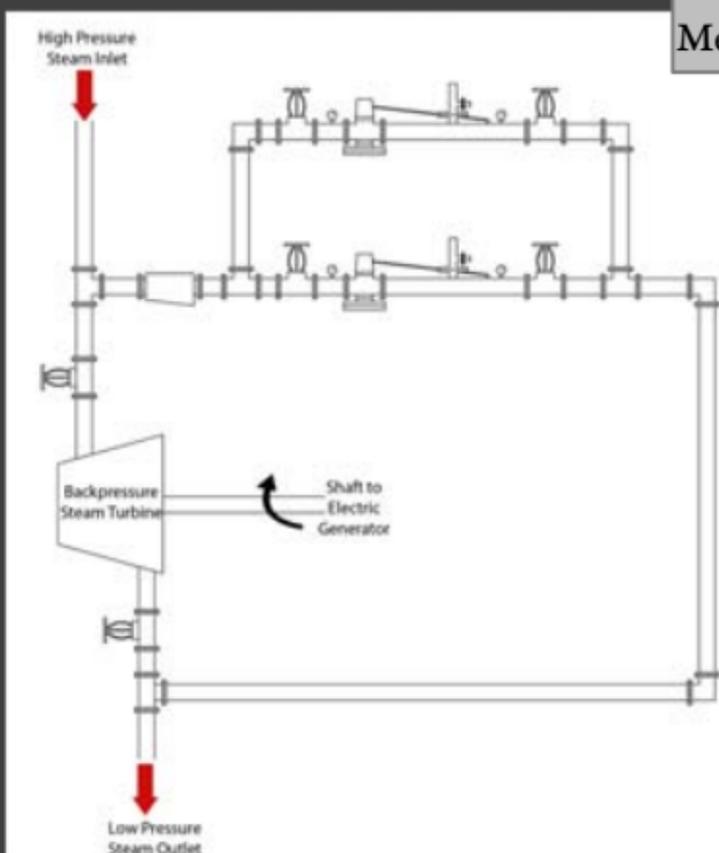
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Mechanical Redesign

BPST Analysis

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Total Yearly Savings - \$40,093

Initial Cost - \$160,000

Yearly O/M Cost – \$15,240

Simple Payback – 7 Years

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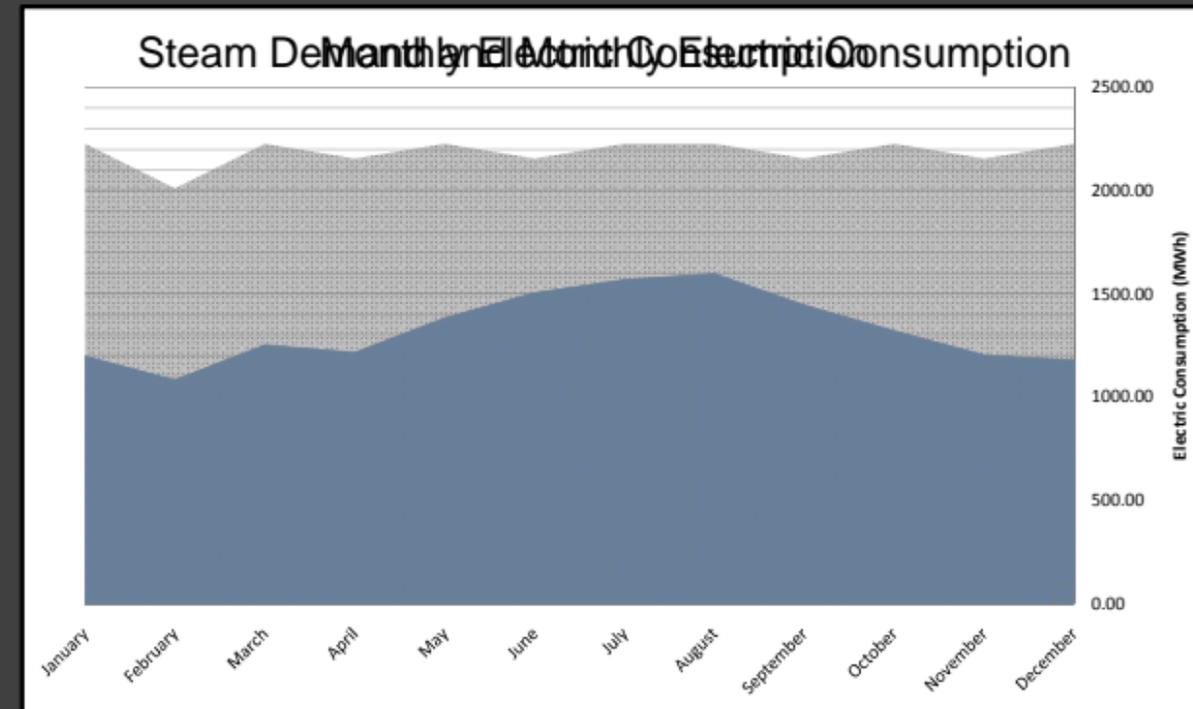
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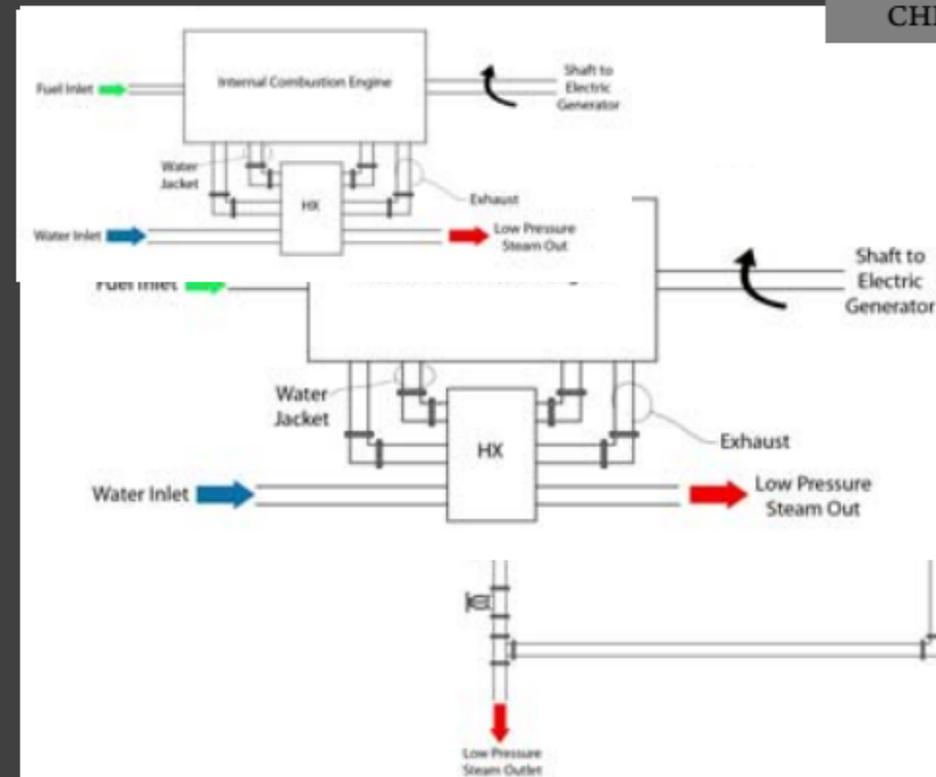
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### CHP without BPST

Total Yearly Savings - \$902,815

Initial Cost - \$4,208,599

Yearly O/M Cost – \$279,322

Simple Payback – 7 Years

### CHP with BPST

Total Yearly Savings - \$640,275

Initial Cost - \$4,457,555

Yearly O/M Cost – \$292,407

Simple Payback – 13 Years

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Building Overview  
Mechanical System Redesign

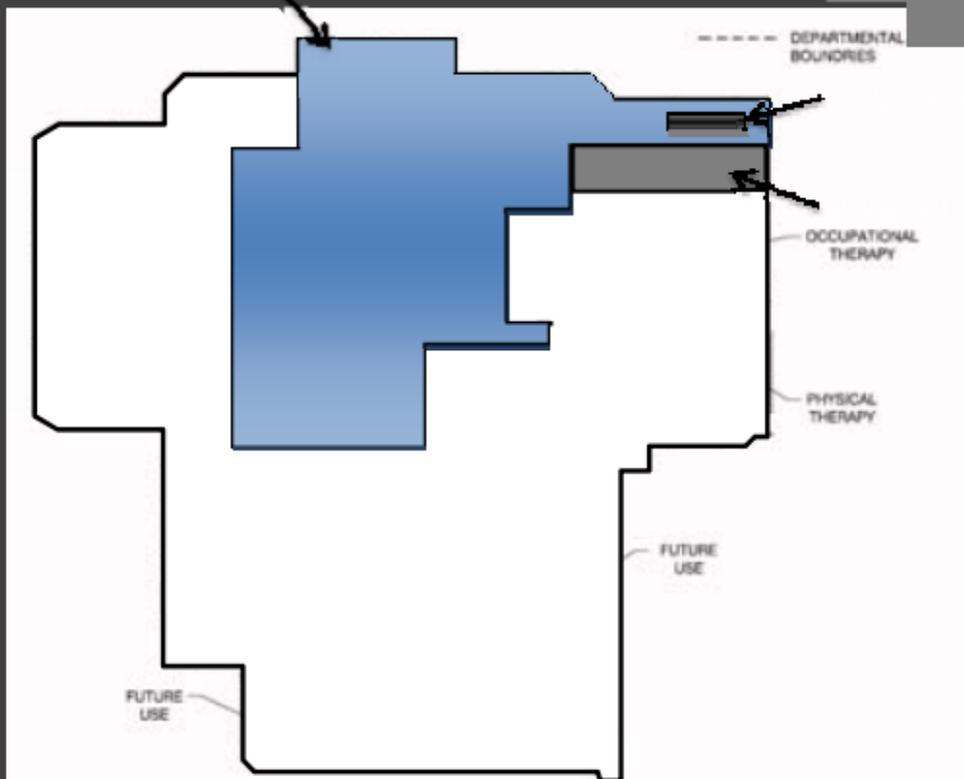
- CHP Acoustical Impact
- IC Engine Acoustical Properties
- Acoustical Study

### Acoustic Analysis

Solar Shading Analysis

LCC and Conclusion

Mechanical Space



Acoustic Analysis

IC Engine

rooms

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Gait Lab									
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Engine dBA re 20μPa	95	101	99	94	93	92	94	95	
NC Max 40									

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- Brief Overview

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## Conclusion

Lifecycle Cost

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- Lifecycle Cost Analysis
- Mechanical System Recommendation
- Questions

LCC and Conclusion

System	System As Designed	Decentralized Supply Fans	Backpressure Steam Turbine	CHP without Steam Turbine	CHP with Steam Turbine
Initial Cost	\$109,500,000	\$109,797,896	\$109,660,000	\$113,708,598	\$113,957,555
Discount Rate	5%	5%	5%	5%	5%
Lifecycle (years)	20	20	20	20	20
Electric Cost	\$1,836,459	\$1,783,890	\$1,798,320	\$67,376	\$67,376
Electric Sold to Utility	\$0	\$0	\$0	\$323,815	\$396,441
Purchased Steam Cost	\$843,972	\$843,972	\$843,972	\$21,695	\$356,861
Natural Gas Cost	\$0	\$0	\$0	\$2,012,360	\$2,012,360
Total O/M Cost	\$500,000	\$521,600	\$515,240	\$779,322	\$792,407
20 Year Lifecycle Cost	\$142,898,168	\$142,541,054	\$142,582,956	\$135,857,693	\$139,377,899

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Rank	5	3	4	1	2

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- Questions

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