Charles E. Smith Center

Presentation Guide

- **Introduction**
- Proposed Alterations
- Combined Heat and Power
- Energy Recovery Wheel
- Construction Management Breadth
- Conclusions
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- Questions

Project Background

Charles E. Smith Center

Washington, DC

Location:	Washington, DC
Cost:	$43 M
Type:	Athletic Arena
Size:	4 Stories
	104,000 SF
Schedule:	Construction Start- Oct 2008
	Construction Finish- Fall 2010
Delivery:	Design, Bid, Build
Owner:	George Washington University

Mechanical Option

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Design Objectives

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- Sustainability
- ASHRAE Standards
- Quality
- Aesthetics
- Center Piece

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Mechanical Systems

Charles E. Smith Center

Washington, DC

- Natatorium
- 1st Floor
- 2nd and 3rd Floors
- Arena

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CHP

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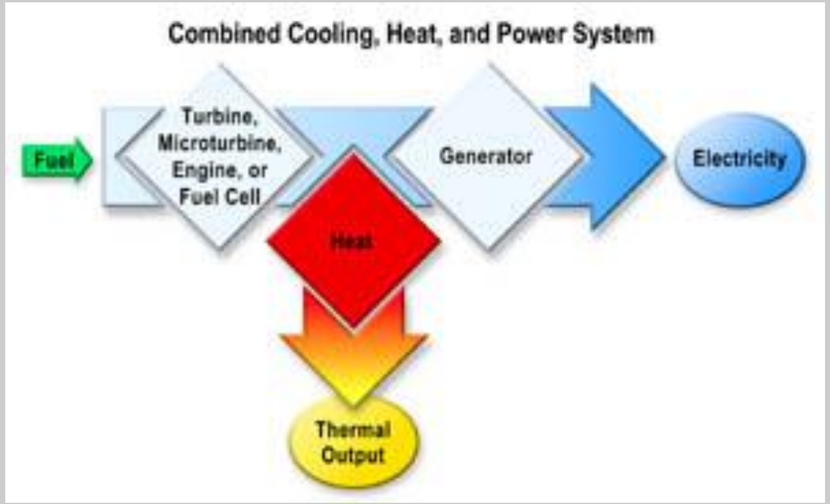

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Energy Recovery

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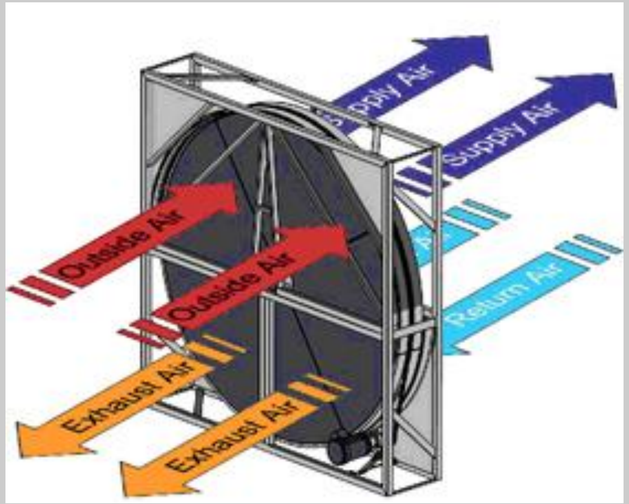

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Electrical/CM Investigations

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Electrical

- Effect of CHP

Construction Management

- Schedule Impact
- Operations and Maintenance

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CHP

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Objectives

- Reduce dependability on electric
- Increase facility efficiency
- Reduce overall costs

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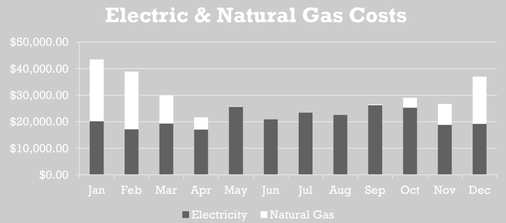

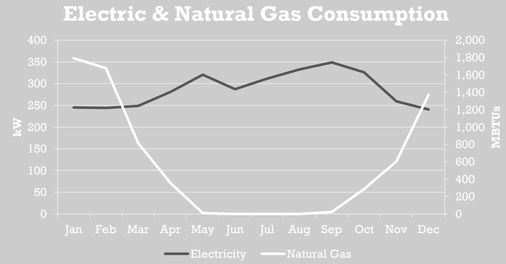

Feasibility

- Utility Prices
- Utility Use
- Spark Gap
- Thermal/Power Ratio

Mechanical Option

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CHP

Prime Mover

Microturbine	Small number of moving parts. Compact size and light weight. Low emissions. No cooling required.	High costs. Relatively low mechanical efficiency. Limited to lower temperature cogeneration applications.	30 kW to 250 kW
Spark ignition (SI) reciprocating engine	High power efficiency with part-load operational flexibility. Fast start-up. Relatively low investment cost. Can be used in island mode and have good load following capability. Can be overhauled on site with normal operators. Operate on low-pressure gas.	High maintenance costs. Limited to lower temperature cogeneration applications. Relatively high air emissions. Must be cooled even if recovered heat is not used. High levels of low frequency noise.	< 5 MW in DG applications
Compression ignition (CI) reciprocating engine (dual fuel pilot ignition)			High speed (1,200 RPM) ≤4MW Low speed (102-514 RPM) 4-75 MW

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CHP

Base Cost

- Includes Boiler
- Exclude Generator

	Initial Cost	Price Difference
Existing	$230,000	$390,000
w/ CHP	$620,000	

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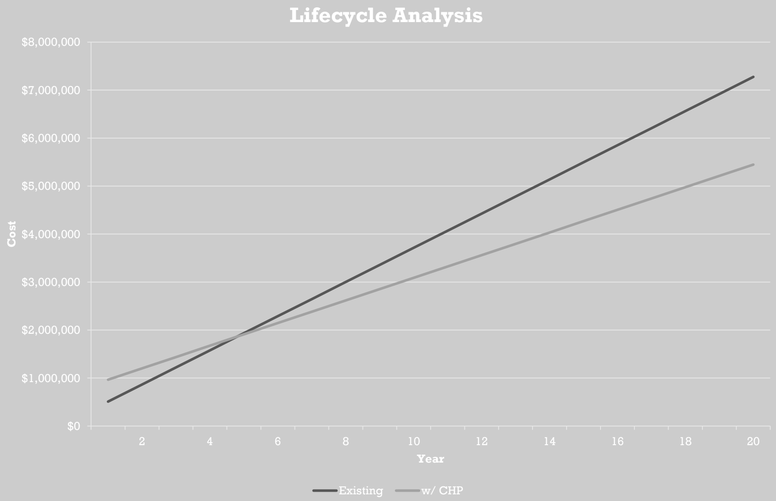

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Mechanical Option

Energy Recovery

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Objectives

- Reduce energy use through lost heat
- Increase facility efficiency
- Reduce overall costs

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Energy Recovery

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	Capacity (CFM)
AHU-4	5800
AHU-5	2030
AHU-6	2900
AHU-7	1800
Total	**12530**

New Air Conditioning Unit

- 2nd Floor Mechanical Room
- BCs in Ceiling
- Acoustic
- Space

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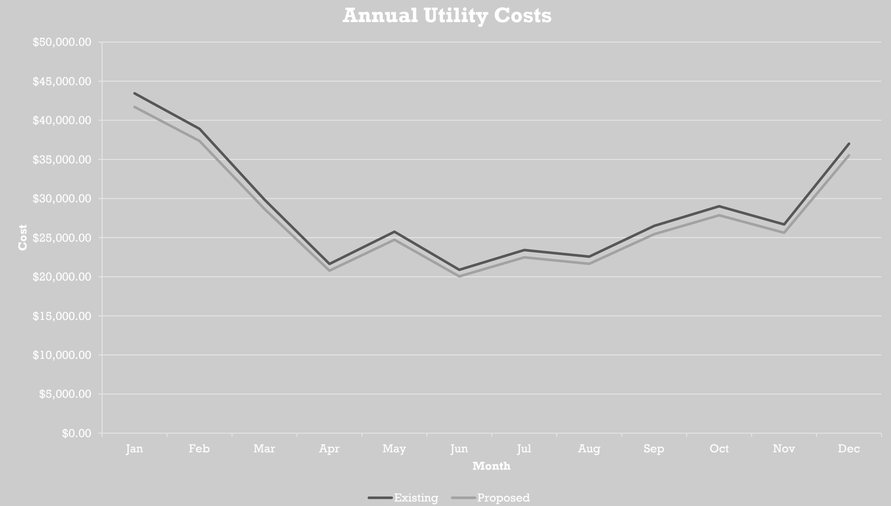

Mechanical Option

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Energy Recovery

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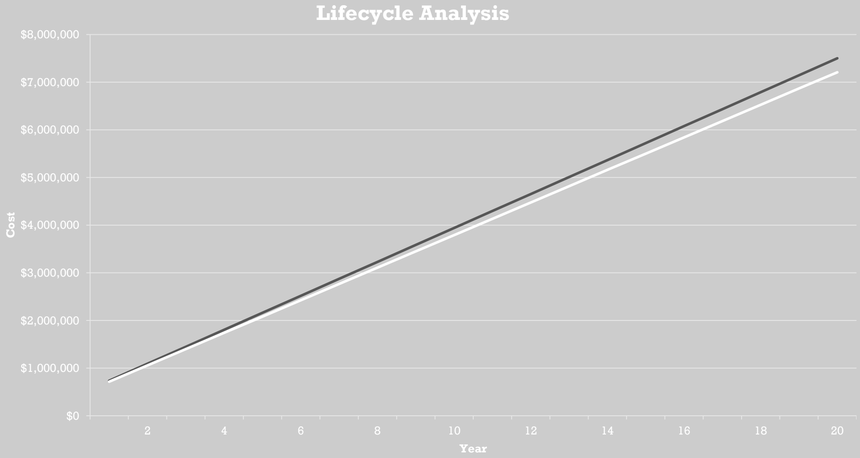

Mechanical Option

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CM Considerations

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Objectives

- Minimize learning curve
- Increase worker efficiency
- Reduce overall costs

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Mechanical Option

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CM Considerations

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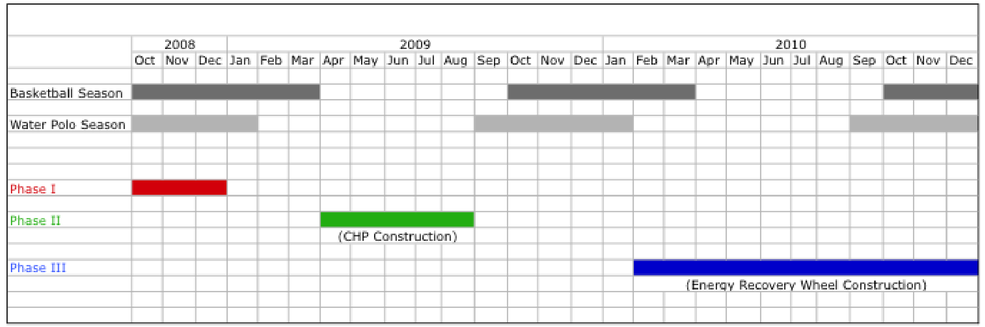

Mechanical Option

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Recommendations

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Mechanical Option

CHP

- Yearly savings of ~ $100K
- Life cycle cost ~ $2M
- Payback period ~ 6 yrs
- Operations and Maintenance
- Space

Recommendations

Presentation Guide

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Energy Recovery

- Yearly savings of ~ $13K
- Life cycle cost ~ $250K
- Payback period ~ Instant

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Mechanical Option

Acknowledgements

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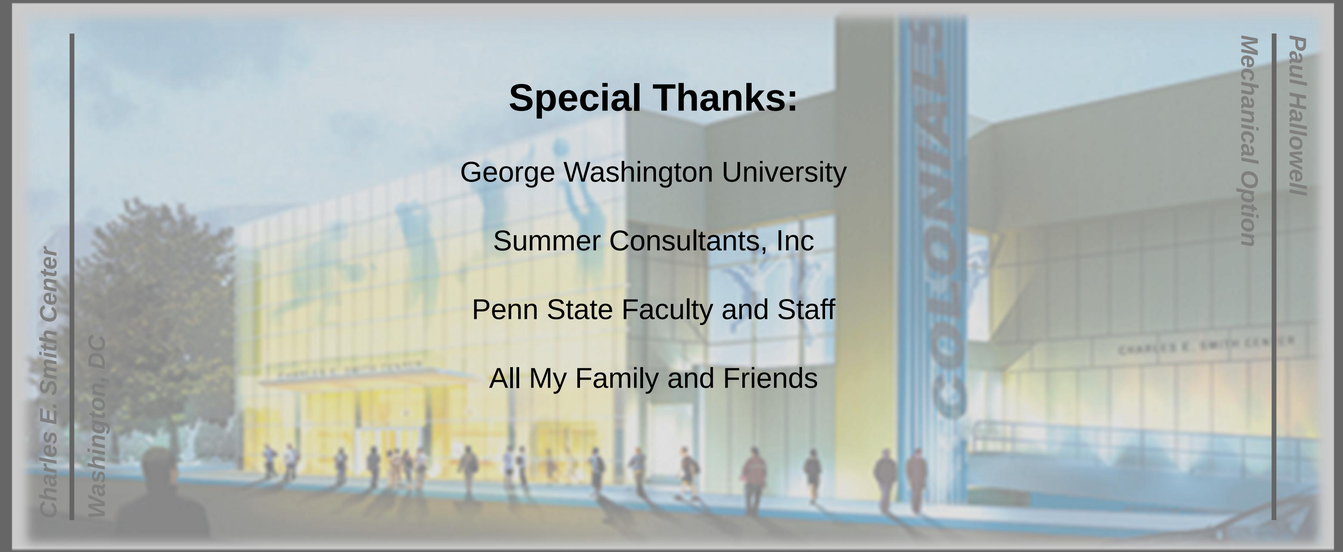

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Penn State Faculty and Staff

All My Family and Friends

Questions

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