

SUPPORT SERVICES BUILDING

PENN STATE MILTON S. HERSHEY MEDICAL CENTER



PENN STATE AE SENIOR THESIS FINAL PRESENTATION
WILL LAZRATION
CONSTRUCTION MANAGEMENT - DR. RILEY

SUPPORT SERVICES BUILDING
PENN STATE MILTON S. HERSHEY MEDICAL CENTER

PRESENTATION OUTLINE

WILL LAZRATION
CONSTRUCTION MANAGEMENT

PRESENTATION OUTLINE:

- I. PROJECT BACKGROUND
- II. INTRODUCTION OF ANALYSIS
- III. ANALYSIS #1: FOUNDATION RE-DESIGN
 - I. Initial Conditions
 - II. Re-Design
- IV. ANALYSIS #2: ROOFING
 - I. Part I: Roofing Type Comparison
 - II. Part II: Elimination of Offset Roof
- V. ANALYSIS #3: RENEWABLE ENERGY SOURCES
 - I. Part I: Geothermal System
 - II. Part II: Installation of PV Array
 - I. Site Analysis
 - II. System Design
- VI. SUMMARY & CONCLUSION
- VII. ACKNOWLEDGEMENTS

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PROJECT BACKGROUND

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OWNER:

- Pennsylvania State University
- Hershey Medical Center

LOCATION:

- Hershey Medical Center – Hershey PA

BUILDING INFORMATION

- 42,796 SF
- 2 Stories + 1,000 SF Basement
- Built Atop Existing Utility Tunnel

PROJECT INFORMATION

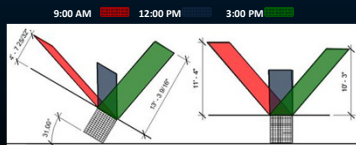
- Delivery Method: Design-Bid-Build
- Contract Type: CM @ Risk
- Project Cost: \$14,395,331.00 GMP
- Construction Dates: 7-1-2010 – 8-31-2011



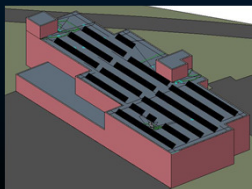
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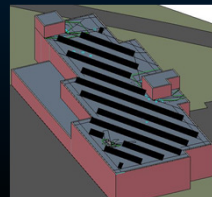
ARRAY ORIENTATION & TILT COMPARISON							
Angle	Array Orientation	Min. Row Spacing to Avoid Shading	Max # of Panels	Size of System (kW)	Average Solar Radiation (kWh/m ² /day)	Annual AC Energy (Deterate Factor of 0.8) (kWh)	kWh/ Panel/ Year
35°	Rotated 31°	11'-10"	252	80.64	4.41	97,118	385.39
	Due South	9'-9"	253	80.96	4.55	101,033	399.34
30°	Rotated 31°	10'-5"	248	79.36	4.42	95,832	386.42
	Due South	8'-8"	269	86.08	4.54	107,280	398.81



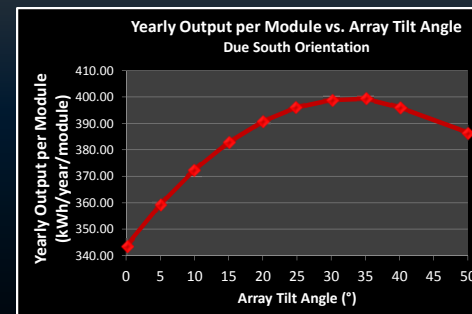
Minimum Row Spacing Determined by Shadow Lengths



Rotated 31° Orientation with 35° Tilt



Due South Orientation with 35° Tilt



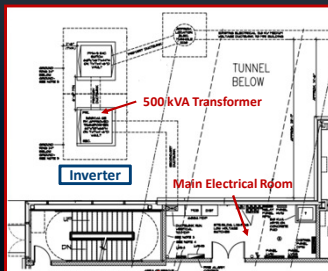
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PHOTOVOLTAIC ARRAY SYSTEM DESIGN

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Feed From Inverter to Combiner Panel/Box Sizing

- Max current from inverter data sheet: 91A/phase
- $91A \times 1.56$ (NEC Multiplier) = **142A**
- NEC Table 310.15(B)(2)(a): Multiplier for 4-6 current carrying conductors in a raceway = **0.8**
- NEC Table 310.16 (90°C Wire): 2/0 AWG = **195A**
- $195A \times 0.8 = 156A > 142A \Rightarrow OK$**

AC FUSED DISCONNECT SWITCH SIZING

- Max current from inverter data sheet: 91A/phase
- $91A \times 3$ phases 1.25 (NEC Multiplier) = **342A**
- Ideal fused disconnect switch size: 350A => not available => **400A**
- Interrupt Rating must be greater than; $500kVA / (.480kV * 3^{1/2}) =$ **600A**

