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engineering strategies for LEED platinum

Great River Energy

Presented to:

University of Minnesota Power Group

by:

Randy Olson, PE, LEED AP

Scott Rieger, PE, LEED AP

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introductions

Randy Olson, PE, LEED AP

Mechanical Engineer

Scott Rieger, PE, LEED AP

Electrical Engineer

background

owner

- Great River Energy
- 5th Largest electric generation and transmission cooperative in the United States

background
goals

- Achieve LEED Platinum
- "…do something with energy efficiency that had never been done before."

Mike Finley
Director of Business Operations
Great River Energy

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background
site selection

background

team

Architect:

PERKINS + WILL

Engineer:

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background

project

- 180,000 sf corporate office
- Data Center
- Full Kitchen and Cafeteria
- Conference Center

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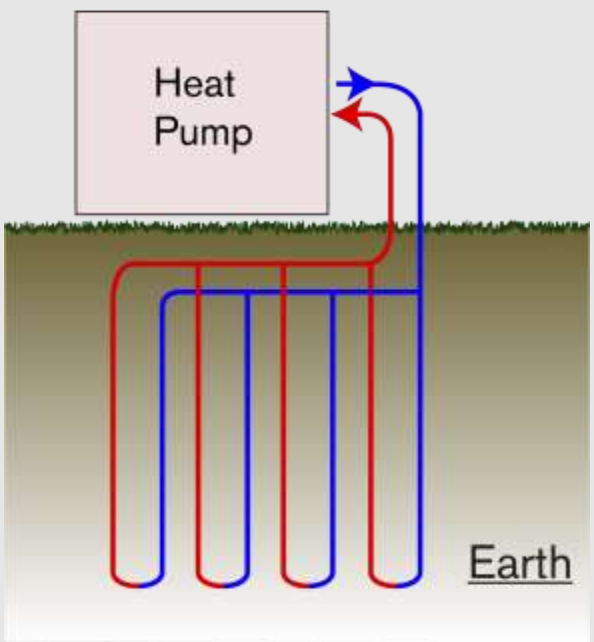
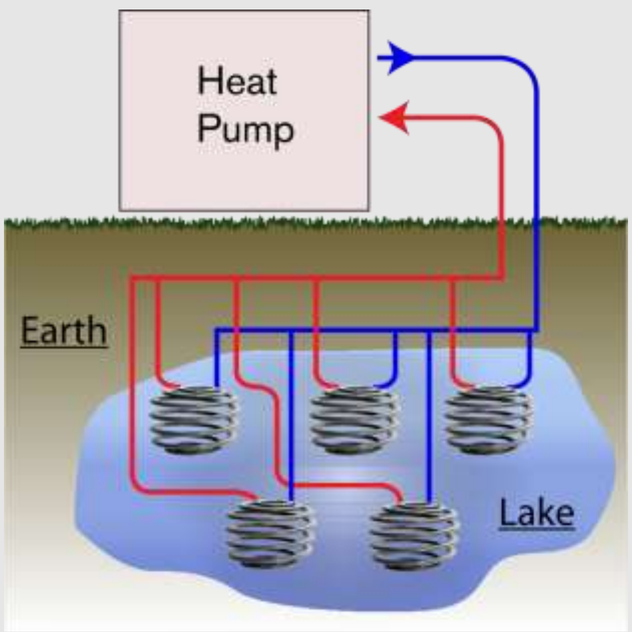
mechanical systems

lake source geothermal

vertical ground source vs. lake source

- Both feasible
- Lake option is less costly





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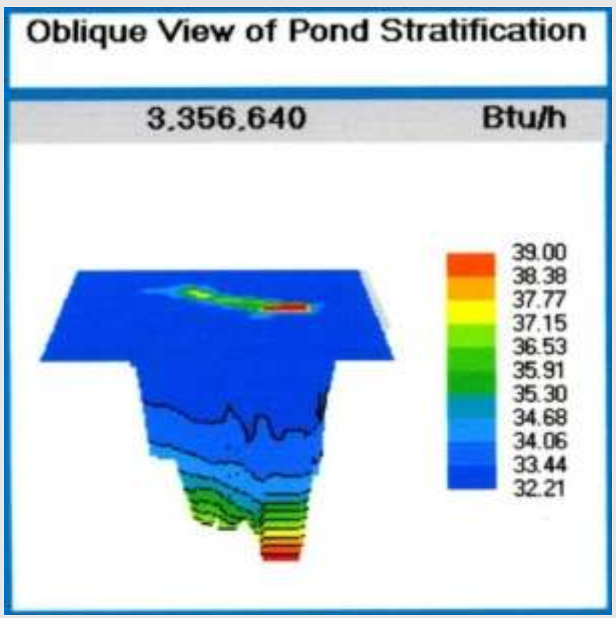
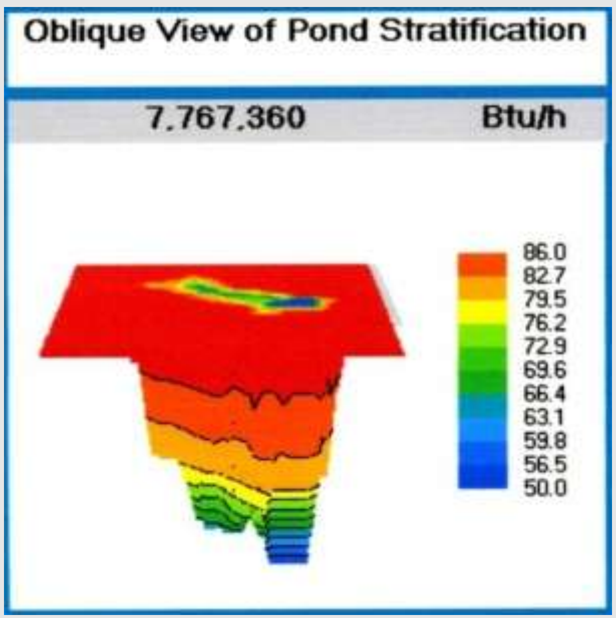
lake source geothermal

lake study

- Minimal impact
- Less than 1°F change



Winter



Summer

lake source geothermal

lake access and use

- City owned (not DNR controlled)
- No public access

lake source geothermal

Slim Jim vs. HDPE

- Slim Jim showed good performance
- HDPE more proven over time

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lake source geothermal installation details

- Simple
- Serviceable

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displacement ventilation (DV)
energy efficiency

- Less fan static pressure
- Warmer discharge air temperatures
- Warmer return air temperatures

displacement ventilation

indoor air quality (IAQ)

- ASHRAE allows reduction in ventilation quantities with DV
- However provided 30% more than code to improve IAQ

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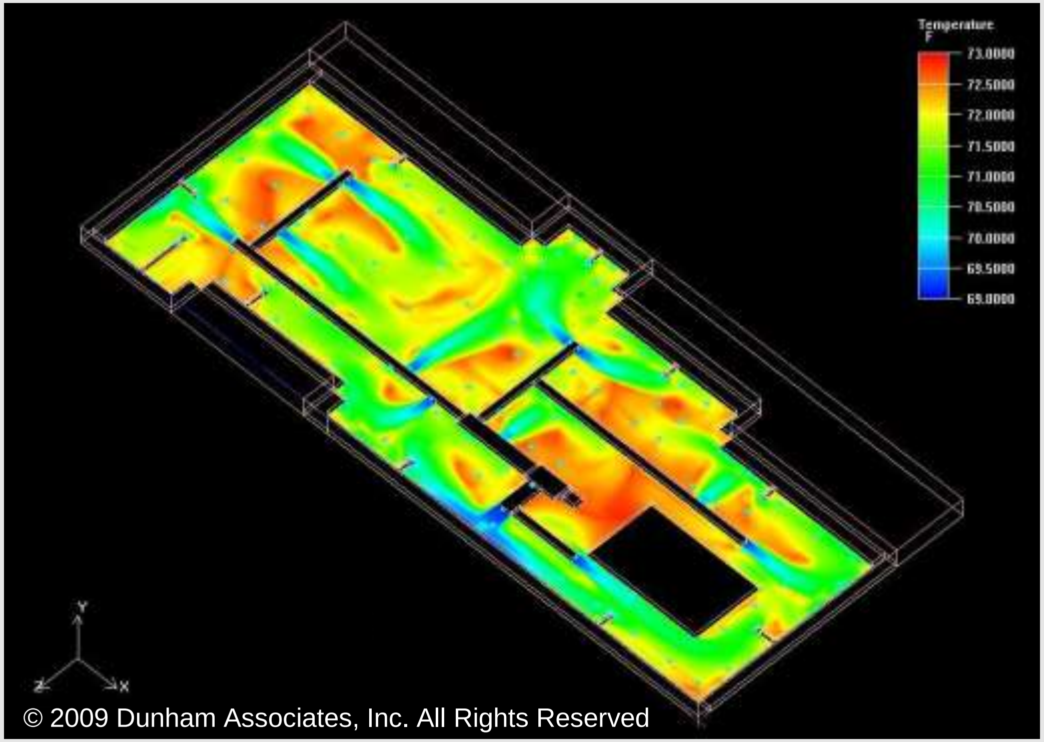
displacement ventilation
CFD modeling analysis

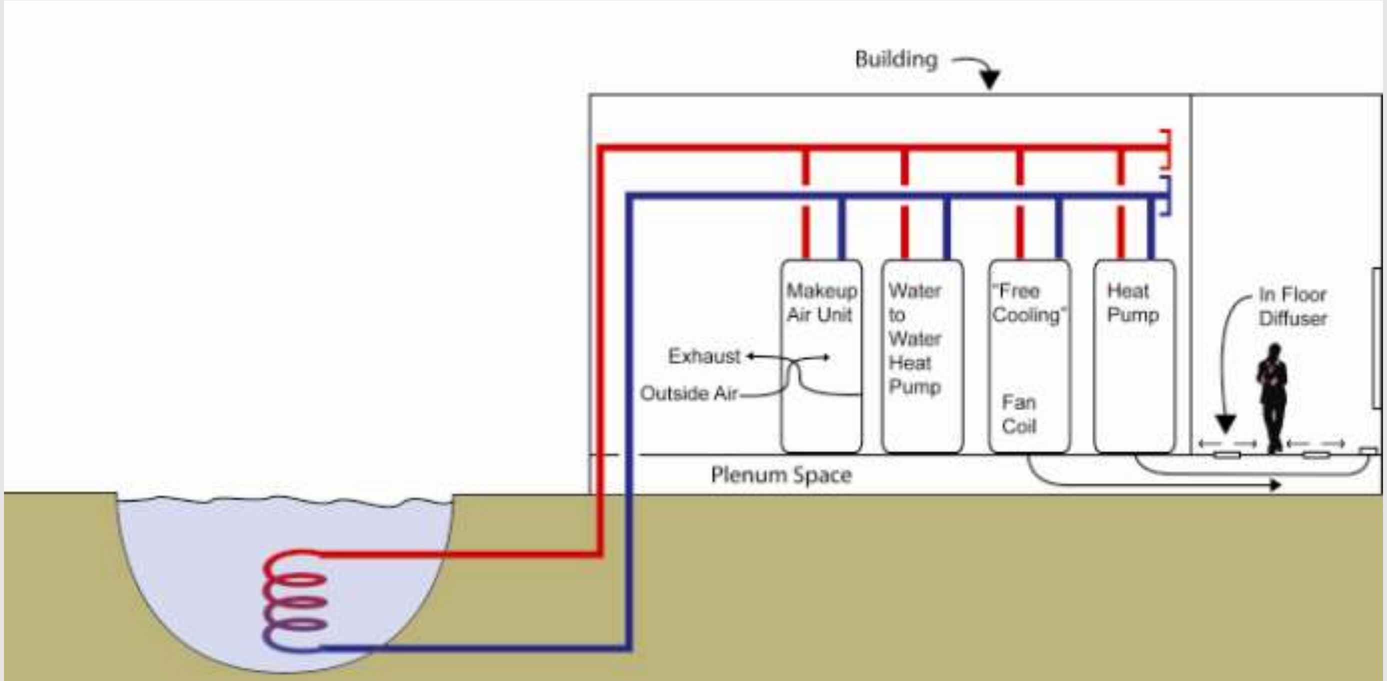


- Underfloor air flow
- Underfloor delivery temperature
- Space temperature

displacement ventilation

synergy with lake system

- Free cooling much of the year
- Sensible only, warmer discharge temps



outside air

- Heat recovery
- Free cooling
- Heat pump
- Dehumidification
- Deliver to fan coil units

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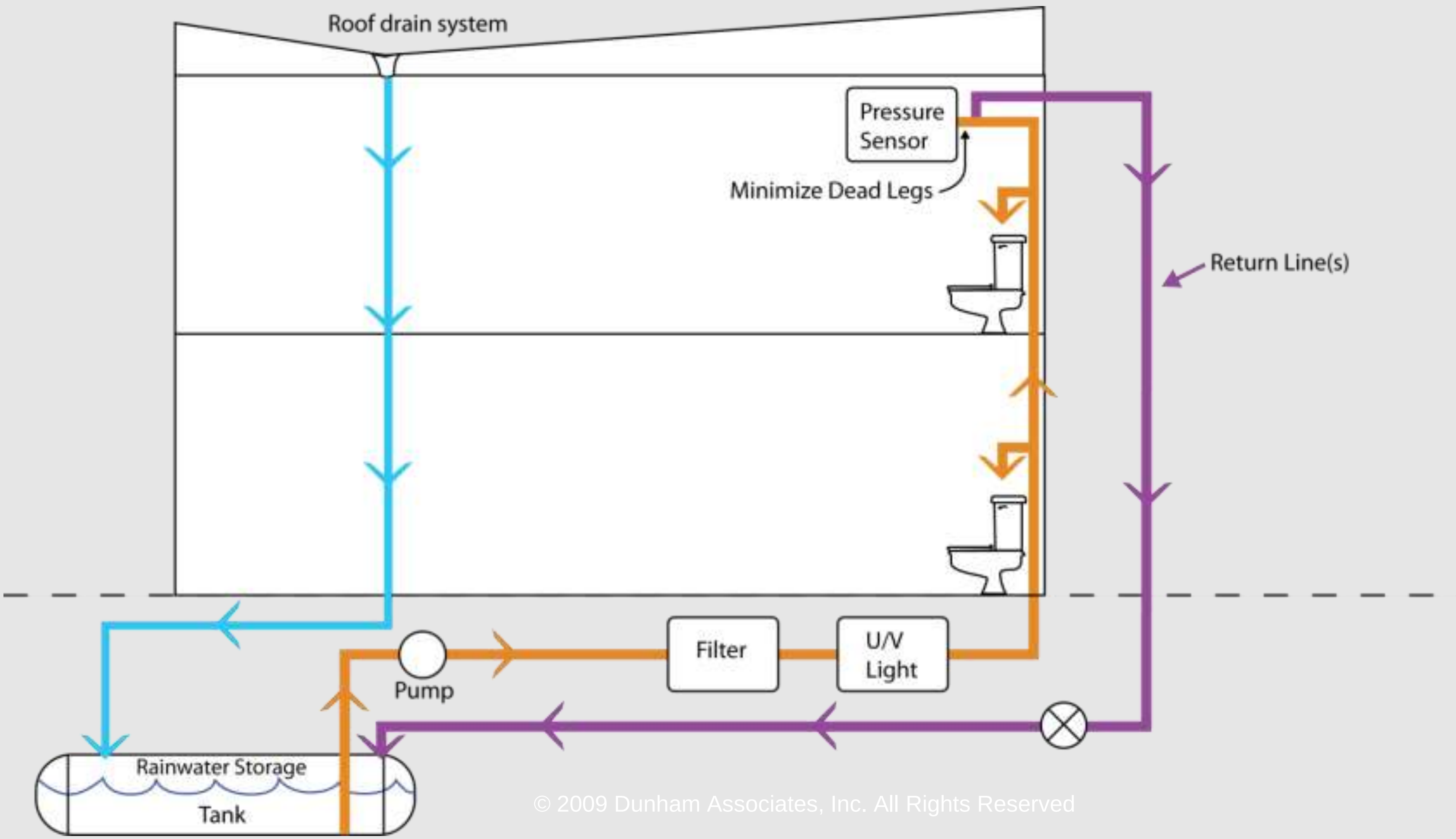
mechanical systems
other strategies

- Variable speed drives
- Temperature controls
- Measurement and Verification

water efficiency

rainwater harvesting



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electrical

wind power

location (urban environment)

- City of Maple Grove placed restrictions
- Owner Concerns
  - Safety issues
    - Redundant Ice Sensing

wind power turbine

- Size: 166 ft tall (top of blade)
  Rotor diameter of 97 ft
- Unit is a NEG Micon M700 manufactured in Denmark

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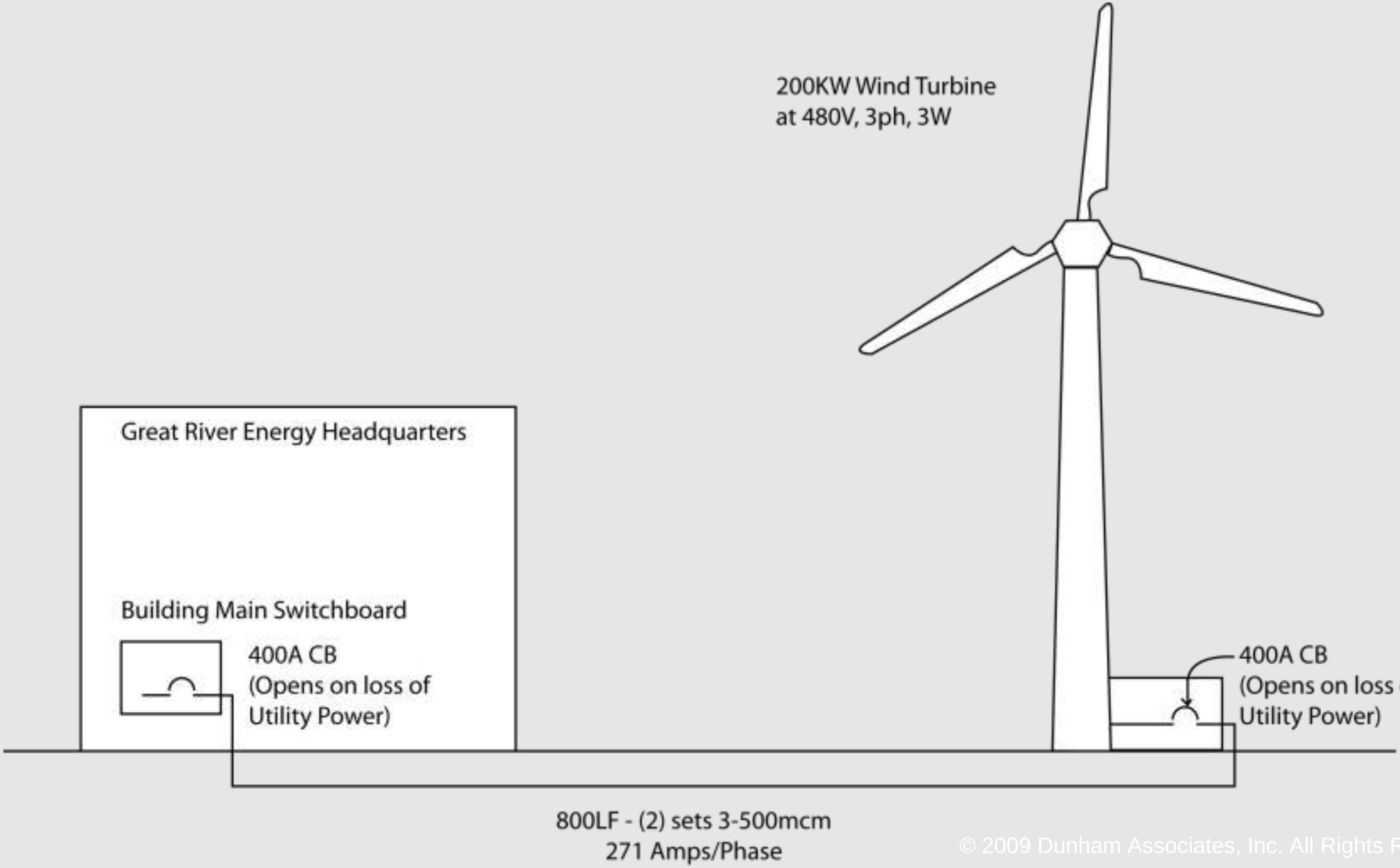
wind power capacity

- Great River Energy purchased unit from Energy Maintenance Services (EMS)
  - Shipped to Gary, SD in 2007 for refurbishment
    - Gearbox was remanufactured
    - Generator was rewound
- Nameplate data
  - 200 KW
  - Expected to produce 375,000 kwHr/Yr
- Total installed cost: (foundation, electrical, etc.)
  - $500,000

wind power

connection to building/grid



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wind power adjustments

- Wind speed vs. output
  - >7 – 9mph = Motoring (electricity)
  - 10 – 45mph = Producing
  - ≥ 30mph rated output
  - 45mph = Safety cutout
- Wind Turbine had very inconsistent power factor
  - Dependent on wind speed
- GRE installed power factor correction

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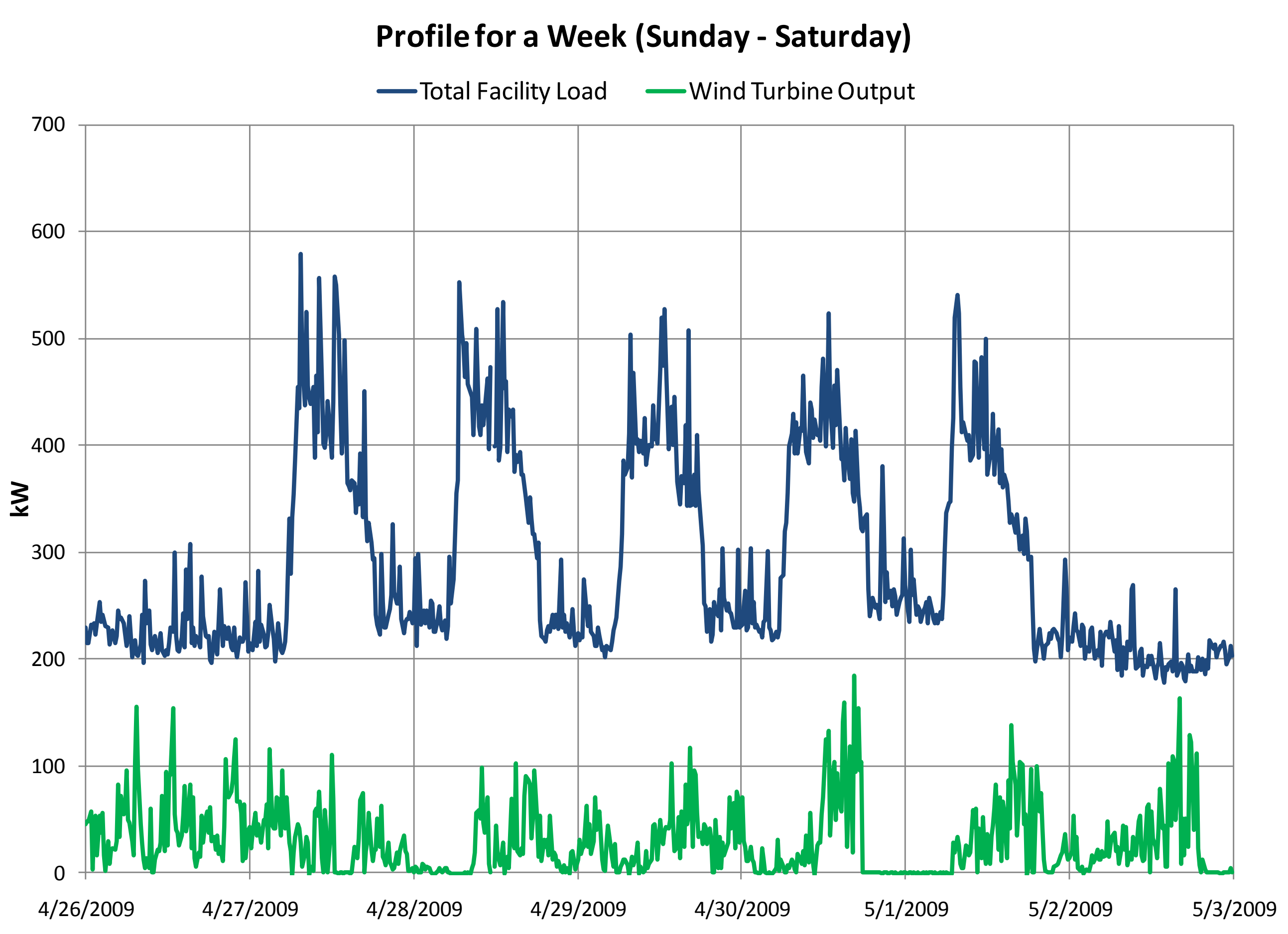
wind power

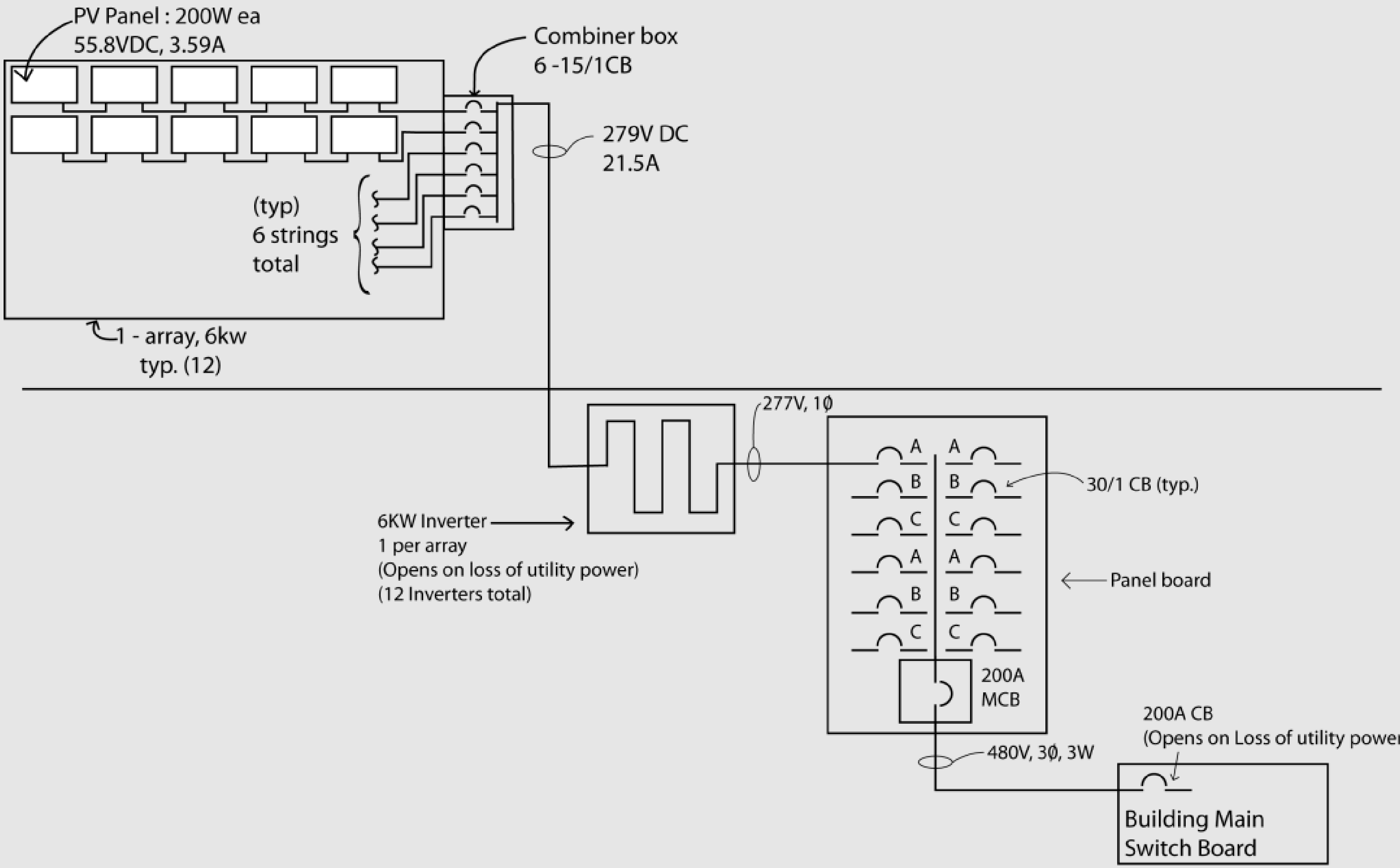
wind power graph



photovoltaic power location

- 72kw PV panels
  - 66kw located on roof
  - 6kw located on ground
- PV panels mounted at 45 degrees
  - Median average of winter/summer sun angle

photovoltaic power technology



photovoltaic power connection to building

- Inverters (12)
  - Sunnyboy, 6kw each
  - 277V, 30A breaker in subpanel
- Shuts down with loss of utility power

lighting system

daylight harvesting

- Ceiling mounted photo sensors
- Fixtures with dimming ballasts

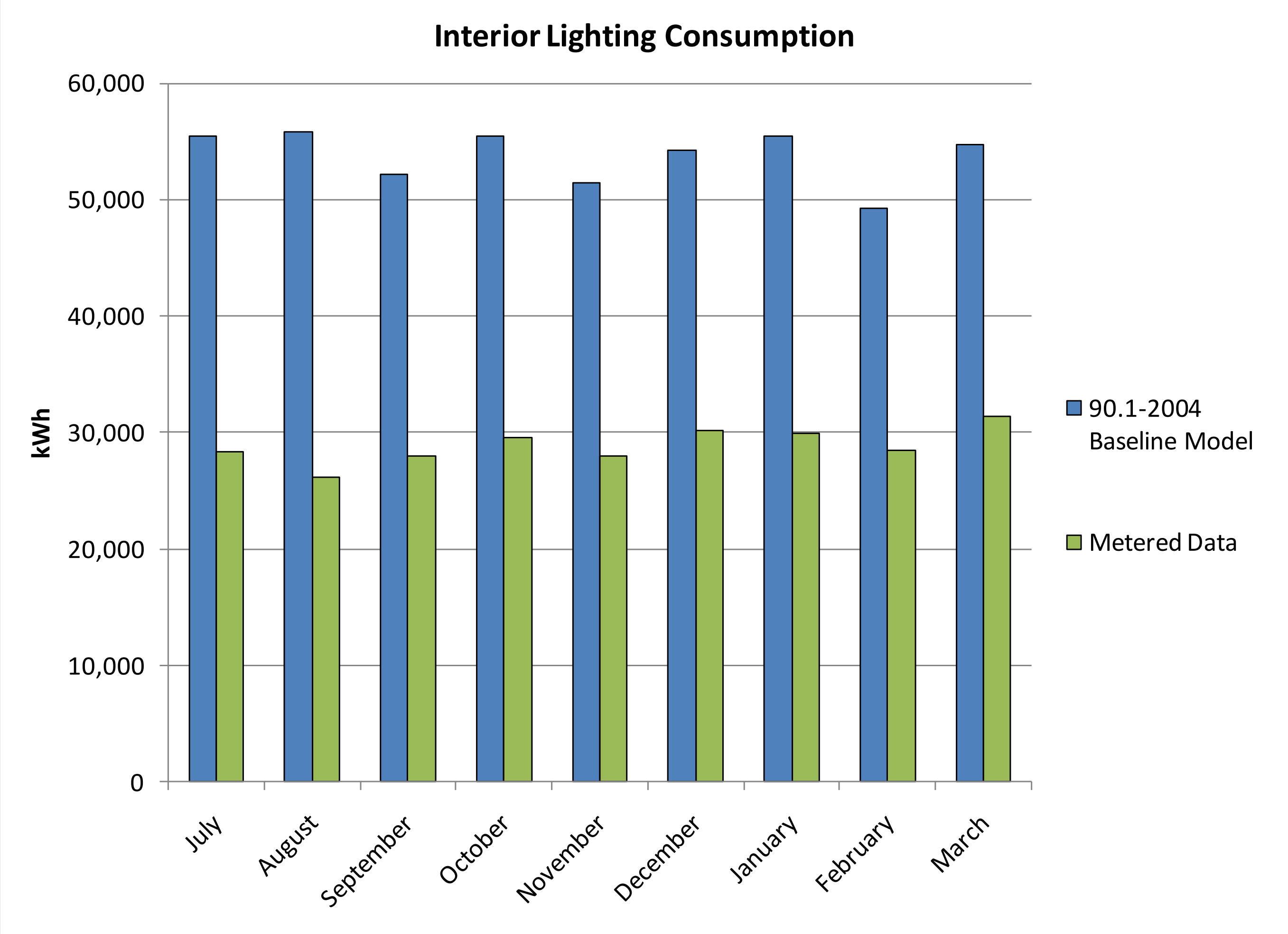
lighting system

system design

- Exterior row dimmed separately
  - Measuring light from exterior
- Interior row dimmed individually
  - Measuring light from center atrium
- Center row on/off
- Preset levels

lighting system

interior lighting consumption



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lighting system

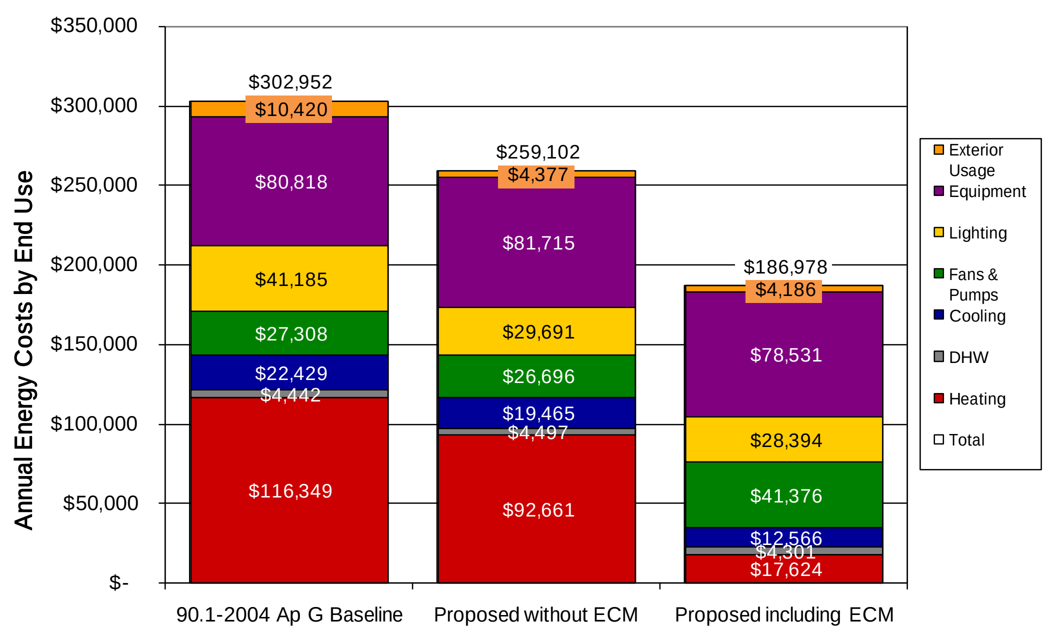
exterior lighting

- Lower lighting poles
  - Better able to control light
  - Required more light poles
- Reduced the wattage of lamps
  - Achieved same foot-candle levels with 15% less wattage

results

energy savings

- 49% reduction in energy costs
- “Exceptional” calculations required



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national awards

- USGBC LEED Platinum
- Consulting Specifying Engineer ARC Gold Award
- ACEC Engineering Excellence Award - Grand Award
- AIA/COTE Top Ten Green Project for 2009

thank you for your time

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