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

May 19, 2009
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
background

site selection
background

team

Architect: PERKINS

Engineer: W I L L
background project

• 180,000 sf corporate office
• Data Center
• Full Kitchen and Cafeteria
• Conference Center
mechanical systems

© 2009 Dunham Associates, Inc. All Rights Reserved
lake source geothermal
vertical ground source vs. lake source

• Both feasible
• Lake option is less costly
lake source geothermal lake study

- Minimal impact
- Less than 1°F change
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
lake source geothermal installation details

- Simple
- Serviceable
displacement ventilation (DV)

energy efficiency

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

© 2009 Dunham Associates, Inc. All Rights Reserved
displacement ventilation

indoor air quality (IAQ)

• ASHRAE allows reduction in ventilation quantities with DV
• However provided 30% more than code to improve IAQ
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
mechanical systems
other strategies

- Variable speed drives
- Temperature controls
- Measurement and Verification
water efficiency
rainwater harvesting
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
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

200KW Wind Turbine
at 480V, 3ph, 3W

Great River Energy Headquarters

Building Main Switchboard
400A CB
(Opens on loss of Utility Power)

800LF - (2) sets 3-500mcm
271 Amps/Phase

400A CB
(Opens on loss of Utility Power)
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
Profile for a Week (Sunday - Saturday)

- Total Facility Load
- Wind Turbine Output

© 2009 Dunham Associates, Inc. All Rights Reserved
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

PV Panel: 200W ea
55.8VDC, 3.59A
(typ) 6 strings total

1 - array, 6kw
typ. (12)

Combiner box
6-15/1CB

279V DC
21.5A

6KW inverter
1 per array
(Opens on loss of utility power)
(12 inverters total)

277V, 10

Panel board

30/1 CB (typ.)

200A CB
(Opens on Loss of utility power)

200A MCB

Building Main Switch Board

© 2009 Dunham Associates, Inc. All Rights Reserved
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 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

![Interior Lighting Consumption chart](Image)
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
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