A HOLISTIC APPROACH IN REDUCTION OF ENERGY LOADS AT HILLVIEW MIDDLE SCHOOL

How daylighting and lighting systems can help reduce energy consumption
PRESENTATION OVERVIEW

• Introductions and Case Study Background
• Planning Process and Project Goals
• Energy Reduction Goals
• Design Process
• Daylighting and Lighting Systems
• Costs and Funding Sources
• Results and Benefits
• Operational Considerations
• Introductions
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• Case Study Background
  – Located in Menlo Park, CA
  – Design and Construction of new middle school
  – Existing 9 Acre School Site
  – 1000 Student campus; 2 story buildings
  – 80,000 SF of new facility space
  – 48 Teaching stations
  – $51M Project Cost
  – School opened in September 2012 (2 year construction project)
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Existing School Layout
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• Planning Process and Project Goals
  – Local Bond Measure passed in June 2006
  – Visioning Process: Designing a 21 Century School
  – Environmental Goals and Objectives
    • Energy reduction, water conversation, materials, recycle, etc.
  – Adoption of CHPS (Collaborative High Performance School) Guidelines
  – Design Standards and Education Specifications
  – Reduction of Energy Loads to meet Cost Neutral Energy Goals
  – Conduct Energy Modeling and Analysis
    • Estimated Energy Consumption: 378,000 KWh Annual
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• Energy Use/Reduction Strategies
  – Reduce Energy Consumption
    • Major Energy Users (Electrical and Gas)
      – HVAC, HW, Pumps, Fans, Etc.: 60%
      – Lighting: ~ 40%
      – Plugin Loads: ~ 20% (big variable due to changing use of technology)
  – Reduce Energy Need
    • Increase natural lighting (daylighting)
    • Improve Building Envelop Systems
    • Limit Use of Air Conditioning (condition spaces that only need them)
    • Use Energy Management Systems to control HVAC systems
  – Produce Enough Energy from Photovoltaic Solar System to offset usage (goal of being cost neutral)
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• Design Process

Aggressive load reduction through optimized building envelope design, high-quality daylighting, and high efficiency Lighting and HVAC systems and controls
Daylighting and Lighting Systems

- Daylighting vs. Solar Gain
  - Exterior Control – active and passive systems, solar control and shading
  - Optimize glazing for daylight, high performance glazing
  - Window coverings
  - Daylight harvesting – can reduce lighting energy use by 85%  
    - Use of Solar Tubes, Skylights, and Light Wells
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• Daylighting and Lighting Systems
  – Lighting Systems
    • Volumetric distribution lighting—general classroom
    • Task lighting with asymmetrical distribution—teaching wall
    • Occupancy sensors and digital photo sensors—detect daylight levels
    • Dimmer switching—manual override
    • Lighting Controls
    • Exterior LED—lower energy consumption and longer life
    • Dark sky compliant to reduce “nocturnal glow and glare”
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• Costs and Funding Sources
  – Cost
    • Additional Studies and Analysis: ~ $115-150K
    • Lighting Upgrades
    • Efficient HVAC Systems
    • Dual Glazed Windows
    • Shade Structures
    • 225 KW PV System: $1.1M + other cost (structural steel, roofing, conduit, etc.)
    • Commissioning: ~$100K
  – Funding Sources
    • Local Bond
    • State Funding (OPSC)
    • California Solar Initiative ($250,000 in PV rebate)
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• Results and Benefits
  – Better lighting control for learning
  – Reduce energy cost by 13%
  – Lighting/daylighting provide best return on investment
  – Increase comfort level by reducing heat gain
  – Need to conduct 1 year analysis and make adjustments as needed
    • Estimated Annual Electricity Bill: $85,000 – 98,000
    • November to August 15 Electrical bill to date: $21K
Solar Energy Production at Hillview MS

Generation by Month:
- September 2012: 18,510 kWh
- October 2012: 12,562 kWh
- November 2012: 6,915 kWh
- December 2012: 12,562 kWh
- January 2013: 18,510 kWh
- February 2013: 18,510 kWh
- March 2013: 18,510 kWh
- April 2013: 18,510 kWh
- May 2013: 18,510 kWh
- June 2013: 18,510 kWh
- July 2013: 18,510 kWh
- August 2013: 18,510 kWh

Total Generation: 59,850.64 kWh
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• Lessons Learned and Operational Consideration
  – User Training and Understanding Critical
  – EMS Training and Adjustment Ongoing
  – Commissioning and Optimization Critical
  – Plan for Hidden Costs and Challenges
  – Practical Systems and Technology to match District/School ability to maintain