

STATE OF CALIFORNIA

The Department of General Services

Grid Neutral

Electrical Independence for
Schools and Community Colleges

Green California School Summit & Exposition
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Presenters



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Grid Neutral Basics



Defining Grid Neutral



- A site that provides at least as much **electricity** as it consumes in a year.
- Different than “zero net energy,” which deals with both electricity and fossil fuels.



Why Go Grid Neutral?



- Cost avoidance for school districts!
- Tax credit incentive programs can reduce the cost of implementing grid neutral.
- Power purchase agreements can give schools electrical energy independence in 10-15 years.



Getting to Grid Neutral



- DSA has spent the last year developing “how-to” solutions for schools to use to become grid neutral.
- A series of seven workshops were held in September through October, covering a critical components of how to go grid neutral.
- A guidebook is available on DSA’s website at:
www.dsa.dgs.ca.gov/OtherProg/gridneutral.htm



New Versus Existing Facilities



- The guidebook focuses on how to design new grid neutral facilities.
- The guidebook also addresses the modification of existing facilities to get campuses to grid neutral.



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Comprehensive Planning



Assembling the Team



- **Sponsors:**
 - School board members
 - Utility companies
 - Community stakeholders & media
 - Federal, State, and Local Government Agencies
- **Beneficiaries:**
 - Students
 - Teachers
 - Administrators
 - Curriculum planners
 - General public (who might also use facilities)



Assembling the Team



- **Implementers**
 - School facility planners
 - Consultants and specialists
 - Maintenance and operations
 - Architectural and engineering team
 - Builder, construction team, and major subcontractors
- **Others to include:**
 - Custodians
 - School site staff
 - Local Fire Marshal
 - Waste management/recycling experts
 - Joint use partner
 - DSA-certified inspector



Project Delivery Methods



- Integrated Project Delivery (IPD) is based on collaboration and allows for input during the design phase.
- Building Information Modeling (BIM) supports IPD through collaboration by combining design, fabrication information, erection instructions, and project management logistics.



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Energy Efficient Design



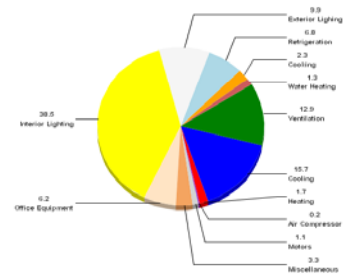
Best Practices

- The Collaborative for High Performance Schools (CHPS)
- Leadership in Energy and Environmental Design (LEED)



Design for Energy Efficiency

- Integrated design
- Building orientation
- Cool roofs
- Passive heating and cooling
- Alternative heating and cooling technologies
- Day lighting, High-efficiency lighting, Occupancy sensors
- Control systems
- Furnishings, Fixtures and Equipment
- New building Commissioning



Existing Building Efficiency Measures



- Building envelope (Air leakage, insulation)
- A/C duct sealing
- Heat avoidance (cool roofs, window film)
- A/C unit tune-up
- Lighting – LED replacements, Fluorescent upgrades, Parking lots, Exit signs, Occupancy sensors and controls
- High Efficiency HVAC – VS motors, Load shifting, Refrigerant sub cooling, Flow control, Cooling tower water management
- Boilers
- Control systems, control sequence optimization
- Reduce “Plug Loads” (Appliances, IT, Special equipment)
- Existing building commissioning (retro-commissioning)



Retrofit Case Study



- Chico Unified School District lighting retrofit
 - Started by removing existing fluorescent lights based on CHPS recommended lighting levels.
 - Installed Super T8 28-watt fluorescent lamps and high efficiency electronic ballasts.
 - Replaced all outside lighting with Compact Fluorescent Lamps (CFLs).

Results:

- \$150,000/year in savings!
- Anticipated payback 1-2 months!
- Emissions reduced by 900,000 lbs of CO₂/year!





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Energy Generating Technology



Photovoltaic (PV) Systems



- Ground-Mounted
- Roof-Mounted
- Shade Structures
- Building-Integrated Photovoltaic (BIPV)
- Stand-Alone PV Structures



Butte College Program



- Goal: Grid Neutral by 2015.
- Phase 1: one-megawatt field that generates **1.6 million** kilowatt hours annually.
 - That is 25% of the college's total energy!
- The program implements specific criteria for each project.
 - Sets fixed annual payments for a defined payment period.
 - Must include a viable financial partner & contractual methodology.



Solar, Geothermal, Wind



- Solar thermal – domestic hot water, space heating, pool heating
 - Potential to meet 50-75% of water heating needs
- Geothermal heat pumps
 - Can reduce energy costs by 20 to 60%.
 - Can reduce maintenance costs by 20 to 50%.
 - Low life cycle costs.
- Wind





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Energy Measurement



Measuring/Controlling Energy Use



- Benchmarking
 - Monthly usage
 - Peak demand
 - Load isolation and profiles
- Utility bill analysis
 - Utility for training programs
- Problem identification & correction
- Conservation program persistence





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OFFICE OF PUBLIC SCHOOL CONSTRUCTION

Maintenance & Operations



M&O Staff are Critical



- Involve maintenance & operations from the start
 - Facility planning, construction
 - Participate in building commissioning
 - Trained on systems and controls
- Educated on system performance tracking and techniques for maintaining efficiency
- Trained on continuous commissioning



Policy Considerations



- Performance goals
 - Energy usage reductions
 - GHG emission reductions
- M&O policies
 - Preventative maintenance programs
 - Performance driven retrofits
- Facility usage policies (i.e., personal appliances)
- Conservation program
 - Sponsorship
 - Performance tracking
- Training and awareness (Staff, students, Users)



Evaluating Opportunities



- Untapped conservation potential
- Life Cycle Cost Analysis – EE measures
- Age and condition of building and systems
- Energy usage trends
- Building usage patterns
- Potential size and location of generation equipment





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Innovative Funding



Opportunities for Change



- Power Purchase Agreements (PPA) Master Agreements
 - Templates for K-12, community colleges, and small school districts
 - **Keep the Tax Incentive Credits coming!**
- Statewide Procurement Templates.
 - Ability to purchase services as well as manufactured products
- Utilities to treat Districts as an Enterprise
 - Allows one site to produce credit for other sites in a District



Opportunities for Change



- Assembly Bill (AB) 625
 - Funnel money from Williams Energy Settlement Funds into Solar School Program
- Senate Bill (SB)17 or SB 19
 - Feed-in Tariffs to pay when District overproduces energy
- State Code 8869-80
 - \$3.8 Billion in Federal Funds if language includes schools



Opportunity for Gains



- In 2006, Elk Grove Unified School District (EGUSD) consumed approximate 58.2 MILLION kWh of electricity.
 - That equated to **\$6.2 MILLION!**
- Implementing low cost and no cost measures, and adding retrofits to the lighting and heating/air conditioning system, costs could be cut by up to **30%**.



Opportunity for Gains



- EGUSD could enter into a power purchasing agreement as a public/private partnership and install solar panels.
 - In the FIRST YEAR, the district could have fixed electricity costs that are up to 10% lower than before.
 - That is a savings of up to **\$620,000** a year!



Opportunity for Gains



- In 15-20 years, depending on the buyout agreement, EGUSD may be able to produce enough electricity to eliminate the entire electricity bill.
 - Cost avoidance would be dependant on base utility charges and the solar systems' production.
- After paying base utility charges and with zero net electricity, the saved **\$6 million** can go towards:
 - Teachers!
 - Textbooks!
 - Computers!



Evaluation Tools



- Decision making tool
- Cost benefit analysis
- Total cost of ownership analysis
- Discounted cash flow analysis
 - Net Present Value
 - Internal Rate of Return
- Compare different designs to identify which is best investment

Life cycle cost analysis is the key to making comparisons and to create new schools with the lowest long-term cost of ownership



It Can Work!



- Contra Costa Community College District made 3.2-megawatt solar system and energy efficiency improvements.
- \$35.2 million project was designed, engineered and constructed by Chevron Energy Solutions.
- Cost offset by \$8.5 million in rebates and other incentives.
- \$26.7 million net cost paid by Measure A funds.
- Expected savings of **\$70 million** over 25 years!



It Can Work!



- Los Angeles Community College District is installing solar panels, architectural wind and geothermal systems to produce enough electricity to take the campuses “off the grid.”
- With a power purchasing agreement, immediate savings were to be 30%, but recent bond measures can result in an early buyout.
- Buying out the agreements can result in savings of **\$9 million** a year!



It Can Work!



Milipitas Unified School District entered into a power purchasing agreement that will result in 65-80% energy offset.

Rancho Milpitas Junior High School



| | |
|----------------------|--|
| CSI Max: | 228kW |
| Canopy 1: | 105 kW |
| Canopy 2: | 77 kW |
| Canopy 3: | 24 kW |
| Total Size: | 216 kW |
| Inverter 1-2: | 250 kW total |
| Site Considerations: | <ul style="list-style-type: none"> • May become a high school • Cell phone tower shading • Shading analysis performed for south parking lot • Canopy 2: 3 rows, 65' each |
| Legend: | <ul style="list-style-type: none"> E-Main Electrical I-Inverter |





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QUESTIONS?



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THANK YOU!

*Images provided by:
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Solar Schoolhouse*

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