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The Department of General Services

STATE OF CALIFORNIA

DIVISION OF THE
STATE ARCHITECT

DEPARTMENT OF GENERAL SERVICES

Final Outcome of Workshops

Guidebook for K-12 School Districts & Community College Districts Board Members and Superintendents:

How to Achieve a Grid Neutral School

to be presented at the Green Schools Summit: December 8-10

Anaheim, California

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Roy McBrayer, *Deputy to the State Architect*

Chair of the Green Building Committee for Assembly Bill (AB) 32

"The Implications of California's Global Warming Law on Schools"

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Agenda

8:00am-8:15am	Greeting by David Thorman, State Architect
8:15am-9:00am	Implications of AB32 on Schools, Roy McBrayer
9:00am-9:15am	Grid Neutral Project Overview
9:15am-9:30am	Rules of Engagement
9:30am-10:15am	Comprehensive Planning
10:15am-10:30am	**BREAK**
10:30am-11:15am	Energy Efficient Design
11:15am-12:00pm	Energy Generating Technology
12:00pm-1:00pm	**LUNCH**
1:00pm-1:45pm	Energy Measurement
1:45pm-2:30pm	Maintenance & Operations
2:30pm-2:45pm	**BREAK**
2:45pm-3:30pm	LACCD: Off-the-Grid, Larry Eisenberg
3:30pm-4:15pm	Innovative Financing
4:15pm-4:30pm	Conclusion

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What is the compelling business case for Grid Neutral at our Community Colleges?

Already Being Proven at LACCD

- Grid Neutral by January 2009
- No Upfront Cost
- Immediate 10% Electrical Savings
- Demand Management (Energy Conservation) is Expected to Give Another 30% Savings.

Annual Potential All Community Colleges

- We spend $2 Billion Spent on Construction
- 6 Million Square Feet Affected
- Could Save $9 Million/Year after 10-year Payback
- Could Save 6 Thousand Tons CO2/Year

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What is the compelling business case for Grid Neutral at our K-12 Schools?

Annually

- $5 Billion Spent on New/Renovation Construction
- 15 Million Square Feet Affected
- $21.5 Million/Year after 10-year Payback
- Save 30 Thousand Tons CO_2/Year

“Grid Neutral” defined:

“A site that produces at least as much <u>electrical</u> energy as it uses in a year”

“Grid Neutral” defined mathematically:

HISTORICAL BENCHMARKED ELECTRICITY USE

– ELECTRICITY ENERGY EFFICIENCY GAINS =

IMPORTED ELECTRICITY FROM THE GRID

– EXPORTED ELECTRICITY THRU ON-SITE GENERATION

Grid Neutral compared with **Zero Net Energy (ZNE) Schools**

per Collaborative for High Performance Schools (CHPS) 2009 criteria

Grid Neutral

- **"A site that produces at least as much electricity as it uses in a year"**
- **May use electricity from the grid**
- **Energy used from the grid is balanced at the end of the year with on-site energy production**
- **Not allowed to use outside sources such as propane or natural gas for uses such as cooking, water heating, space heating or backup generators.**
- **Strategies should be available for the life of the building**

Zero Net Energy (ZNE)

- **"A site that produces at least as much energy (electricity, natural gas, propane, etc) as it uses in a year"**
- **ZNE schools may not use sources of energy produced off-site such as propane and natural gas**
- **Need to use a combination of strategies to both conserve energy use and find alternative sources for supply**
- **Strategies should be available for the life of the building**

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Six Components to achieve a grid neutral school:

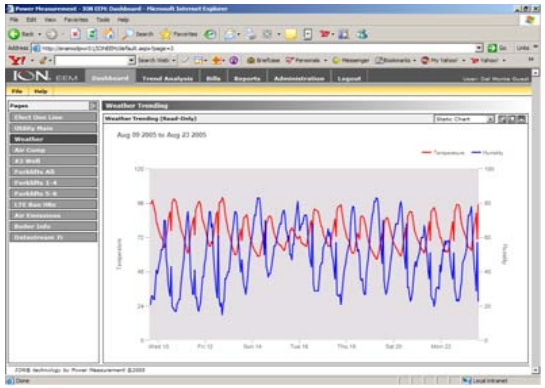
Comprehensive Planning

Energy Efficient Design

Energy Generating Technology

Innovative Funding

Energy Use Management



Operations & Maintenance

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Comprehensive Planning

September 8th 2008

Presenter: Steve Newsom, AIA, LEED AP

LPA Inc.

Comprehensive Planning

Who are the members of the "Dream Team" to plan a grid neutral school construction project?

How can this team be incorporated into a successful Grid Neutral project, given the different delivery methods currently available?

What is the critical path in the planning process?

Members of the Dream Team

- Custodians
- Site Staff
- Engineer – energy specialist
- Potential Suppliers
- School IT Department
- Local Fire Marshal
- Commissioning Agent
- Waste Management/Recycling expert
- Labor union, work force development team
- Inspector
- Joint use partner
- Law Enforcement
- Educational Organization

- Legislative representatives
- School Board Member
- Community Stakeholders & Media
- Project Champion
- Utility Company
- Research / Universities
- Government Agencies
- Federal (FAA, DOE, Others)
- State (Cal Trans, DSA, OPSC, CDE, CEC, CPUC)
- Local Agencies
- End Users
- School Finance Administrators
- Curriculum Specialist
- Site Section Team
  - Environmental consultant
  - Soils / Geo-tech Engineer

- Design Consultants
- Architectural & Engineering Team
- Energy Specialist
- Maintenance & Operation
- Green Building consultant
- Energy Service Company (ESCO)
- School Facility Planners/Construction
- Construction finance/legal counsel
- Construction Team
- Builder
- Major subcontractors
- Potential Suppliers
- Energy manufacturers
- Commissioning Agent

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Dream Team

Over and above the normal Design Team participants need to include 3 groups:

Sponsors
Beneficiaries
Implementers

Sponsors
Beneficiaries
Implementers

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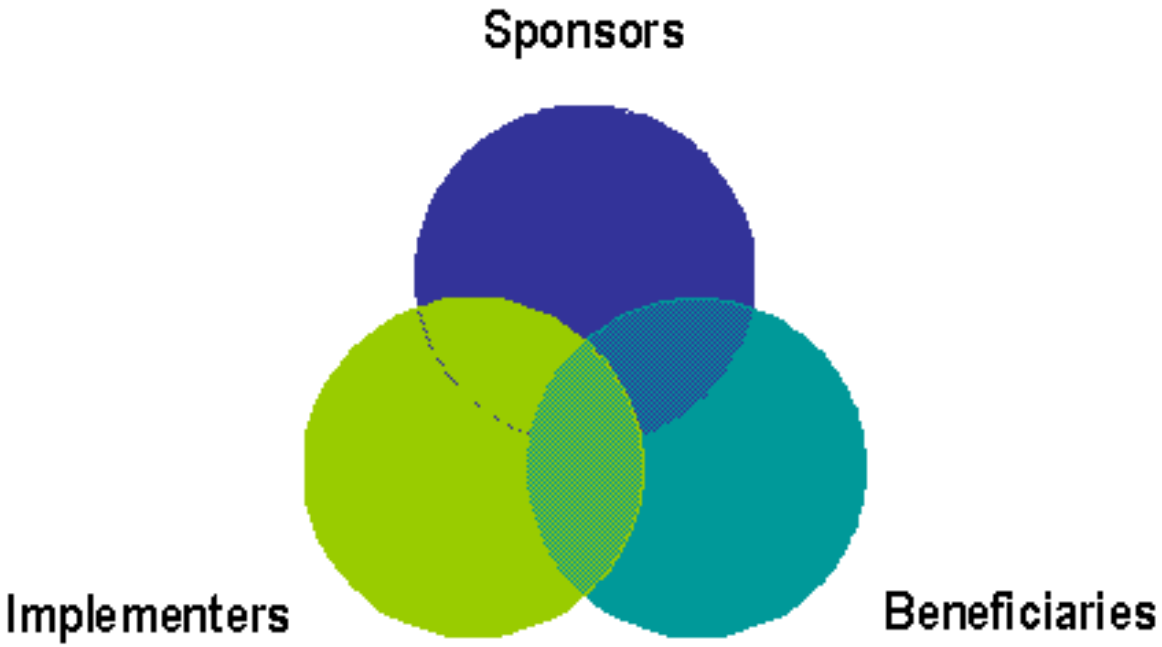
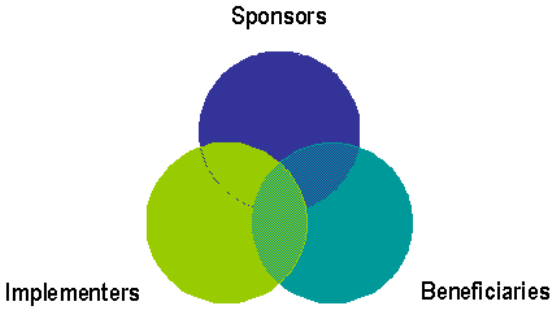
Dream Team



Comprehensive Planning

Sponsors:



- SCHOOL BOARD MEMBERS
- COMMUNITY STAKEHOLDERS & MEDIA
- PROJECT CHAMPION
- UTILITY COMPANY
- RESEARCH / UNIVERSITIES
- GOVERNMENT AGENCIES
- FEDERAL (FAA, DOE, OTHERS)
- STATE (CAL TRANS, DSA, OPSC, CDE, CEC, CPUC)
- LOCAL AGENCIES

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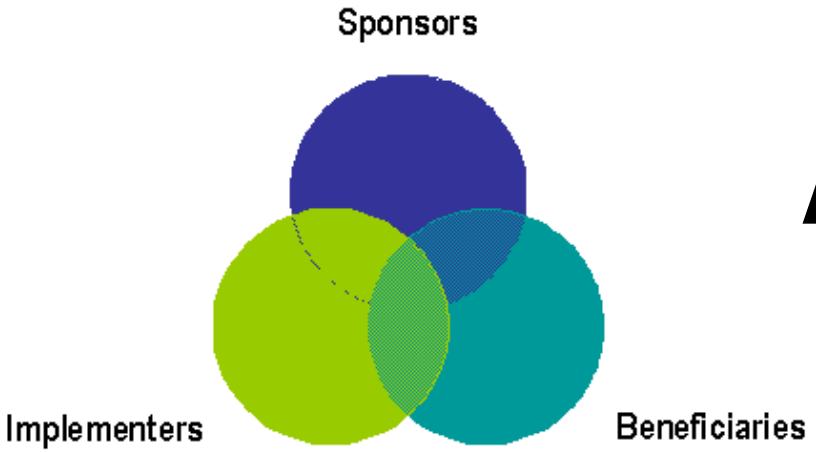
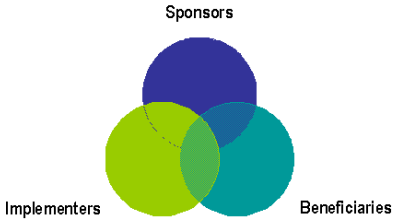
Comprehensive Planning



Beneficiaries:

- **END USERS**
- **SCHOOL FINANCE ADMINISTRATORS**
- **CURRICULUM SPECIALIST**

Comprehensive Planning



Implementers:

- SITE SELECTION
- DESIGN CONSULTANTS
- ARCHITECTURAL / ENGINEERING TEAM
- ENERGY SPECIALIST
- MAINTENANCE & OPERATION TEAM
- GREEN BUILDING CONSULTANT
- ENERGY SERVICE COMPANY (ESCO)
- SCHOOL FACILITY PLANNERS / CONSTRUCTION
- CONSTRUCTION FINANCE / LEGAL
- CONSTRUCTION TEAM
- BUILDER
- MAJOR SUBCONTRACTORS
- POTENTIAL ENERGY SUPPLIERS / MFR.
- COMMISSIONING AGENT

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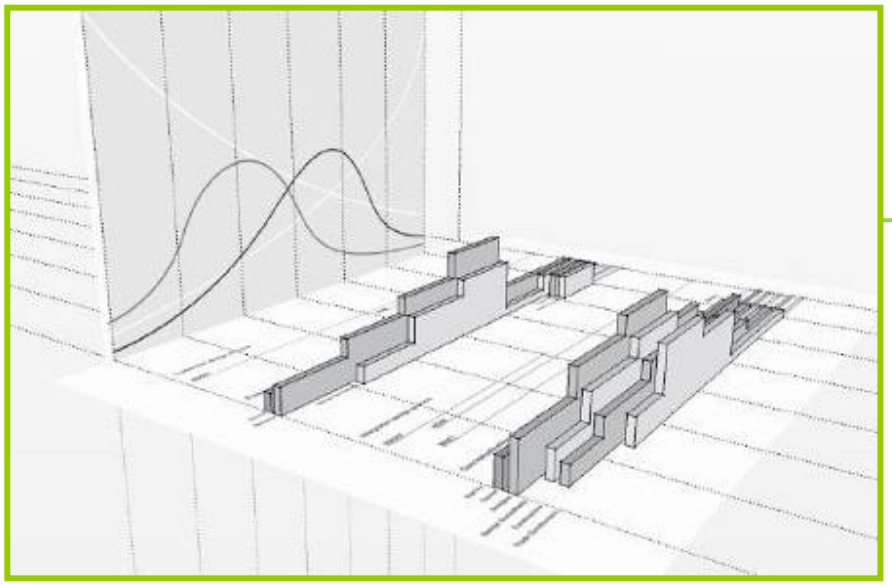
Comprehensive Planning

How can this team be incorporated into the different delivery methods?

Integrated Project Delivery (IPD)



Current Delivery Methods:

Design-Bid-Build

Design / Build

CM, CM At-Risk, or CM Multi-Prime

Agency CM

Lease-Lease-Back

VS.

IPD Fundamental Principles

1. **Mutual respect and trust**
2. **Mutual benefit and reward**
3. **Collaborative innovation and decision making**
4. **Early involvement and key decision makers**
5. **Early goal definition**
6. **Intensive planning**
7. **Open and enhanced communications**
8. **Appropriate technology**
9. **Virtual organization and leadership**

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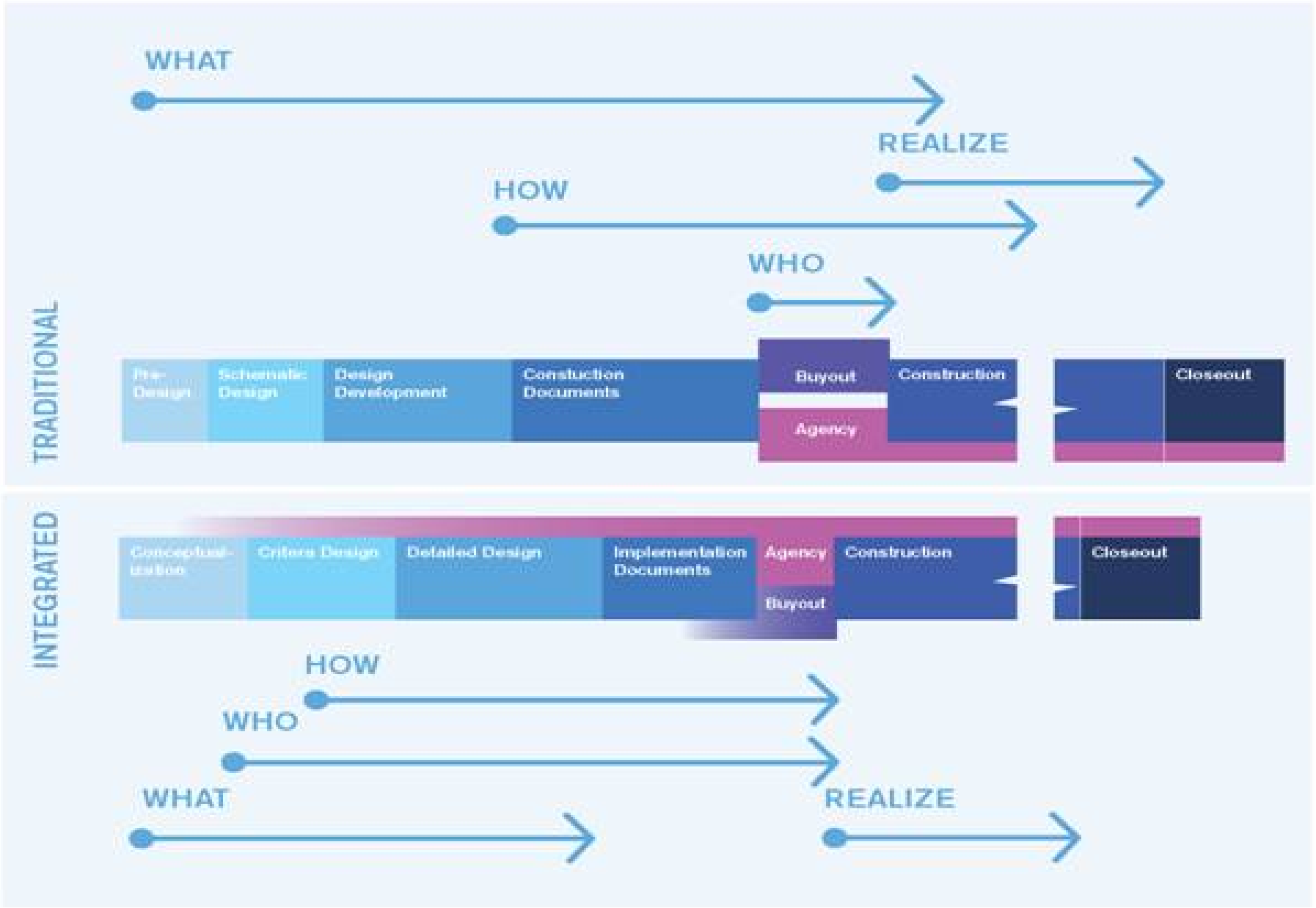
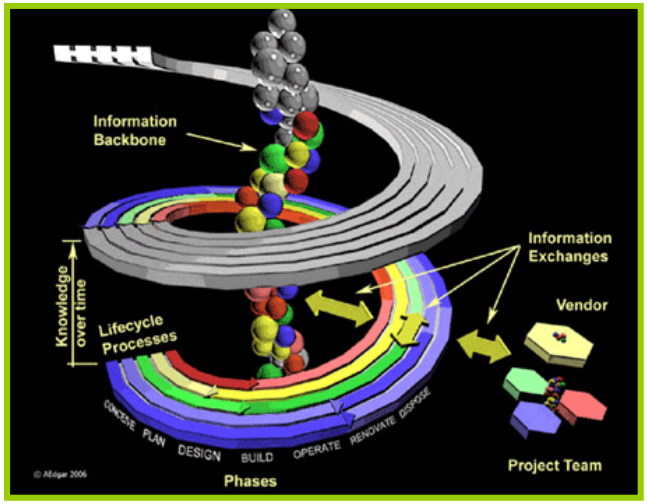
Integrated Project Delivery



Building Information Modeling (BIM)



BIM can combine, among many things:

- Design
- Fabrication information,
- Erection instructions, and
- Project management logistics in one database
- Collaboration throughout the project's design and construction.
- Owner can manage the facility well beyond completion of construction for such purposes as space planning, furnishing, monitoring long term energy performance, maintenance, and remodeling
- Coordination of Mechanical, Electrical, Structural and Plumbing in a three dimensional model

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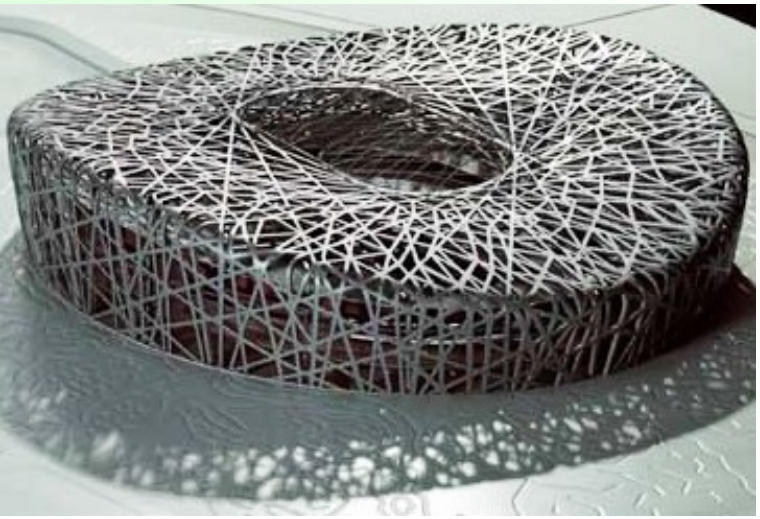
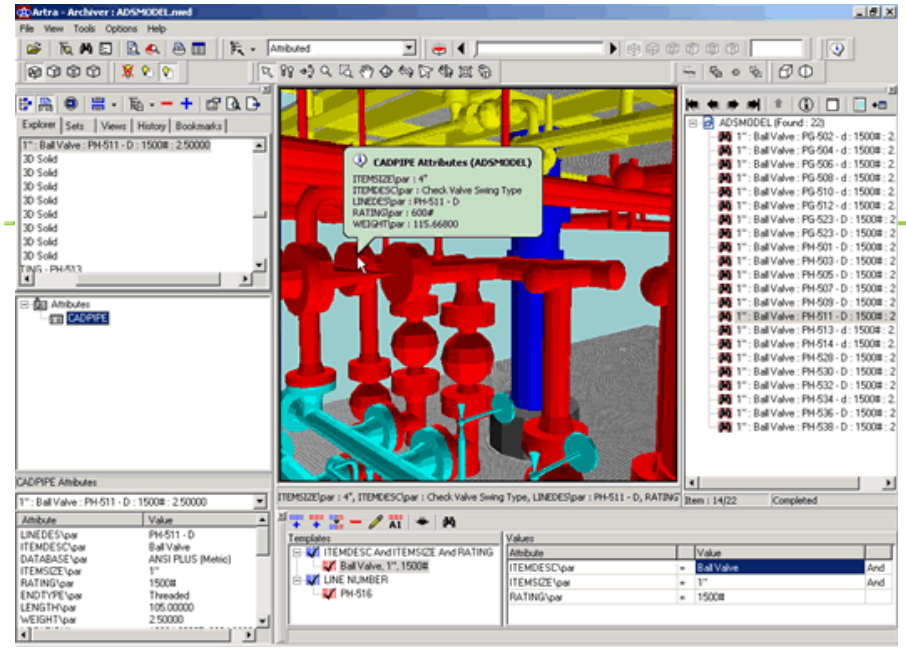
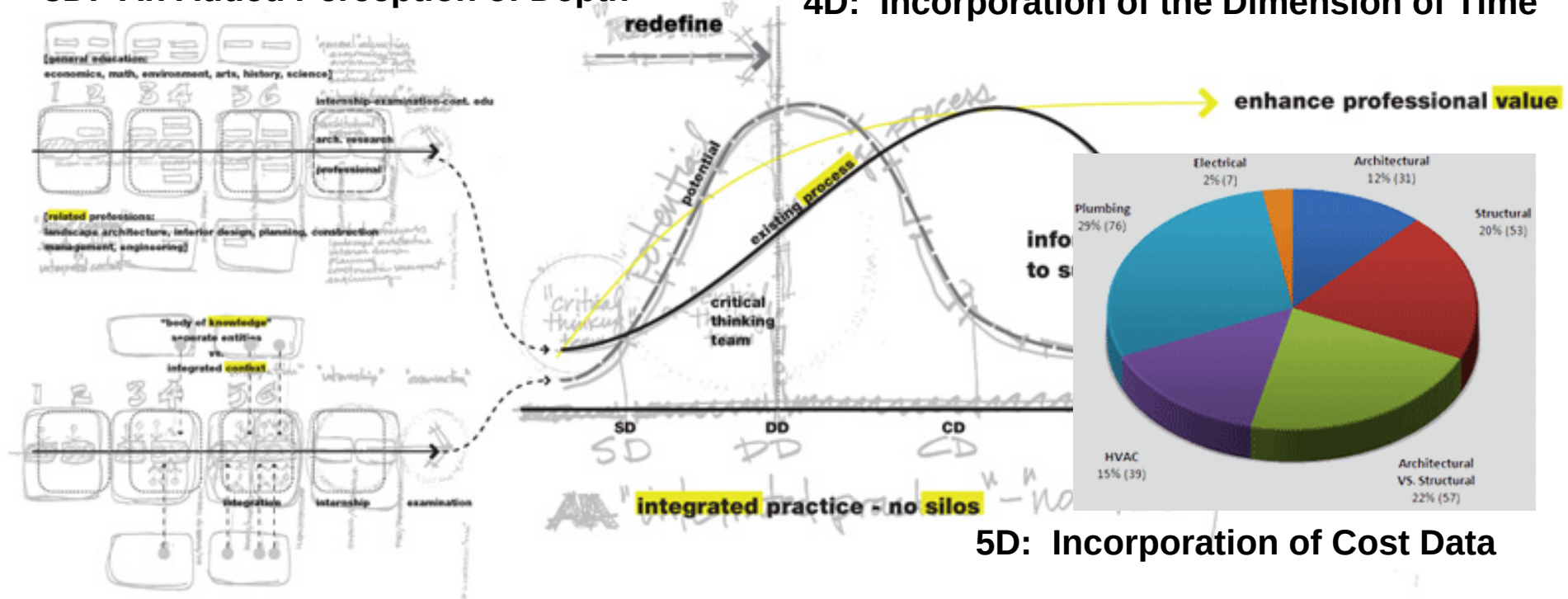
BIM



3D: An Added Perception of Depth

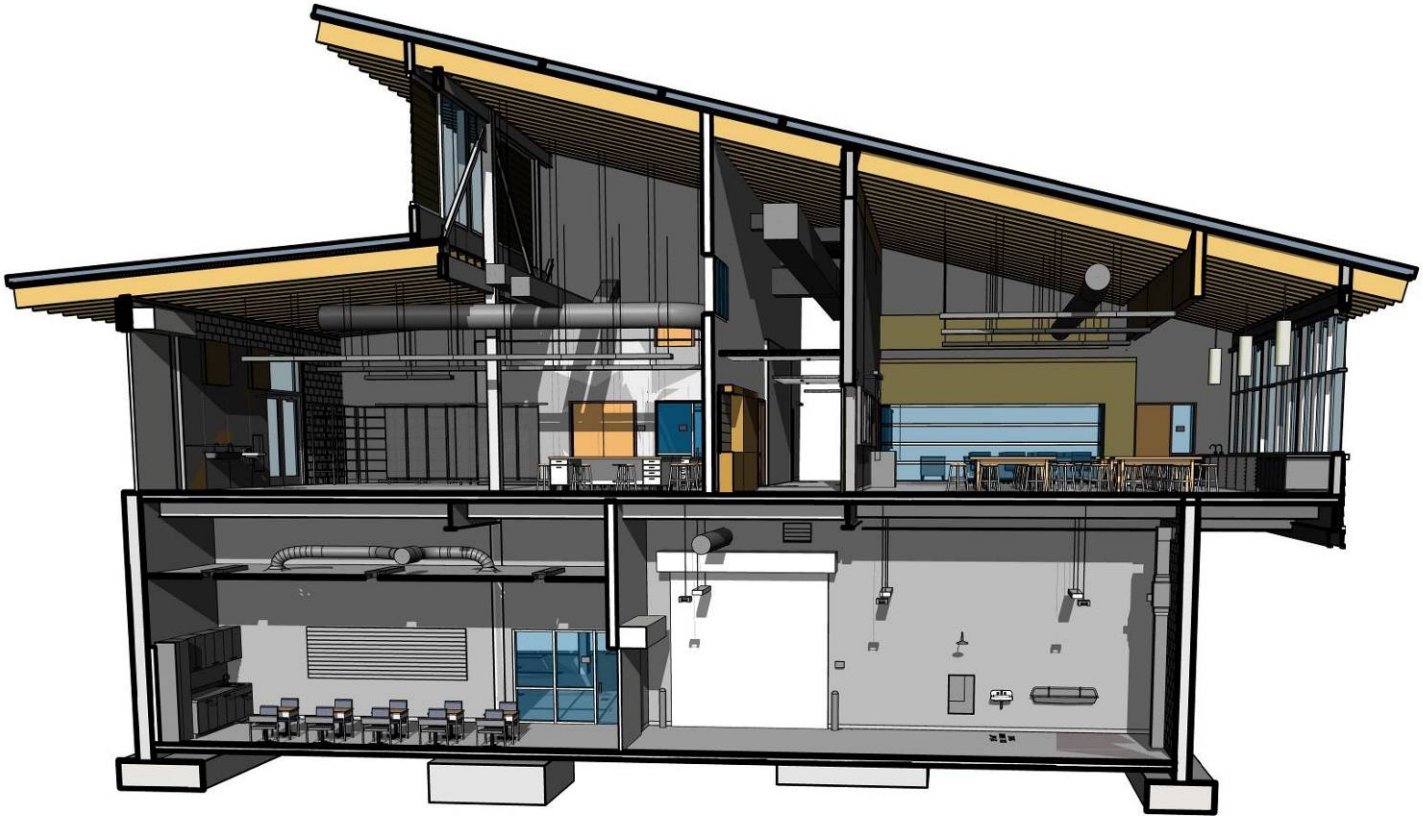


4D: Incorporation of the Dimension of Time



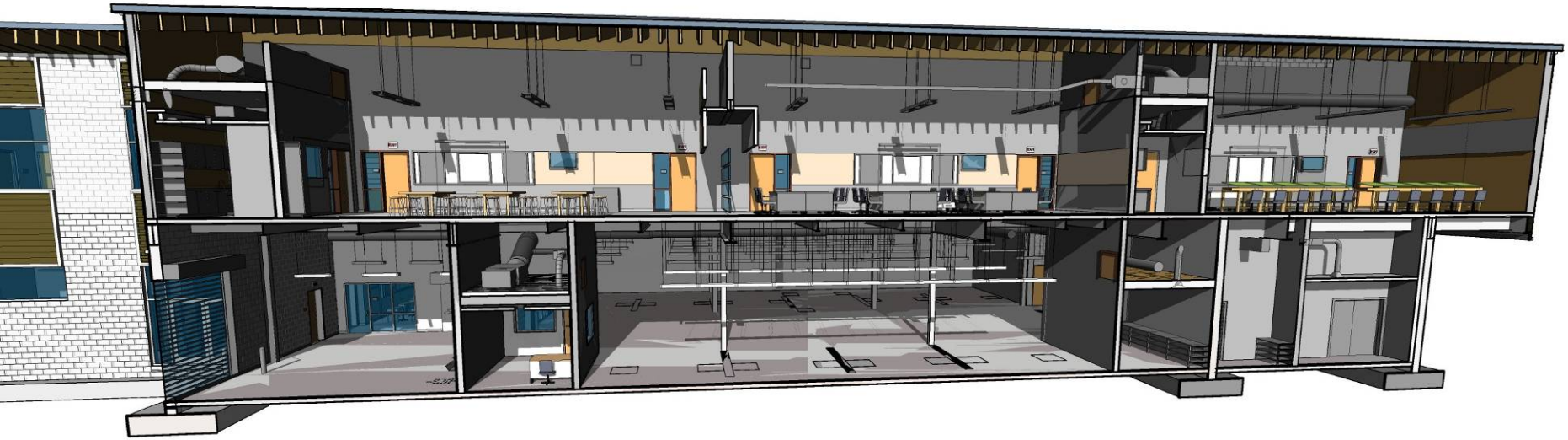
5D: Incorporation of Cost Data

Building Information Modeling (BIM)



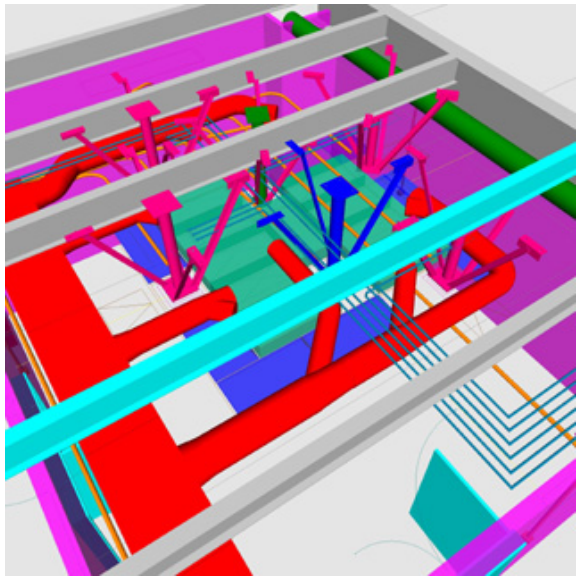
School Building Section

Building Information Modeling (BIM)

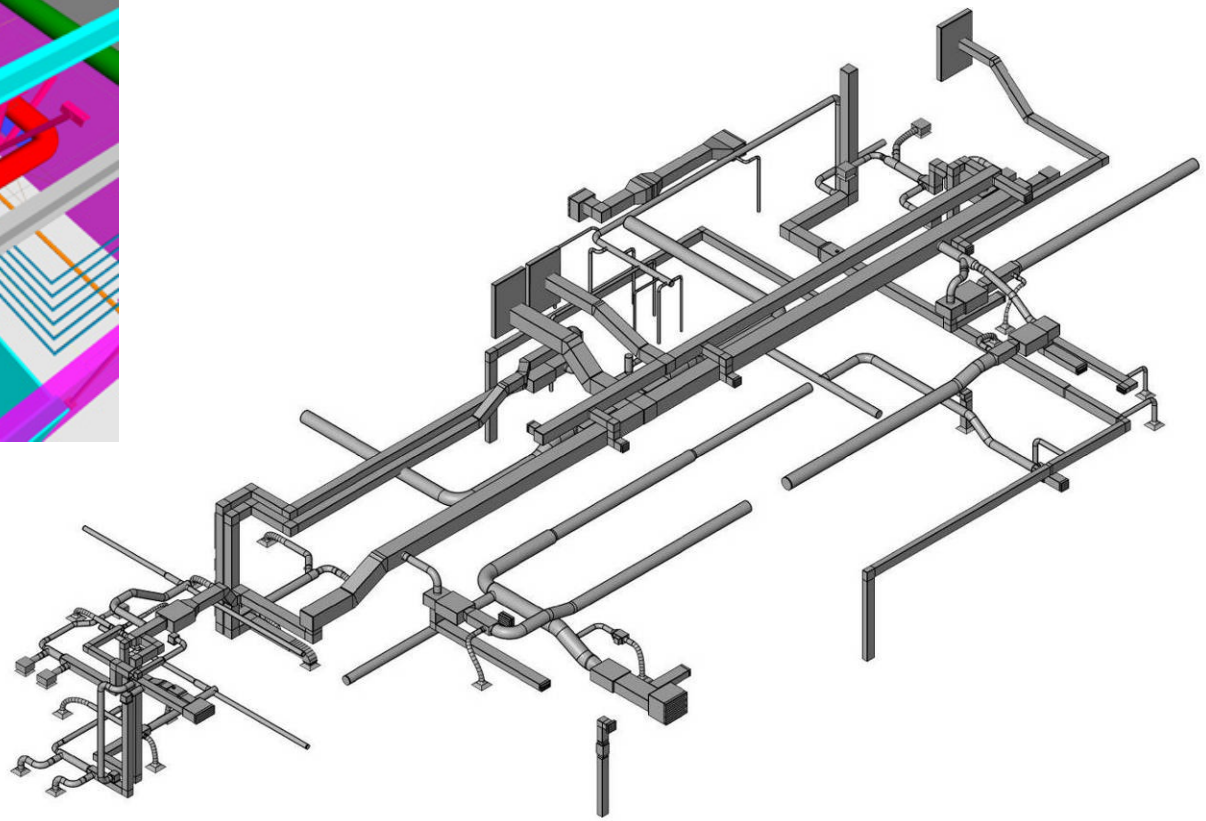


School Building Section

Building Information Modeling (BIM)



Mechanical Systems – 3 Dimensional



Comprehensive Planning

What is the critical path in the planning process?

Critical Path

1. **Establish baseline**
   Measure the current energy usage for the district by conducting a facilities assessment for existing schools.
2. **Set Performance Goals**
   Set energy performance goals for the district, based on existing standards.
3. **Develop Electrical Power Master Plan**
   An electrical power master plan helps determine the rest of the projects. First programming then planning.
4. **Develop District-Wide Program**

- Benefits
- Costs
- Preliminary plan to include:
  - Recommended Delivery Method
  - Financing
  - Strategy
  - Maintenance and Operations
  - Goal of Projects (100% Grid Neutral per project / per year)

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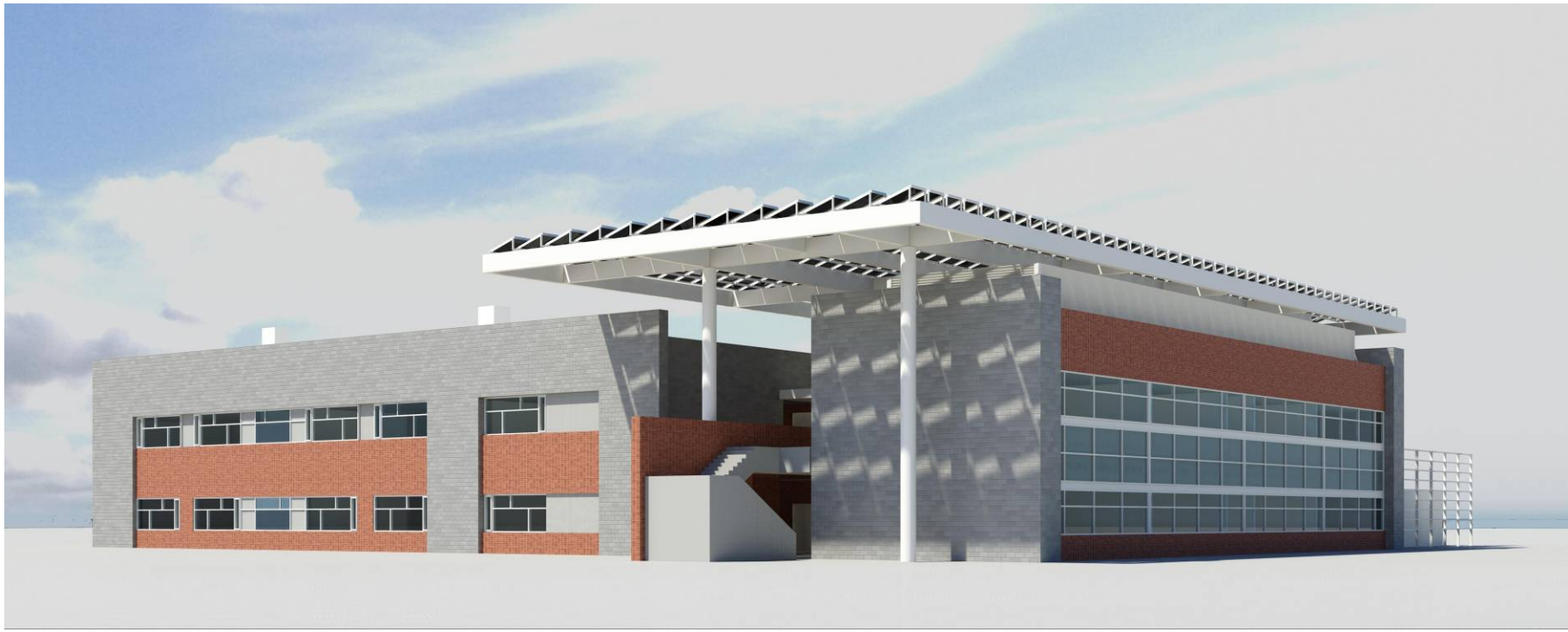
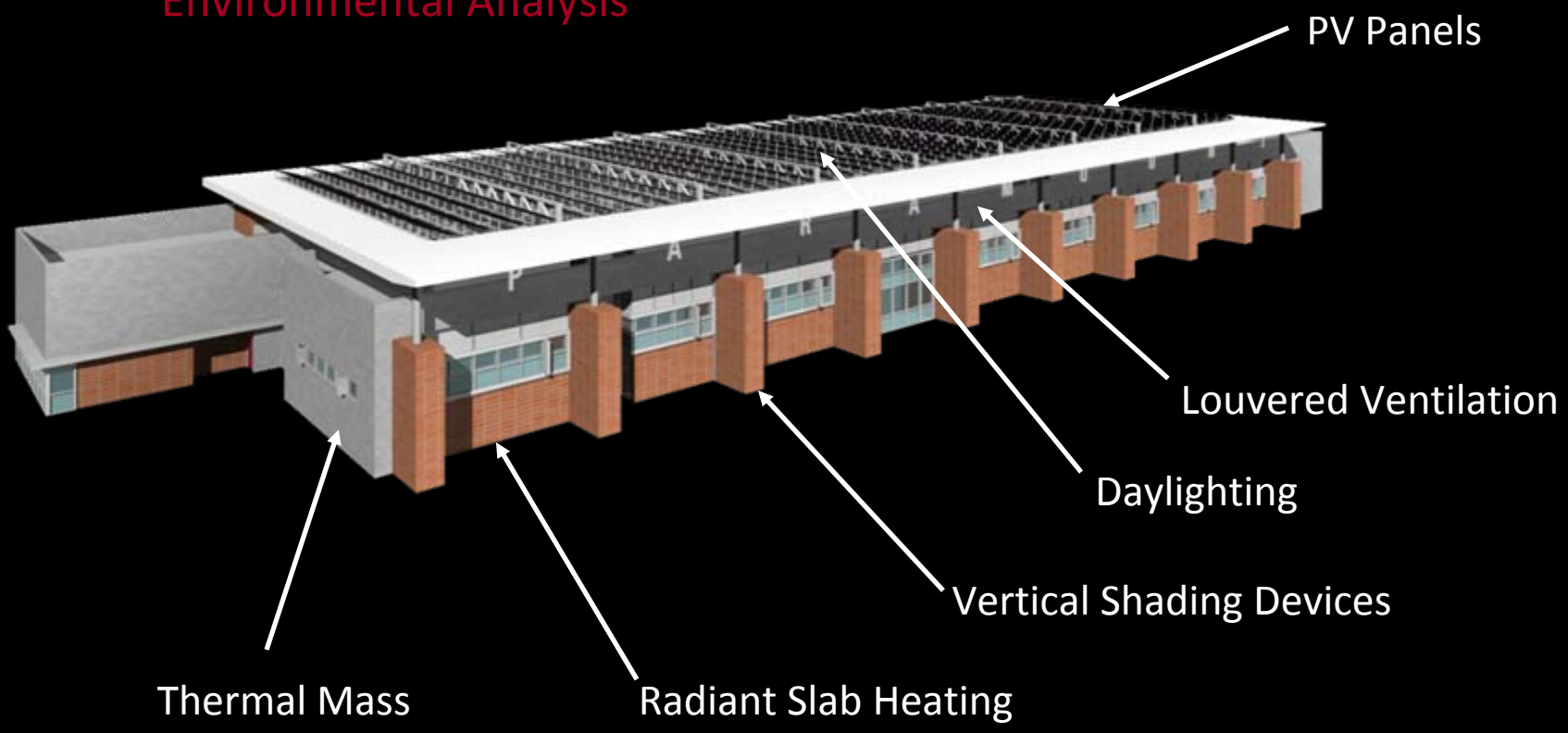
Case Study:

Paramount USD – Grid Neutral Design



Field house

Environmental Analysis



Area of PV Array (70% of Field House Building Roof) ……19, 586 s.f.
Annual PV Energy Output ……398,402 kWh/yr
Expected Campus Annual Building
Electrical Energy Demand (Without PV) ……1,861,999 kWh/yr
Capitol Cost of PV Array (After Incentives) ……$ 1,179,700

Case Study:

Paramount USD – Grid Neutral Design

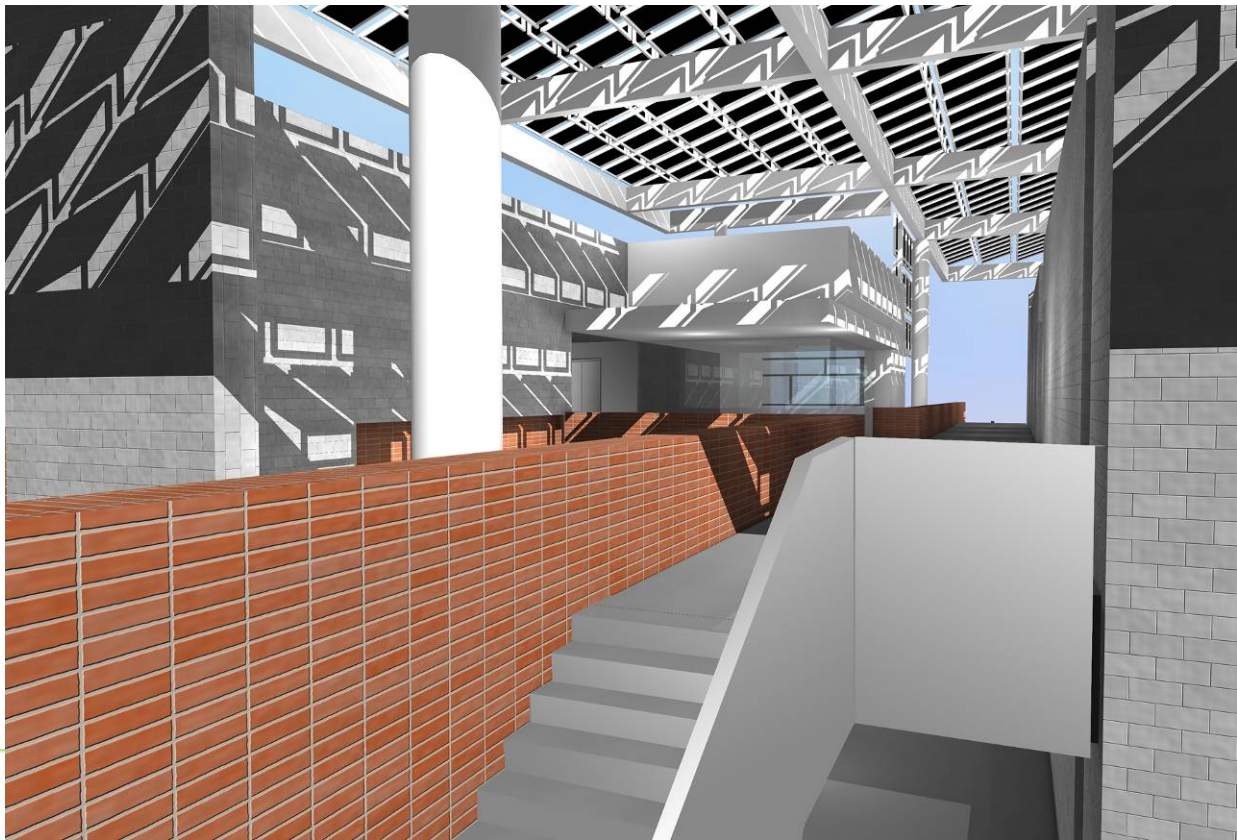
Percentage of Campus Wide Annual Cost Savings ……..21%

Annual Electricity Cost Reduction ……$63,700/yr

Payback ……18.5 yr

30 yr Lifecycle Savings (With PV)……$2,092,850

Annual Electricity Reduction to Field House Building ……215%



Workshop Participates

Steve Newsom
Andy McPherson
Larry Eisenberg
Dana Hamerik
Ying Wang
George Parker
Fred Yeager
Steve Paul
Theresa Townsend

Aaron Jobson
Ziggy Rubel
Ric Magnum
Kristen Heinen
Howard Ashcroft
Pete Guisasola
Chip Smith
David Thorman

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Question and Answers

Comprehensive Planning

Energy Efficiency Design

September 19th 2008

Presenter: Liz Shirakh,

California Energy Commission

Energy Efficiency Division

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Energy Efficient Design

- ***What Energy Efficient Measures Have the Highest Return On Investment For New Schools?***

- ***What are Alternatives to Typical HVAC Systems?***

- ***What Renovations Are Necessary to Off Set Need for On-Site Electrical Generation?***

Why Design Energy Efficiency First for Grid Neutral Schools?

- ***Energy Efficiency Measures have the largest return on investment***

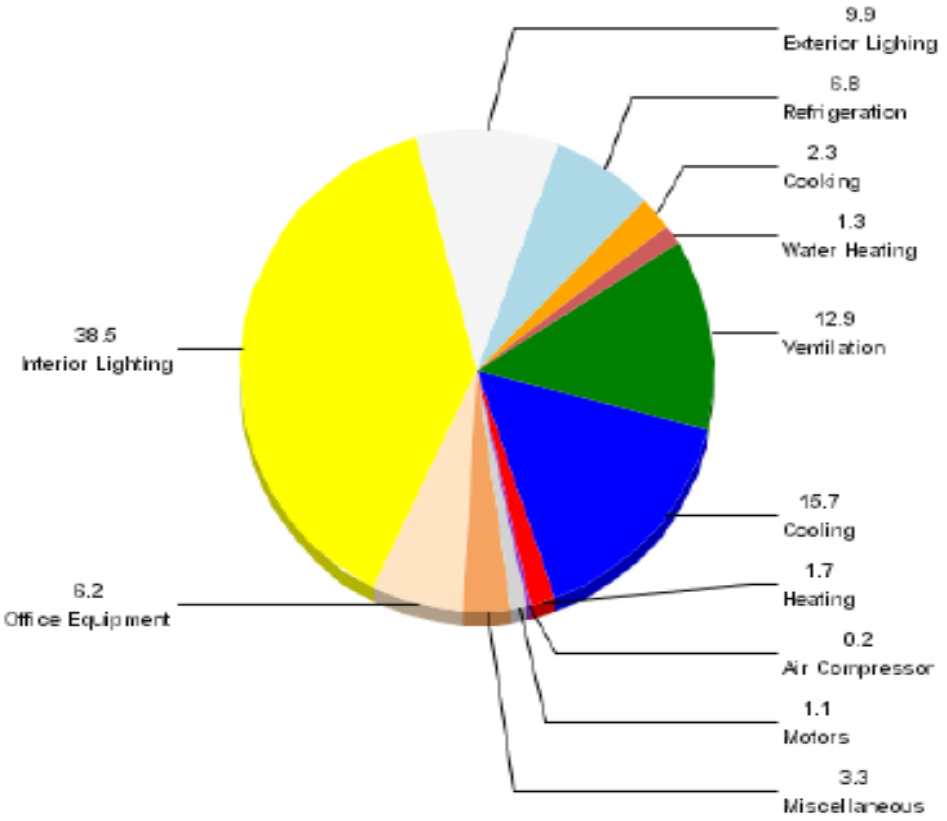
- ***Size renewable energy***
- ***systems to the optimal***
- ***energy efficient building***


Courtesy: Fossil Ridge HS - Colorado

"Energy Efficiency is our cheapest fuel."
~ Tim Simon, CPUC

Calif. School Electricity Usage

Lighting: 48%
HVAC: 32%
Kitchen Usage: 10%
Plug Loads: 10%



Source: California Commercial End-Use Survey (CEUS), April 2007

Start with High Performance School Construction

Two rating systems:

- *Collaborative for High Performance Schools (CHPS)*
  - ***www.chps.net***

- *Leadership in Energy & Environmental Design (LEED) for Schools*
  - ***www.usgbc.org***

CHPS

- *Flexible rating system that defines High Performance schools*
- *Incentives available through OPSC that mostly mirror the CHPS criteria.*

CRITERIA SCORECARD

Credits in bold font = CHPS-recommended credits

Site 14 points ✓

Site Selection	Prereq 1	Code Compliance	R	P1.1. Comply with all requirements of Title 5.	
	Credit 1	Sustainable Site Selection	1	1.1. No development on sites that are: prime agricultural land, in flood zone, habitat for endangered species, parkland.	
			1	1.2. Do not develop on greenfields.	
			1	1.3. Create centrally located sites with in which 50% of students are located within minimum distances of the school.	
			1	1.4. Joint use of facilities.	
			1	1.5. Joint use of parks.	
			1	1.6. Reduce building foot print.	
Transportation	Credit 2	Transportation	1	2.1. Near public transit.	
			1	2.2. Provide bike racks and bike lanes for 15% of school population.	
			1	2.3. Minimize parking lot and create preferred parking for carpools.	
Stormwater Management	Prereq 2	Construction Erosion	R	P2.1. Control erosion and sedimentation to reduce negative impacts on water and air quality.	
	Credit 3	Post-construction Management	1	3.1. Minimize runoff.	
			1	3.2. Treat runoff.	
Outdoor Surfaces	Credit 4	Design to Reduce Heat Islands	1	4.1. Shade or lighten impervious areas, or reduce impervious parking.	
			1	4.2. Install cool roof.	
Outdoor Lighting	Credit 5	Light Pollution Reduction	1	5.5. Minimize outdoor illumination with no direct beam leaving site.	

Energy Efficient Design

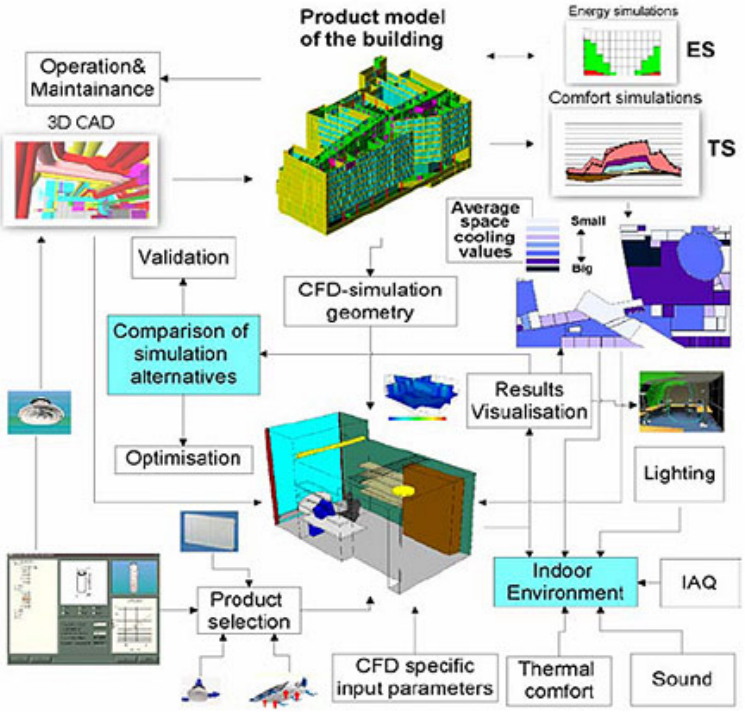
What energy efficient measures have the highest return on investment (ROI) for New Schools?

Highest ROI Energy Efficient Measures:

1. Programming
2. Site
3. Building
4. Systems
5. Furnishings, Fixtures, and Equipment

Programming

- Integrated Design
- Scheduling/time of day
- Commissioning
- Flex standards for use of the space



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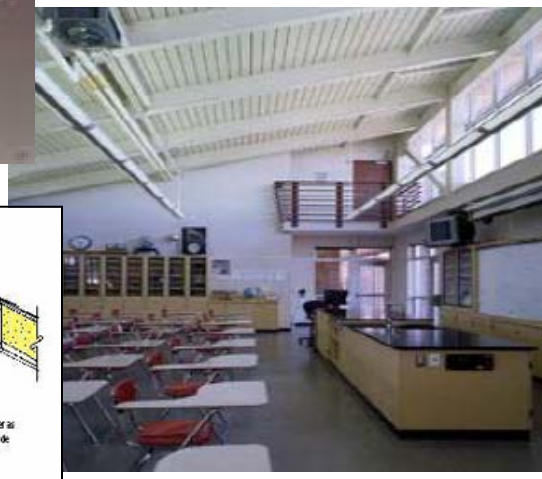
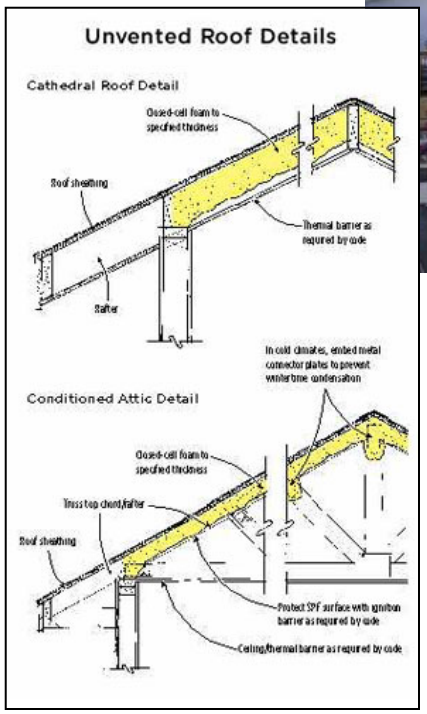
Site and Building

- Building Orientation
- Roof Assemblies
- Day Lighting
- Natural Ventilation
- Thermal Mass
- Integrated Design





Systems

- Electric Lighting
- HVAC
- Controls
- Commissioning

Furnishings, Fixtures, and Equipment

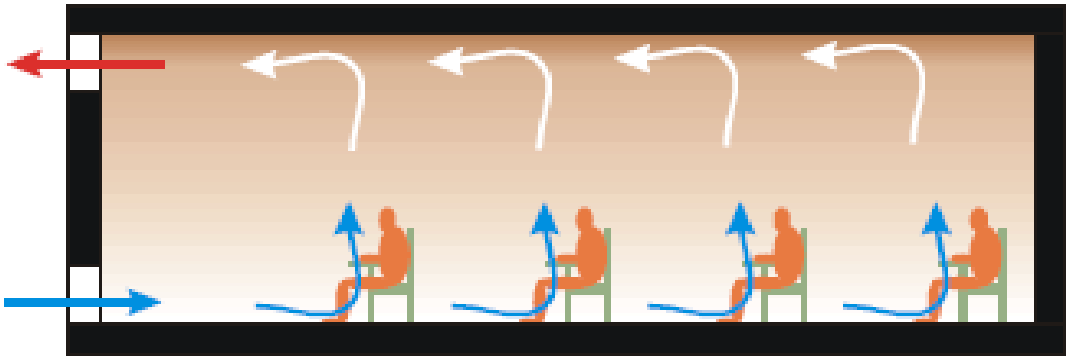
- Efficient Equipment
  - Classrooms, offices
  - Kitchens, Shops
- Plug load control – turn equipment off when not in use.
- PV load compatibility

Energy Efficient Design

What are Alternatives to Typical HVAC Systems?

Alternative HVAC Systems

- High Efficiency Air Distribution
- Natural Ventilation Systems
- Under size the HVAC System
- Displacement Ventilation System
- Dedicated Outside Air System
- Reduce Radiant Load

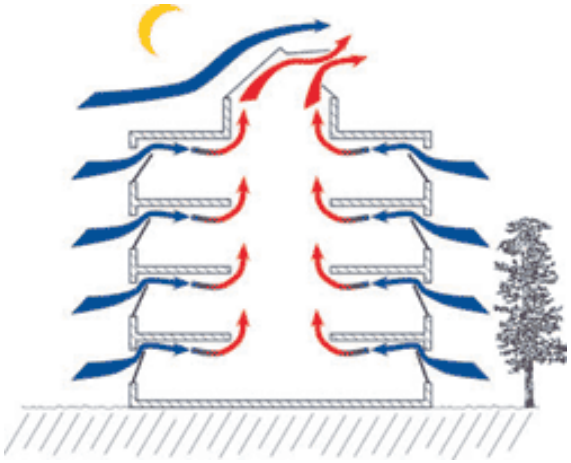


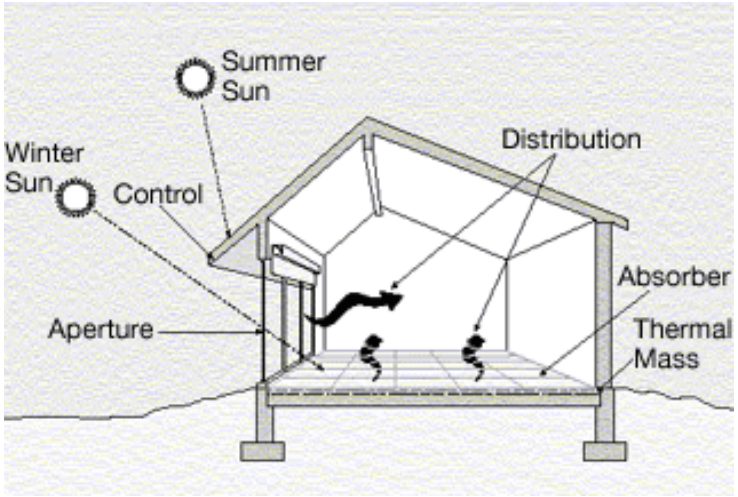
Alternative HVAC Systems *Continued*

- Evaporative Cooling
- Climate Specific Design for Systems & Equipment
- Demand-Control Systems
- Zone Control
  - *Admin office in summer*
  - *Multipurpose spaces*

Natural Ventilation Strategies

- Cross Ventilation
- Solar chimneys
- Stacked ventilation
- Ceiling fan
- Reduce Radiant Load





Energy Efficient Design

What Renovations Are Necessary to Off Set the Need for On-Site Electrical Generation?

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Renovations Energy Efficiency

- Daylighting
- Heat Avoidance
- Natural Ventilation
- High Efficiency HVAC
- Appliances, Plug Loads & Special Equipment

Reoccurring Themes

- Integrated Design
- Ultimate Sustainability Building Design
  - **Passive Systems = Primary Solution**
  - **Active System = Backup Solution**
- Load Reduction

What is the Existing School Stock?

Presenter: Lisa Gelfand, AIA, LEED AP

Gelfand Partners Architects

DSA Green Ad Hoc Committee

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What is the Existing School Stock?

- Multi-story Design (Pre 1940's)
- Finger Design (1959-1965)
- Wing Design (1960-1970)
- Open or Pod Classroom Design (1970's)
- Portables

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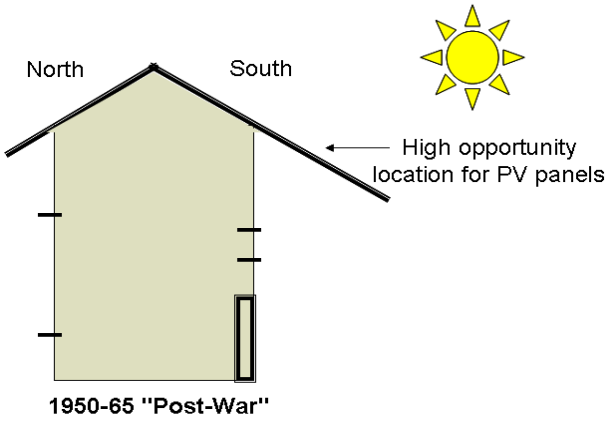
Pre War:

- Massive masonry/concrete structures
- Multi-Story
- 20%

1950-65's Finger Design



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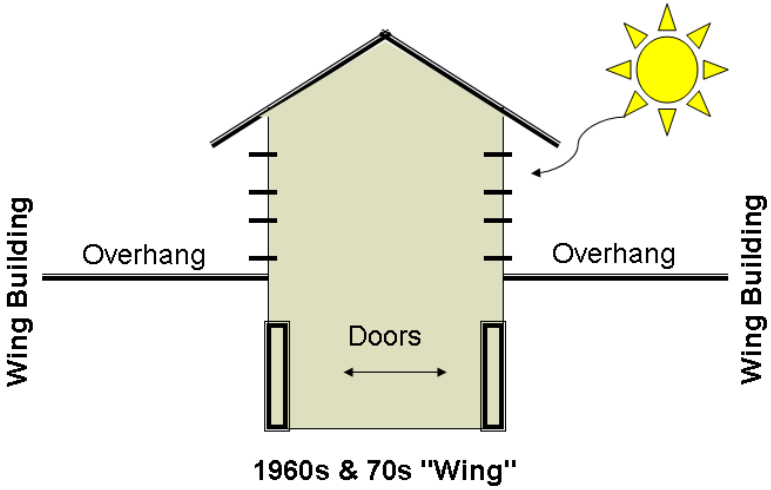
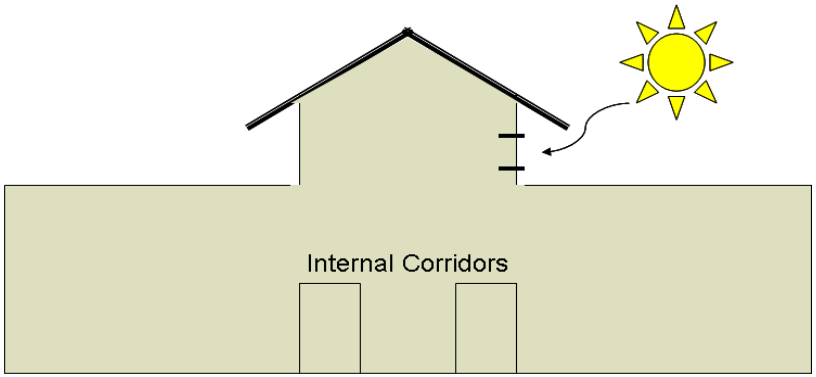
1960-70's Wing Design



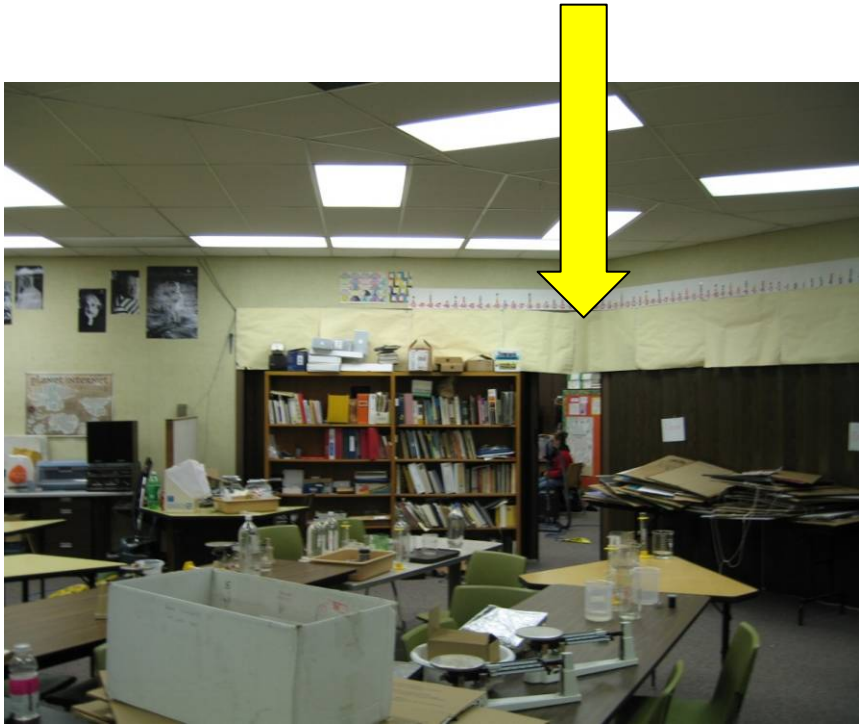
1970's Pod Design:

Open Classrooms

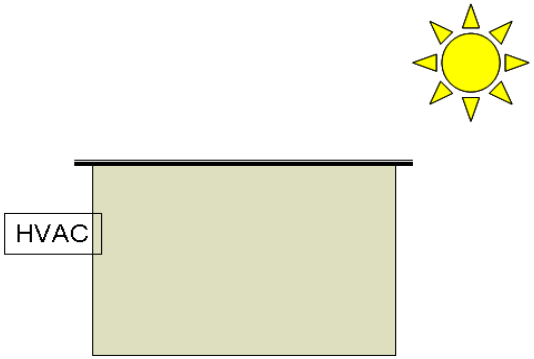


1970s Solid "Pod"

Now often modified with temporary walls to provide individual classrooms



Portables



Energy Efficiency Opportunities Based on School Design

- Although certain school designs may require specific energy efficient retrofits, there are common opportunities that apply to all school construction types.

Passive Systems – Primary Solution

- Daylighting improvements
- Natural ventilation
- High reflective surfaces (interior and exterior)
- Landscapes – Designed for heat avoidance
- High performance glazing
- Shades and blinds integrated into windows
- Automated window ventilation
- Consider climate zone opportunities

Active System – Backup Solution

- Daylight harvesting
- Lighting controls
- Re-configure electrical lighting
- Insulation
- Ceiling fan
- Natural exhaust ventilation

Workshop Participates

Lisa Gelfand
Liz Shirakh
Charles Eley
Craig Hoelllwarth
Richard Flood
Lisa Heschong
Virginia Lew
Dan Burgoyne

Rob Samish
Lowell Shields
Jim Ogden
Mark Fischer
Alok Singh
Stephen Oliver
Loralyn Perry
Paul Vetter

Question and Answers

Energy Efficient Design

DIVISION OF THE
STATE ARCHITECT
DEPARTMENT OF GENERAL SERVICES

15 minute break time

Energy Generating Technology

September 10th 2008

Presenter: Patrick McCoy,

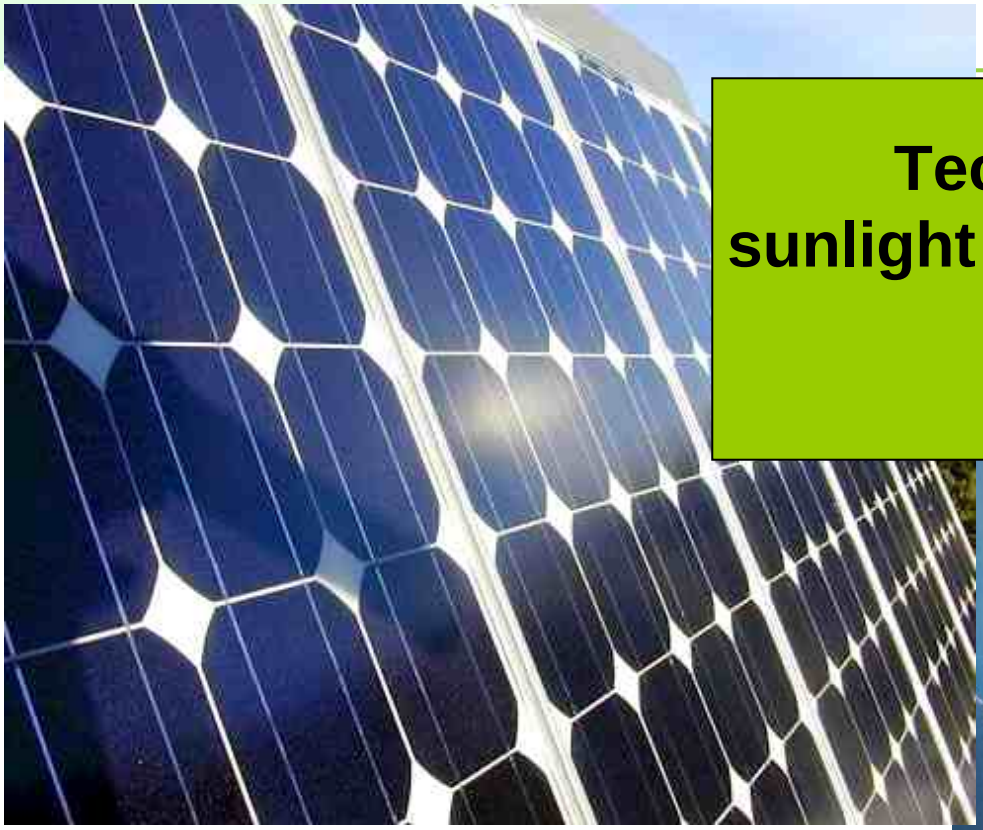
Energy Specialist

DGS Green Team

Energy Generating Technology

- ***What are the benefits, opportunities and obstacles of different on-site generation?***
  - ***Photovoltaics (PV) systems***
  - ***Building Integrated Photovoltaics (BIPV)***
  - ***Solar Thermal***
  - ***Small wind applications***

Photovoltaic (PV) Panels



Technology that converts sunlight directly into electricity through solar cells

An Inverter is used to transform the direct current (DC) from the solar system to alternating current (AC) for use in the building.

Roof Mounted Photovoltaics (PV)

Irvine Valley College

Photo courtesy of Chevron Energy Solutions

Permissions by Green Technology Magazine

- **Roof penetrating**
- **Non-penetrating**
- **Flat**
- **Flush**
- **Raised Rack**
- **Rolled Roofing**
- **Peel and Stick**

Photo courtesy of De Anza Community College

De Anza Community College

Roof Mounted Photovoltaics (PV)

BENEFITS

- Increase life span of the roof covering
- Reduce cooling loads
- Maximize efficiency of existing square footage of space
- **Less vandalism**
- **Closer to grid point of connection**
- **Less distribution loss**

OBSTACLES

- **Existing Roofs**
  - **Design Loads Increase**
  - **Roof Penetrations**

Permissions by Green Technology Magazine
Photo courtesy of LACCD

Los Angeles Valley College

Ground Mounted Photovoltaics (PV)

Napa Valley College

Photos courtesy of SPG Solar

Permissions by Green Technology Magazine

Butte Community College

Ground Mounted Photovoltaics (PV)

- Fixed Array
- Dual-tilt
- Single axis Tracker
- Dual Axis Tracker

- **Most Feasible for districts in rural areas**
- **Need to file for California Environmental Quality Act (CEQA)**

PV Shade Structures

- Lunch Areas
- Walkways
- Supervision Areas
- Instructional Areas
- Pick up/Drop off Areas
- Parking
- Bus Shelters

Santa Rosa Junior College

Photo courtesy of SPG Solar. Permissions by Green Technology Magazine

Photo courtesy of MWW Group for LACCD. Permissions by Green Technology Magazine

Los Angeles Mission College

Current Case Study:
Solar PV Shade Structures

Solar PV Opportunity Summary – sizing to be finalized

Solar Installations at Milpitas Unified School District

65-80 % Energy Offset

	Proposed Capacity (kW)	% Energy Offset
Burnett	[illegible]	80%
Calaveras High	42[illegible]	71%
Corporation Yard	181	61%
Curtner	139	[illegible]7%
Milpitas High	1002	[illegible]0%
Pomeroy	210	
Rancho	[illegible]	80%
Randall	113	65%
Rose	[illegible]	51%
Russell	221	89%
Sinnott	195	77%
Spangler	134	76%
Weller	149	89%
Zanker	134	66%
Total	3403	73%

Rancho Milpitas Junior High School

CSI Max: 228kW

Canopy 1: 105 kW
Canopy 2: 77 kW
Canopy 3: 34 kW

Total Size: 216 KW

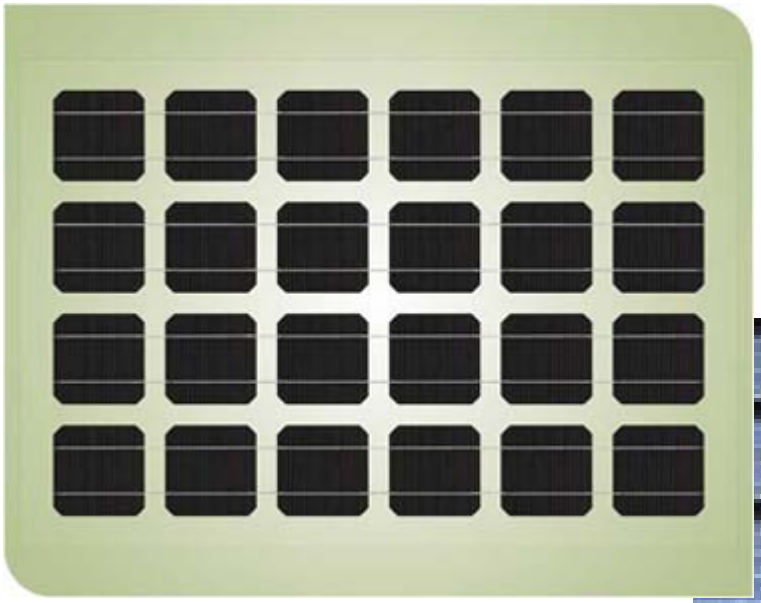
Inverter 1-2: 250 KW total

Site Considerations:

- May become a high school
- Cell phone tower shading
- Shading analysis performed for south parking lot
- Canopy 2: 3 rows, 65' each

Legend:
E-Main Electrical
I-Inverter

Building Integrated Photovoltaics (BIPV)



PV's laminated into glass panels

PV's integrated into shingle roof

- **BENEFITS**
- **Refined Design**
- **Easier to maintain**
- **Savings in materials cost due to dual use of surfaces (windows, roof)**
- **Visible use of solar**

OBSTACLES

- **Panels in fixed orientation**
- **Less efficient solar collection**

Building Integrated Photovoltaics (BIPV)

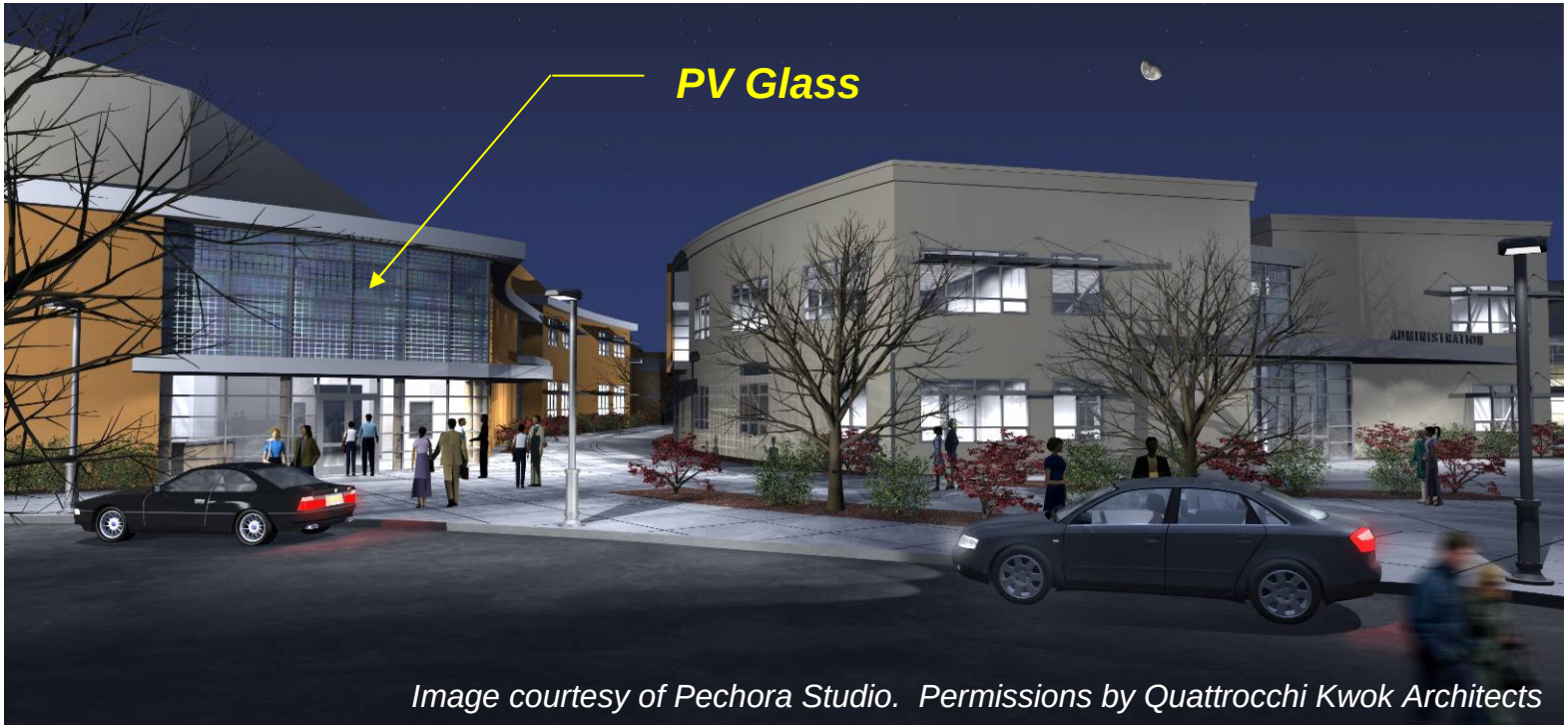


Image courtesy of Pechora Studio. Permissions by Quattrocchi Kwok Architects

"The PV glass installation creates a visible statement of the Sustainable Design Strategies …." Aaron Jobson, AIA

Stand Alone PV Shade Structures

Photo credit to Solar Score®

- Lighting
- Water fountains
- Solar Fans in restrooms
- Solar scoreboards
- Art Features
- Attic Fans

Photo credit to Garden-Fountains.com

Solar Thermal

- **Swimming Pools**
  Showers & Sinks
  Cafeteria Kitchen
  Space Heating
  Space Cooling

- ***Cut Utility Bills***
- ***Save 50-75% of water heating needs***

GRID Neutral Schools

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Energy Generating Technology

- ***Small wind systems***

up to 50 Kilowatts

www. energy.ca.gov

www.windpoweringamerica.gov/schools_model

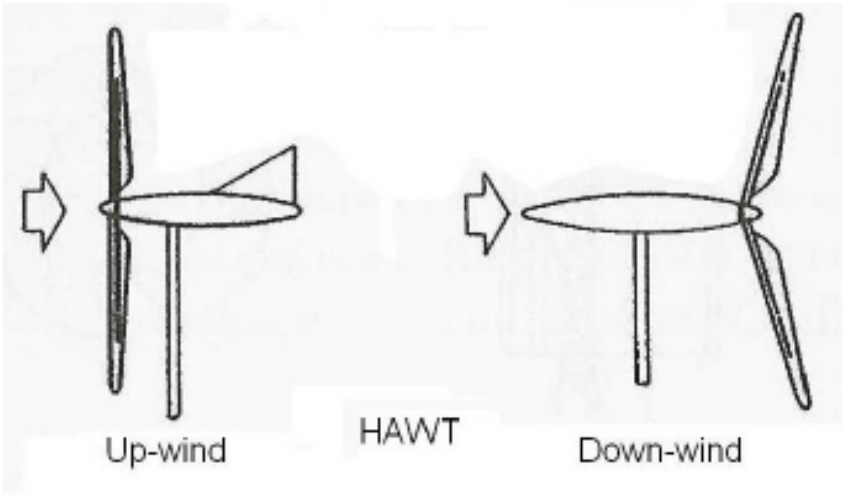
GRID Neutral Schools

U.S. DEPARTMENT OF ENERGY

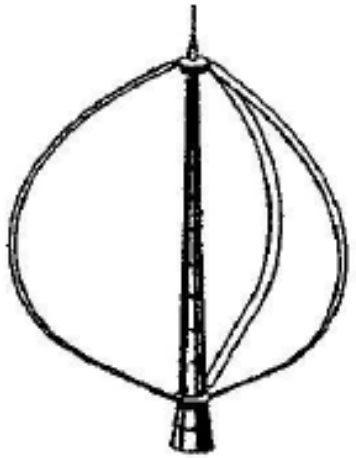
Energy Generating Technology

Horizontal axis wind turbine
- Up-wind
- Down-wind
- With tail
- No tail

- Vertical axis wind turbine
- Building integrated

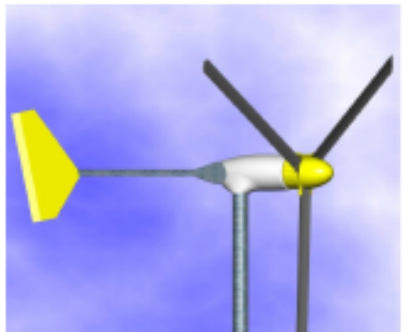


Eldridge, 1980



VAWT

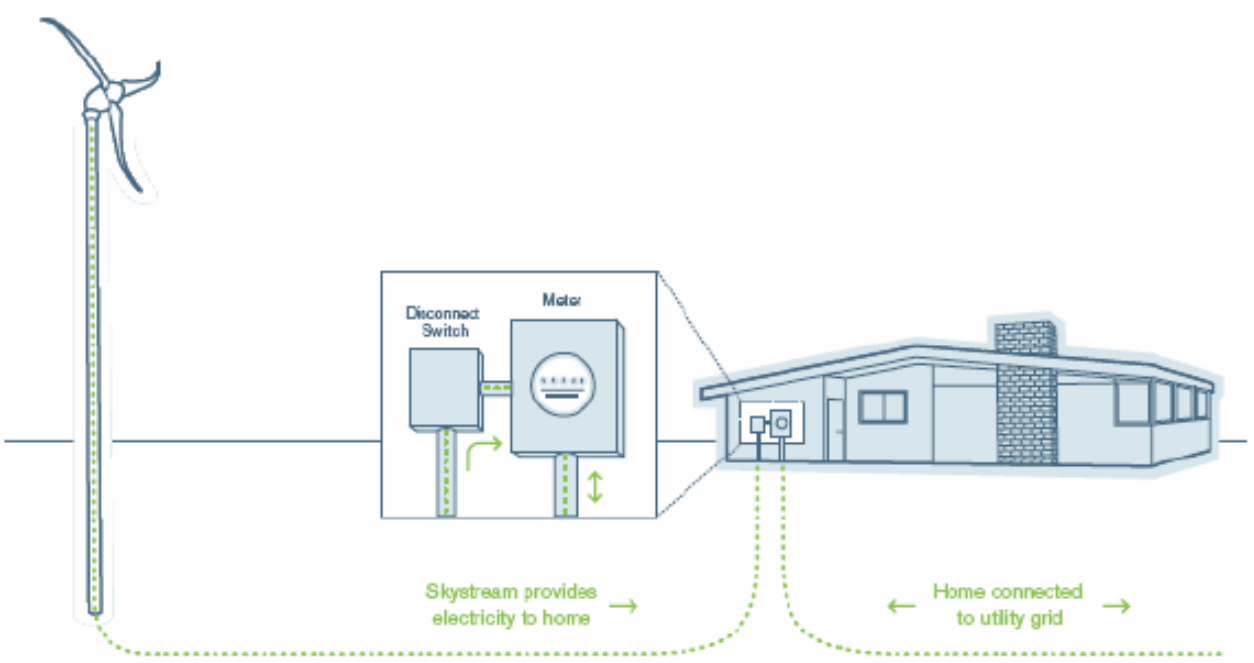
Eldridge, 1980



Energy Generating Technology

Connecting the Small Wind Turbine

- Electrical System
  - Controller
  - Batteries (varies)
  - Inverter (DC to AC)
  - Disconnect
  - Meter



Energy Generating Technology

Checklist for a Energy Generating Technology System

- *Cost / kWh (savings)*
- *Performance*
- *Tracking (15% greater generation)*
- *Non-tracking (no moving parts)*
- *Location*
- *Reliability*
- *Safety*
- *Longevity*
- *System provider's ability to provide "full service" agreement*
- *Low risk of voltage drop*
- *Minimum impact from temperature changes*
- *Does not degrade quality of grid*
- *UL 1741 listing*
- *Multifunctional (e.g. shade)*
- *Self cleaning Educational Component*
- *Theft and vandalism resistant*
- *Ability store excess energy (optional)*
- *Pre-check for vibrations for wind*

GRID Neutral Schools

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Integrating Energy Generating Technology into Education

- Teacher workshops
- Signage
- Learning Kiosks
- Hands-on and remote meter reading
- Viewing real time Data
- Outdoor experiments with alternate energy systems

GRID Neutral Schools

Solar Schoolhouse

Workshop Participates

Patrick McCoy
Alice Sung
Dora yen Nakafuji
Sue Kateley
John Cimino
Jim Barnett
Raghubir Gupta
David Thorman

Don Osborn
Rick Muller
Craig Stager
Joe Flatley
Tom Allen
Pete Liloyan
Dennis Bellet
Theresa Townsend

Question and Answers

Energy Generating Technology


GRID Neutral Schools
DIVISION OF THE
STATE ARCHITECT
DEPARTMENT OF GENERAL SERVICES

lunch break

Energy Measurement

September 22nd 2008

Presenter: Karen Herter, PhD

Heschong Mahone Group, Inc

State Benchmarking Committee Chair

Energy Measurement

The Energy Measurement presentation is not available for our webcast viewers at this time….presenter brought separate presentation.

Energy Measurement

- ***What are the energy use measurement, database, and reporting needs?***

- ***What are the systems or tools that we can use to meet these needs?***

Energy Measurement

- ***What are the systems or tools that we can use to meet these needs?***

Workshop Participates

Karen Herter
Jamie Waters
Nathan Anderson
Chad Hamilton
Mike Langley
David Thorman

Charles Maroon
Nathan Fleischer
Julio Rovi
Randy Britt
Paul Vetter
Theresa Townsend

Question and Answers

Energy Measurement

Maintenance & Operations

September 24th 2008

Presenter: William Savidge, AIA

Facilities Planning & Construction

West Contra Costa Unified School District

DGS

Maintenance & Operations (M&O)

- ***What types of operation and maintenance evaluations need to be made prior to a school's determination to work toward Grid Neutrality?***

- ***What stages in the decision making and development process is communication with M&O staff critical?***

- ***What types of educational and training to ensure creation of and on-going maintenance of Grid Neutral School?***

Maintenance & Operations

Facility Evaluation

Energy Evaluation

Policy & Standards Evaluations

M & O Staffing Evaluations

Facility Evaluation

- Evaluate building site for opportunities and constraints. Where can PV, wind and landscaping be located?
- Evaluate building use
  - Schedule
  - Hours of operation
  - Joint use
  - Areas requiring more electricity (e.g. gym)
- Preliminary Walk-Through Audit
  - Condition/lifespan of existing equipment.
    - Evaluate portables-lease/own, condition Sample Walk-Through Audit Form
- Inventory existing equipment for efficiency

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Energy Evaluation

- **How much electricity are you using? (kWh /sq. foot)**
- **Where is the electricity being used? (% HVAC, lighting, etc)**
  - **Detection of air and moisture leaks with infra-red analysis**
  - **Testing of light levels**
- **What is the potential for retrofitting existing equipment?** (Done as part of an investment-grade energy audit)

Case Study: Chico USD Energy Use Evaluation

Case Study:
Lighting Retrofit at Chico Unified School District
PG&E and staff developed an in-house lighting retrofit project.
1st phase:
De-lamped (removed some existing fluorescent lights) using CHPS recommendations for lighting levels.
Installed Super T8 28-Watt high-efficiency lamps & high efficiency ballasts, where applicable.
2nd phase:
Replace all outside lighting with CFL.

$150,000 / year in savings

After PG&E rebate, anticipate payback between 1-2 months

Reduce emissions by 900,000 lbs of CO_2 per year

Energy Use Evaluations: Building Commissioning

- ***Building Commissioning*** is the process of ensuring, in new construction, that all the subsystems for HVAC, Plumbing, Electrical, Fire/Life safety, and Building Security are operating as intended by the building owner and as designed by the building architects and engineers.
  - ***Retro-commissioning (RCx)*** for older schools
  - ***Commissioning (Cx)*** for new construction follow-up.
    - Potential savings from changing energy loads – commissioning enables you to fine tune for partial loads resulting in higher efficiency systems.
    - Complex control systems require training / cross training.
- Evaluate existing energy management systems.

Policies & Standards

- Evaluate existing M&O policy and procedures and whether they are being followed.
- What are the standards and performance goals for the District?
- Acknowledge the role of teachers in M&O their impact of energy consumption in each classroom
- Facilities Evaluation/Assessment
  - Team M&O and Architect
  - Assessment of existing facilities toward standards
  - Assess utility meters and rate structures
  - Evaluate existing buildings that may already be used as teaching tools.
- Existing PV or mechanical systems, geothermal, radiant floors.
- Locate M&O manuals and update

Policies & Standards:
Rate Structures

Some sites have five meters on site and are paying different rates for each one. For example, one building built in the 20s could have a different rate than those built in the 50s. Ideally, you want to express energy use in terms of whole building net meter, which is a concept that combines energy use from existing meters (but is not actually a physical meter.)

Utilities will do rate schedule scenarios for free!

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M & O Staffing Evaluation

- # of in-house staff
- # of outside staff
- Ratio of Preventative Maintenance to Corrective Maintenance

LAUSD Facilities Newsletter

LAUSD FACILITIES SERVICES DIVISION'S

BLUEPRINT

VOLUME 2 / Summer 2008 / laschools.org

green schools & sustainability

The Seeds for LAUSD's Green Schools Were Planted Long Ago

Recently, Global Green USA pre-sented LAUSD with its California Environmental Leadership award. People took notice.

KTLA television ran a segment on LAUSD's mission to build healthy and sustainable schools, and Discovery Television's Planet Green network will soon feature LAUSD's green schools in a nation-al broadcast. Almost every month a new men-tion appears in the media about our green schools success.

But all this "new" news is actually old news to those in the District that have shaped LAUSD into a nationally recognized leader in green schools.

Efforts to make the District green began nearly a decade ago when voters decided to give LAUSD funds to build desperately needed schools and upgrade existing facili-ties. LAUSD Board of Education member Julie Korenstein put forth a motion in 2001 that was adopted by the entire board, mandating the new schools be designed to

Political commentator Arianna Huffington presents LAUSD Board of Education member Julie Korenstein and Chief Facilities Executive Guy Mehula with the Global Green Millennium Award for California Environmental Leadership.

Schools (CHPS) which measures the sus-tainable features of schools. CHPS cri-teria have been applied to more than 100 designed schools throughout the country since LAUSD helped create it.

Showcase LAUSD schools like Maywood Academy and Charles H. Kim Elementary School have the features that make a school sustainable: ample use of natural daylight, water conservation, acoustics, energy efficiency and the use of recycled materials. However, new schools aren't the only place the District is making its mark.

chief facilities executive

Dear Friend,

Here we are at the height of summer, and the sun is high in the sky. The bright light means a bright future for our green schools and sustainability initiatives, as we embark upon our first solar project.

LAUSD will generate one megawatt of renewable energy at its Pico Rivera ware-house with a solar installation to commence later this summer. This project is our first foray into renewable energy. I fully expect to exceed our goal of at least 15 megawatts of renewable energy by 2012.

The Board of Education has made many visionary decisions that shape LAUSD as one of the nation's leaders in green schools. Many of the Board's goals fall upon the Facilities Services Division to implement. As you will see from this issue of the Facilities newsletter, our team is up to the task.

Recently, Board Member Julie Korenstein and I accepted Global Green's Millennium Award for our green schools efforts. In my speech, I noted we are building one green school a month. It's a monumental task, but when I see how students and teachers excel in healthy and sustainable schools, I know our efforts are worth the hard work.

New schools are exciting, but the majority of our students still attend the more than 800 existing schools. Even here, we are making great strides to be "green" through energy efficiency, water conservation and improved air quality.

Maintenance & Operations (M&O)

- ***What stages in the decision making and development process is communication with M&O staff critical?***

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Decisions affecting M&O: Pre-construction

- ***Pursue Grid Neutral –M&O as agents of change***
  Evaluation/Assessment
  Planning –See Summary of Findings – Comp. Planning
  - ***M&O provides input on existing policies/standards***
  - ***M&O educated on new policies/standards***
- ***Project Design***
  - ***M&O involved in electronic plan review (kiosk)***
  - ***M&O identifies issues with maintainability, security and potential vandalism***

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Decisions affecting M&O: Construction

- ***Continually present, involvement is scheduled***
- ***Becomes familiar with maintenance***
- ***Verifies access to equipment***
  - ***Requests photos of concealed components***
- ***Performs functional testing***
  - ***Identifies deficiencies /resolutions***
- ***Reviews substitutions/"As Builts"/change orders***
- ***Project Acceptance***
- ***Commissioning-M&O observes.***
- ***Gets trained / retrained in 6 months if updates***
- ***Participates in punch list***
- ***Receives, reviews and files warranty documentation***
  - ***Clarify M&O role under warranty period***
  - ***Continual training under first warranty year***

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Decisions affecting M&O: Post Construction

- *Identify construction defects:*
  - *Two years after acceptance*
  - *One year after warranty*
  - *Need outside resources provided after project acceptance*
- *Develops plan to test systems*
- *Develops plan to re-commission*
- *Plan for long-term and on-going maintenance and operation*
- *Provide proper maintenance equipment and training.*
  - *Systems should come with a replacement schedule-roofs AC, PV, etc.*
- *Measure and monitor performance*
  - *Observe PPA maintenance*
- *Enhanced PM's*

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Decisions affecting M&O: Keep it going

- *Instructional Programs*
  - *Location*
  - *Times / Calendar*
  - *Computer-Based*
- *Re-purposing, reconfiguration of space*
- *Addition of portables*
- *Facility alteration/retro* Facility Time of Use
- Sports Programs
- Timing of janitorial
- Joint use
- Procuring Equipment
- Development of standards/policies
  Enforcing energy policy
- Override energy systems
- Personal comfort issues
  Food service changes/additions.
- Electric vehicles
- Budget M&O staffing
- Staff incentive program
- Management of M&O
- Energy measurement

GRID Neutral Schools

DGS

Maintenance & Operations (M&O)

- ***What types of educational and training to ensure creation of and on-going maintenance of Grid Neutral School?***

"Students, teachers and M&O staff become agents of change!"
Jeff Doyle, Senior Project Manager
Twin Rivers Unified School District

GRID Neutral Schools

DGS

M & O Culture Shift

❑ *Education*

- ***Energy management systems –awareness***
- ***Learning communities on green technologies (agents of change)***
- ***Value of integrating M&O***
- ***Energy awareness training***
- ***Reducing plug-loads***
- ***Measuring and monitoring performance***
- ***Integrated education for students***
  - ***Tie it to visual on your campus***
  - ***Monitor in real time***
  - ***Kiosks, Signage in classrooms – highlight features***
  - ***Web based visual of $$$ savings***
- ***Create a guidebook for fostering energy advocacy in students***
- ***Encourage energy "champions" within departments and among students***

GRID Neutral Schools

DGS

M & O Culture Shift

- ***Training***
  - ***Energy management systems - operation***
    - ***Add funding for maintenance, training and support from the vendor in the contract***
  - ***Training for controls (light, PV, etc)***
  - ***Function, operation, maintenance training***
  - ***Quick reference for classroom energy features***
  - ***Signage for energy features****
  - ***Performance measurement***

Workshop Participates

Larry Schoff
William Savidge
Nick Semon
Jim Ogden
Greg Cunningham
Jim Meacham
David Thorman

Virginia Lew
Kip Hansen
Jeff Doyle
John Maloney
Steve Plaxco
Terry Duschka
Theresa Townsend

Question and Answers

Maintenance & Operations

GRID Neutral Schools

DIVISION OF THE
STATE ARCHITECT
DEPARTMENT OF GENERAL SERVICES

15 minute break time

DGS

DIVISION OF THE
STATE ARCHITECT
DEPARTMENT OF GENERAL SERVICES

Larry Eisenberg, *LACCD Executive Director of Facilities Planning and Development*

"Los Angeles Community College District –Off-the Grid"

DGS

Innovative Funding

September 15th 2008

Presenter: Steve Paul,

High Performance Incentive Grant Program

Office of the Public School Construction

Innovative Funding

- ***What are the current funding sources?***
- ***How to evaluate the Grid-Neutral funding mechanisms?***
- ***What are the Opportunities for change?***

Current Funding Sources

Loan Programs

Self- Funded Programs

Free Money

Current Available Funding

Loan Programs:

- **California Energy Commission (CEC)**
  - California Energy Efficiency Financing Program
- **Tax Exempt Financing**
  - General Obligation Bonds (lowest cost)
  - Certificates of Participation
  - Tax Exempt Leases (highest cost)
- **Qualified Zone Academy Bonds**
- **IRS - Clean renewable energy bonds**
  - Clean Renewable Energy Bonds (K-12 only)

DSIRE
Database of State Incentives for Renewables & Efficiency

DGS

Case Study: Loan Program

Anderson Union High School District

- First phase of the project included PV funded through the CEC Energy Efficiency Loan Program.
- The $2,013,930 PV system qualified for an $853,930 rebate from Pacific Gas & Electric Company (PG&E) under the California Self-Generation Incentive Program.

Current Available Funding

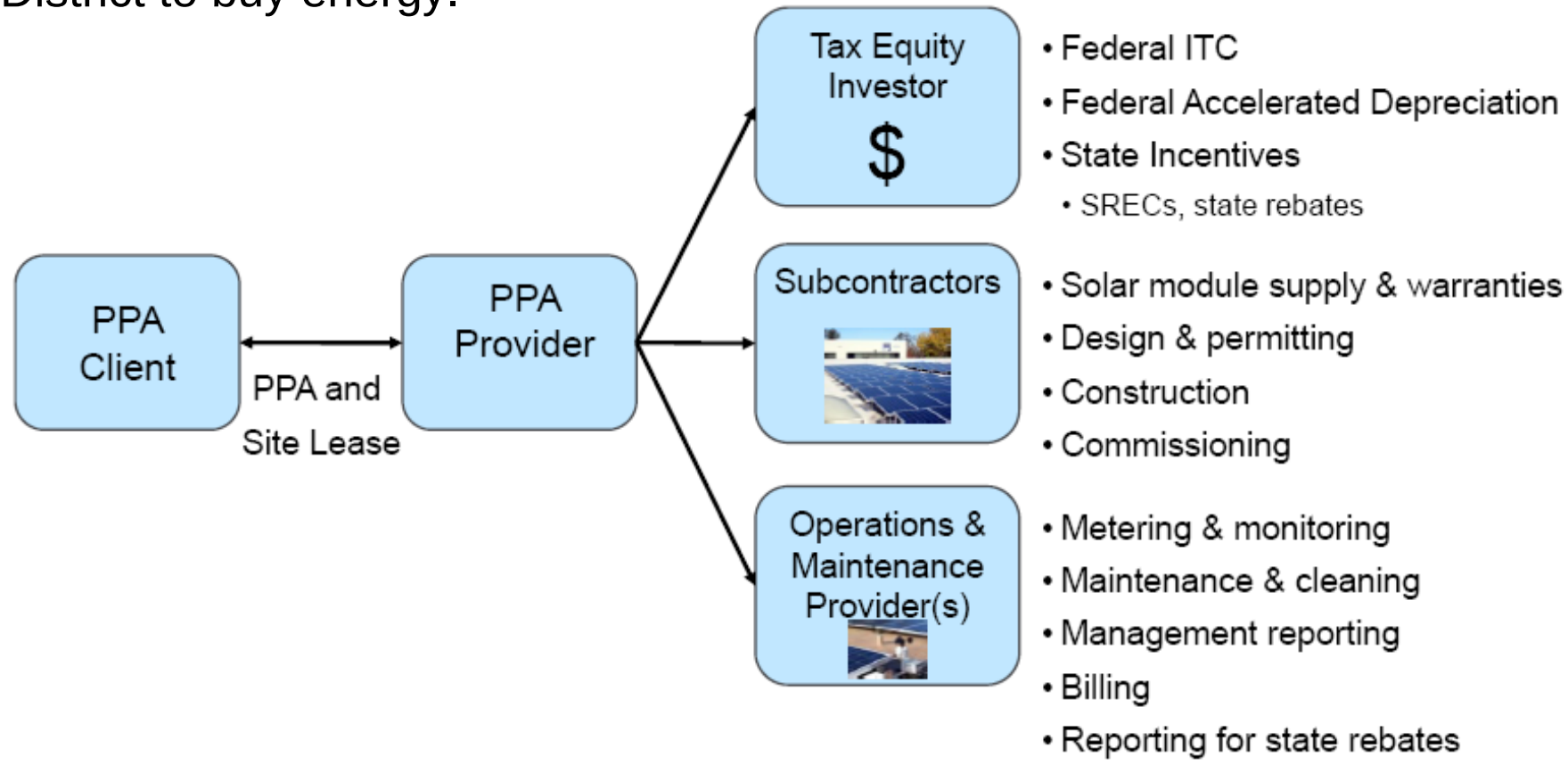
Self-Funding

- District General Fund
- 3rd Party Power Purchase Agreements
- 3rd Party Financing by Energy Service Companies (ESCOs)
- Accelerated (or Rapid) Depreciation
- Federal Tax Incentives

Power Purchase Agreements

PPA Model – How it works

The Third Party manages the financing, installation, and operations of large scale solar system(s), in return for a long-term commitment by the District to buy energy.



Free Money Programs

- **Bonds**
- **Utility Incentives**
- **Utility Rebates**
- **Office of Public School Construction**
- **Flex Your Power**
- **Calif. Energy Commission -**Bright Schools Program
- **Mello Roos**

- **Individual/Community**
- **Grants and Donations**

Free Money Programs

Utility Rebates

High Efficiency Lighting Grants

High Performance School Incentive Grant Program

Public School Construction DGS

DGS

Innovative Funding

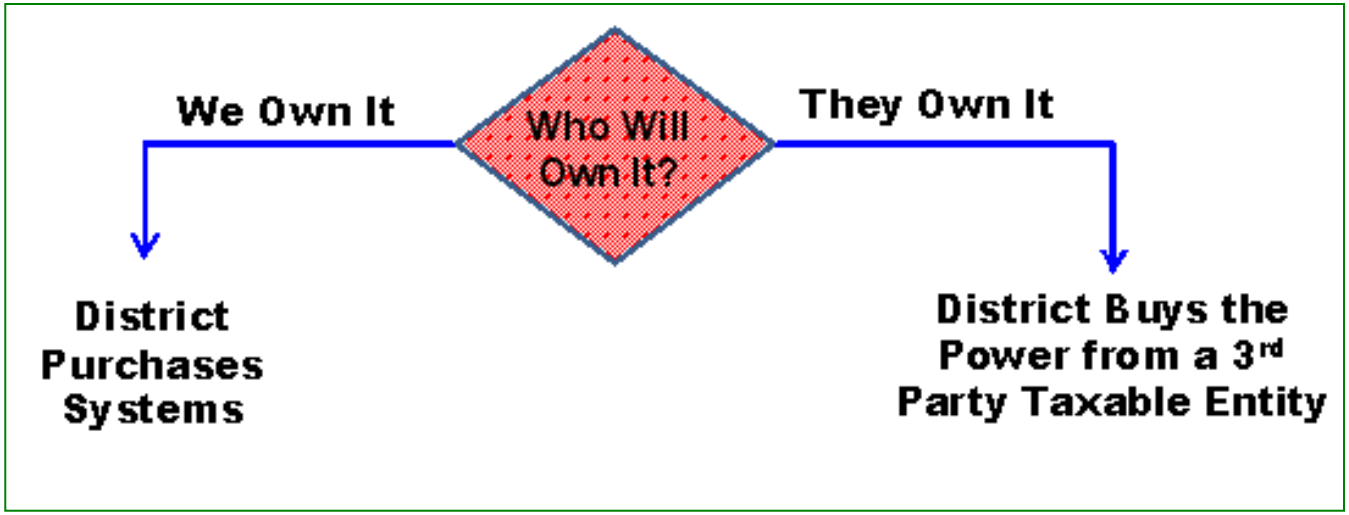
- ***How to evaluate the Grid-Neutral funding mechanisms?***

Evaluation Mechanism:

Determine who will own the Energy Saving System

Option 1: We own it: District Purchases Systems

Option 2: They own it: District buys power from 3rd Party with a Power Purchase Agreement (PPA)



We own it: District Purchases System

District needs to Conduct a Self-Evaluation:

- **Initial Capital Outlay**
- **Operational Savings**
- **Financial Complexity**
- **Administrative Complexity**

If districts can get about $5/watt in rebates, then it is cost neutral to install the system, assuming that it costs approximately $7/watt to install. Districts can pay for the loan to finance the system with a $2/watt difference.

~ Tom Kelly, Helios Project

Evaluation Options:

- **Consult experts to evaluate what the best return on investment of a Energy Saving System**
  - **District Self-Evaluation (with Dream Team)**
  - **Third Party evaluator- free consultant**
  - **Bond Manager Consultant – Business Manager**

We own it: Example

Case Study – District Owns
Contra Costa Com. College District

3.2-megawatt Solar System and Energy Efficiency Improvements

- Designed, engineered and constructed by Chevron Energy Solutions
- $35.2 million project
- Cost offset by
  - $8.5 million in rebates and other incentives administered by PG&E under the State of California's Solar Initiative, Self-Generation Incentive Program and Community College Partnership Program.
  - Net $26.7 million, supported by Measure A bond funds.
- Expected to save CCCCD more than $70 million over 25 years.

They own it: Example of a PPA

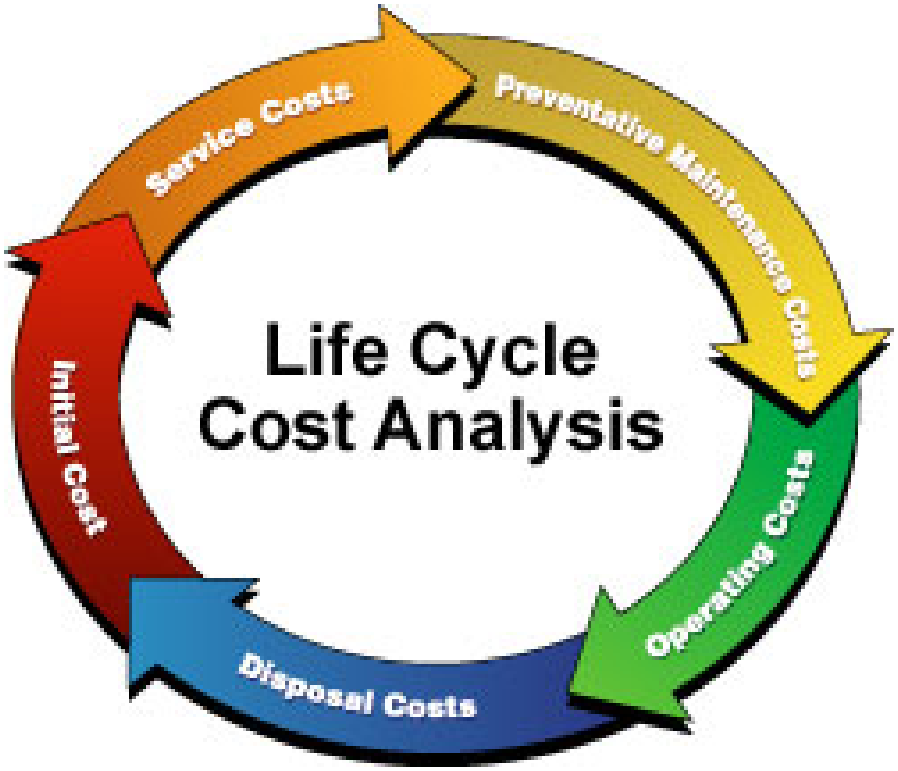
Case Study - 3rd Party Financing (LACCD)

Free Money	*% of $7 kWh*	*$ Amount*
Federal Tax Credit	30%	$2.10
Rapid Depreciation	25%	$1.75
Utility Incentives	20%	$1.40
Reduced Emissions Credits	5%	$0.35
New Market Tax Credit	30%	$2.10
Total	**110% Paid**	**$7.20**

Go Green!

LACCD

Evaluation Tools



- **Decision making tool**
- **Cost benefit analysis**
- **Total cost of ownership analysis**
- **Discounted cash flow analysis**
- **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

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Innovative Funding

- ***What are the Opportunities for change?***

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*
- ***Assembly Bill (AB) 625***
  - *Funnel money from Williams Energy Settlement Funds into Solar School Program*
- ***Utilities to treat Districts as an Enterprise***
  - *Allows one site to produce credit for other sites in a District*
- ***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*

DGS

Workshop Participates

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Theresa Townsend

Question and Answers

STATE OF CALIFORNIA

Thank you for participating!

GRID Neutral Schools

DIVISION OF THE
STATE ARCHITECT

DEPARTMENT OF GENERAL SERVICES