Update on the

Hawai'i High Performance School Guidelines

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THE DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
STATE OF HAWAII

Status of Project

- Grant obtained by DBEDT
- Consultant: Architectural Energy Corporation
- In cooperation with: DOE, DAGS, DBEDT

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March 31, 2005

Life Cycle Cost Calculations

Life-cycle cost (LCC) analyses maximize project values. They take operating and maintenance costs into account and make the most of integrated design opportunities.

So remember to include them in your budget allocations. A very rough rule of thumb is to set aside funds equal to 0.5% of the construction budget for analysis fees.

How To Calculate LCC

Typically, there is a base case scenario against which different alternatives are weighed.

High Performance Hawaii Classroom Prototypes

Integrated design for visual and thermal comfort, as well as optimal energy efficiency

This brochure details four prototype designs for Hawaii schools.

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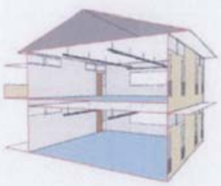
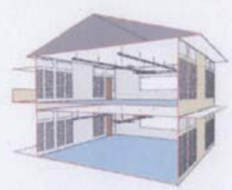
Prepared by:
ARCHITECTURAL ENERGY CORPORATION
Integrated Engineered Solutions

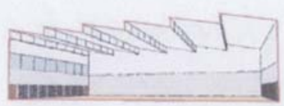
A classroom building designed for daylighting and a mixture of air conditioning and natural ventilation.



A portable classroom designed with daylighting and mixed-mode ventilation.



A naturally ventilated classroom.



Daylighting options for gymnasiums.

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Commissioning for Schools

The complexity of building systems continues to increase through time—as does the impact of their interactions. A single architect can no longer oversee the entire process. And simply assuming that each individual contractor is doing their job carries too great a risk.

One study of sixty new nonresidential buildings found more than half with controls problems, forty percent with malfunctioning HVAC equipment, and one-third with sensors that didn't work properly. In many of the buildings, equipment called for in the plans and specifications was actually missing. A quarter had energy management and control systems (EMCS) with economizers or variable speed drives that didn't run right.[1]

Some level of commissioning is necessary to achieve a high performance school.

What Is It?

Commissioning is a systematic process of ensuring that building systems interact and perform as specified, as intended, and according to the school's operational needs. It results in increased energy efficiency, reduced change orders, better maintainability, and improved occupant comfort and productivity.

Ideally, a full commissioning process is part of every project. However, complete commissioning may not be cost-effective for small projects.

The Two Tiers

Basic: The following projects should include at least basic commissioning.

- New construction projects that cover 5,000 ft² or more of floor area.
- Renovation projects that cost $1,000,000 or more AND cover 5,000 ft² or more of floor area AND include HVAC system replacement, building control system installation or upgrade, or lighting system controls.

Basic commissioning services may be performed by a third party or someone in-house, however, whoever assumes the role of commissioning agent should perform the following tasks:

- Verify that lighting controls have been installed per design and are functioning as intended. This includes occupancy sensors, daylighting controls, multi-level switching, and automatic time clocks.
- Make sure that ventilation and air conditioning equipment has been installed per design and that outdoor air flow, supply air flow, fluid flow, and controls function as specified in the design criteria.
- Ensure that any and all energy management and control systems (EMCSs) perform the sequence of operations and provide trend logs per design. Also establish that sensors are calibrated.
- Confirm that a complete guide has been provided to operations and maintenance staff.
- Check to see that an operating brief has been given to school administrators and teachers.
- Make certain that operating staff have been trained.

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Technician captures performance data in the field.

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[1] Piette, M.A. et al, "Quantifying Energy Savings from Commissioning: Preliminary Results from the Pacific Northwest" (Lawrence Berkeley National Laboratories 1994).

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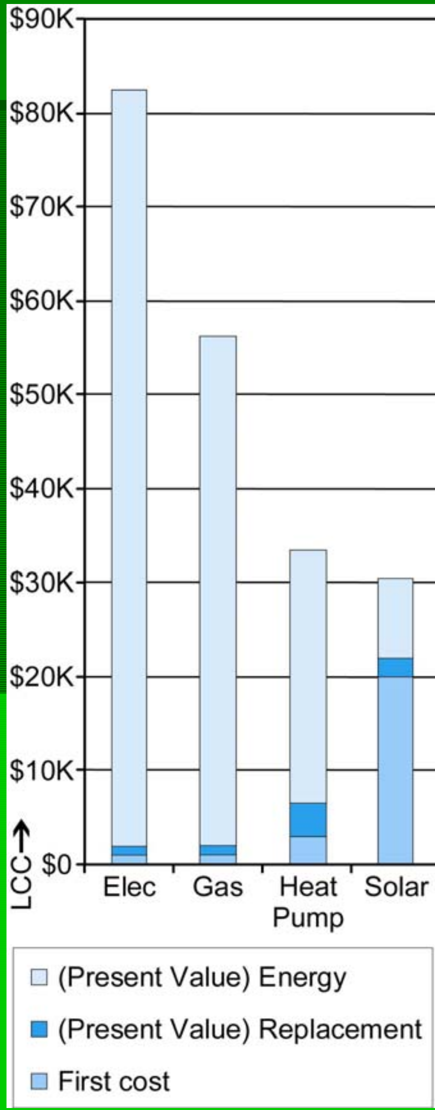

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Table 10 — Commissioning Scope Checklist for Project Scope Developm

Level of commissioning
- _____ Basic commissioning
- _____ Additional commissioning

Party responsible for commissioning
- _____ State official: _______________
- _____ Independent commissioning agent

Systems to be commissioned
- _____ Air conditioning
- _____ Energy management and control system (EM
- _____ Lighting occupancy sensors
- _____ Lighting daylighting control
- _____ Lighting time of day control
- _____ Natural ventilation

Table 11 — "Basic" Commissioning Task List

- Verify that lighting controls have been installed per design and have been t Includes daylight controls, occupancy controls, multi-level switching, and au
- Verify that ventilation and air conditioning system equipment is installed per supply air flow, fluid flows, and controls are tested to meet design criteria.

Table 12 — "Additional" Commissioning Task List

- Engage a commissioning agent.
- Develop and utilize a commissioning plan.
- Develop design intent and basis of design documentation.
- Include commissioning requirements in the construction documents.
- Conduct a focused review of the design prior to the construction documents phase.
- Conduct a focused review of the construction documents when close to completion.
- Conduct a selective review of contractor submittals of commissioned equipment.
- Verify installation, functional performance, training, and documentation.
- Develop a system and energy management manual.
- Have a contract in place for a near-warranty end, or post-occupancy, review.
- Complete a commissioning report

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Table 19 — System Evaluation Matrix with Notes for Designer

System Description
Describe the system characteristics here.

central / room-by-room
chilled water / packaged
variable air volume (single-duct or dual-duct) / constant volume
dual-path / single-path
w[illegible] / air-[illegible]ed
overhead air [illegible]ion / displacement ventilation / under-floor air distribution
ducted return / plenum return
special controls
other special characteristics

Criteria	Criteria Weight (Totals to 100)	Comments *(Note: The comments below are provided as guidance to the designer. When this table is filled out by the designer, these comments should be replaced with a brief discussion of the relative merits or drawbacks for each system option)*	Score (1 to 10) 1 = poor 10 = excellent
Mechanical System First Costs	12	First cost ranked relative to other system options.	
Impact on Other Trades: General Contractor	6	Impact on construction requirements such as mechanical rooms, duct enclosures, shafts, equipment screens.	
Impact on Other Trades: Electrical Contractor	4	Impact on electrical system cost and complexity.	
Floor Space Requirements	6	Impact on usable floor area.	
Ceiling Space Requirements	3	Amount of space required for ducts, fan coils or other system components.	
Energy E[illegible]ciency: Normal Operation	8	Energy perf[illegible]ce during [illegible]rmal school hours relative to [illegible]	
Ene[illegible]cy: [illegible]eration	[illegible]	[illegible]l school hours if only [illegible]ied.	
Flexibility for After-School-Hours Operation	5	The ability to air condition o[illegible] portions of the school for after-hour activities.	
Acoustical Impact	8	Relative impact on noise in the classrooms and other spaces.	
Dehumidification Performance Over Full Operating Range	6	Ability to extract moisture from the supply air to maintain comfort and air quality even when space sensible cooling loads are low.	
Indoor Air Quality	8	Ability to provide adequate level of clean outdoor air to the occupied zone.	
Comfort	8	Ability to maintain stable comfort and humidity	
Ease of Maintenance During School Hours	4	Ability to be accessed for routine or emergency maintenance tasks without disrupting classes.	
Compatibility with Maintenance Staff Resources	6	Level of training required to perform maintenance tasks, and frequency of maintenance required.	
Use of Standardized Parts	4	Commonly replaced components are standard items that can be stocked by Central Services or easily sourced in Hawaii.	
Maintenance Cost and Reliability	4	Cost and reliability relative to the other system options.	
Longevity	4	Relative lifetime of different system options. This can be an issue when comparing water-cooled and air-cooled equipment and when comparing indoor vs. outdoor equipment placement.	
Flexibility for Future Occupancy Changes	2	Ease of rezoning, adding capacity, or adapting to change in occupancy.	
	100	**Total Score** (Rooftop/Floor-by-Floor) **(Sum of Weight x Score, maximum is 1000)**	

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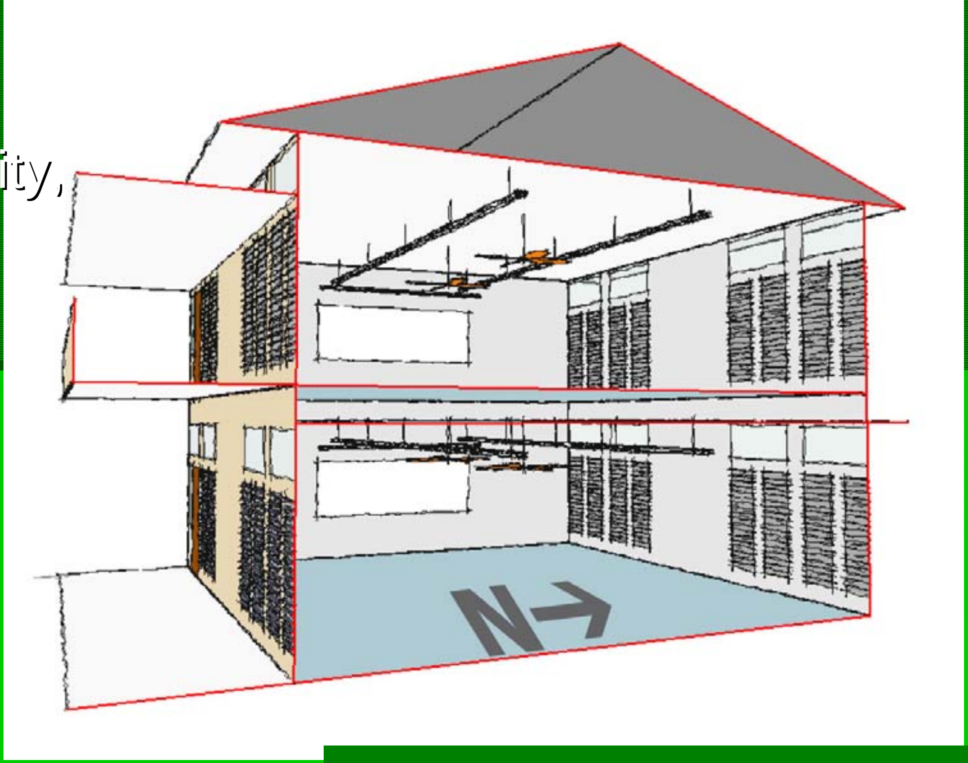

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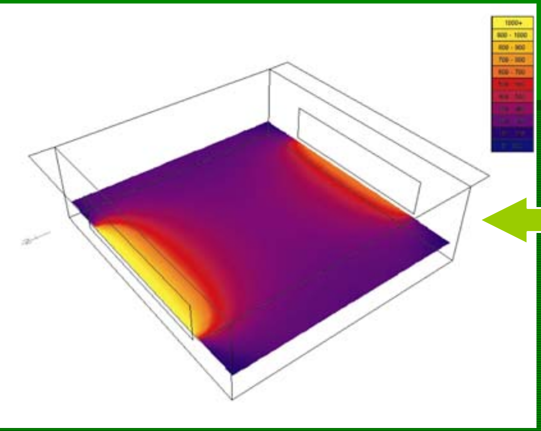
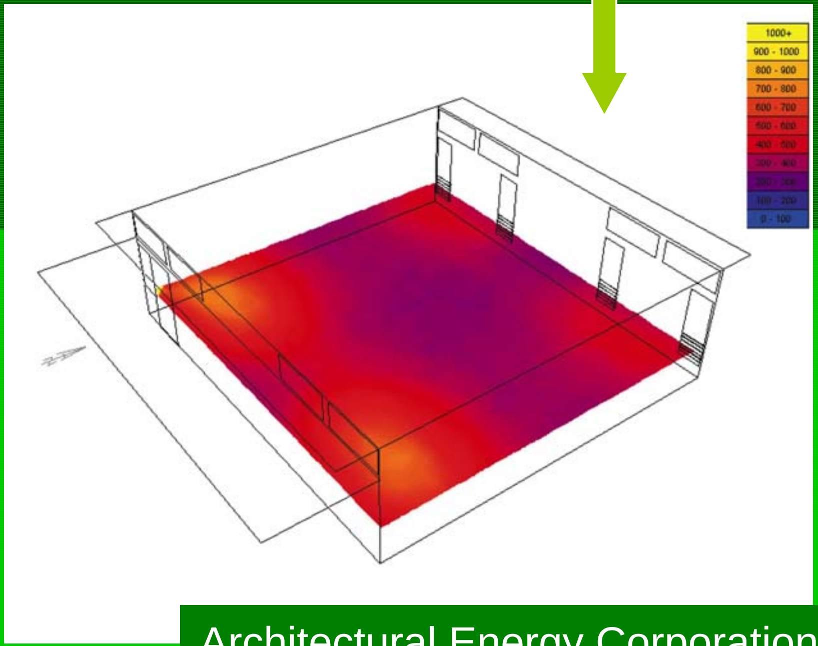


From this

To this



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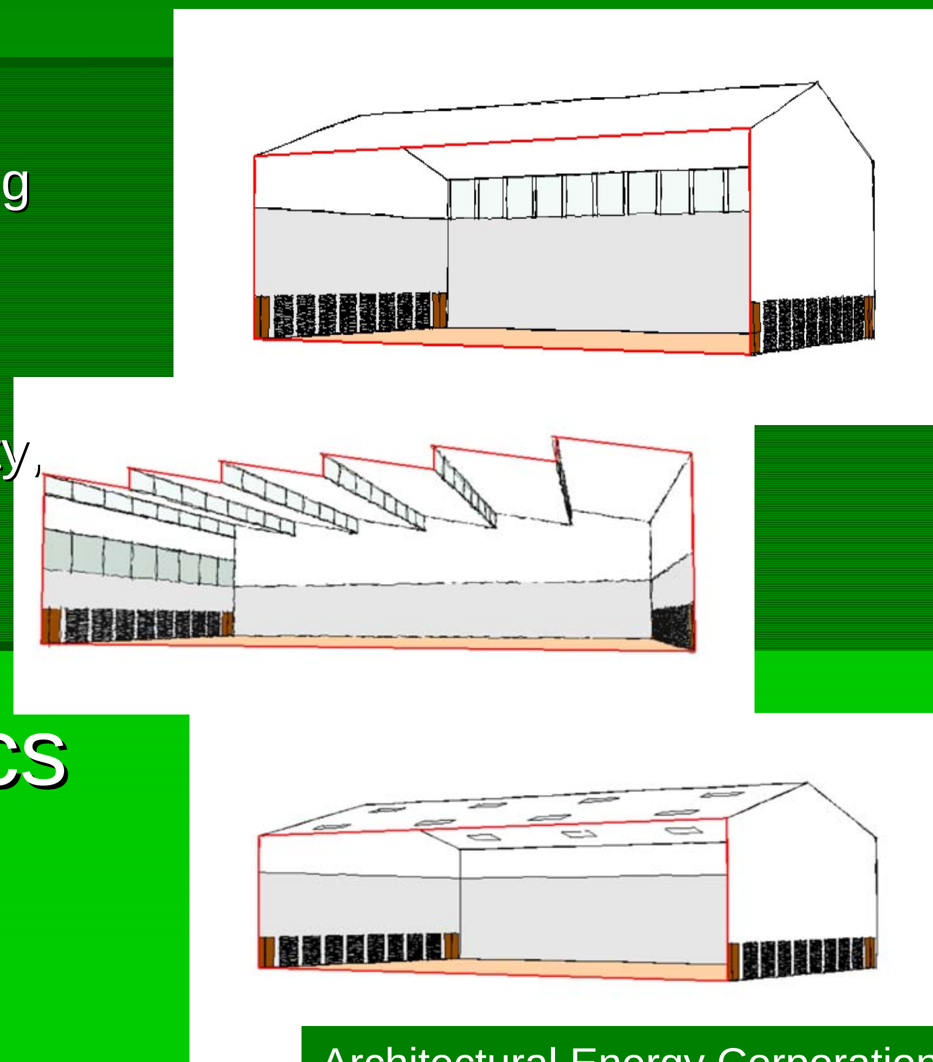

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- Current DOE projects

Okada Trucking Co., Ltd

Ferraro Choi Architects

Waipahu Intermediate Cafeteria

1st DOE project seeking LEED certification

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- Future projects:

Mauka Lani Elem. 8 Classroom Bldg.

Mililani High 10 Classroom Bldg.

Ewa Makai Middle (New School)

PROJECT CHARACTER SKETCH

CONCEPT DEVELOPMENT

EWA MAKAI MIDDLE SCHOOL

OAHU HAWAII

MAY 2005- CHARETTE THREE

The Orcutt/Winslow Partnership 1130 North Second Street Phoenix, Arizona 85004

Mitsunaga & Associates, Inc. 747 Amana Street, Suite 216 Honolulu, Hawaii 96814

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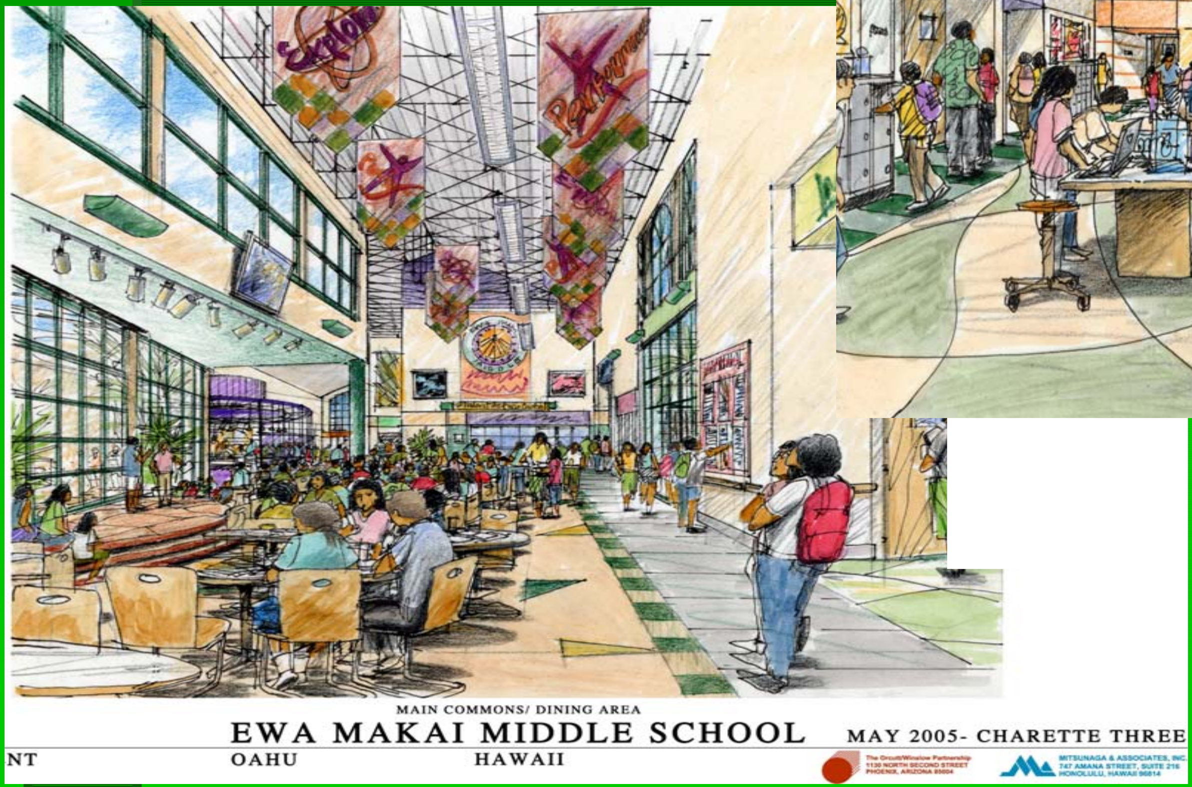
- Daylighting & Efficient AC



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