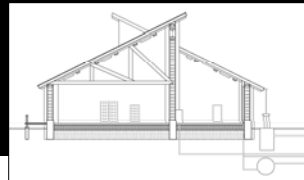
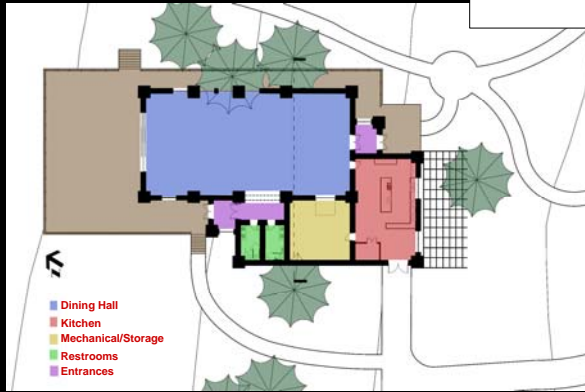


Dining/Auditorium



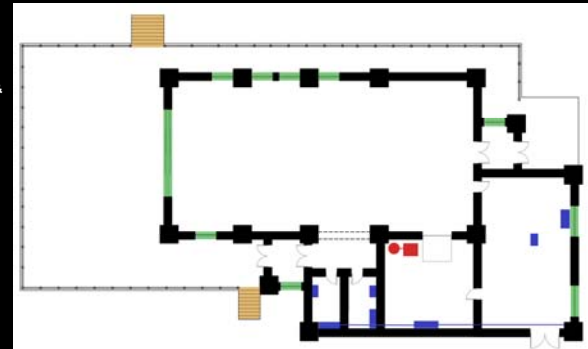
North West Section



Room Layout

Dining/Auditorium Services & Building Methods

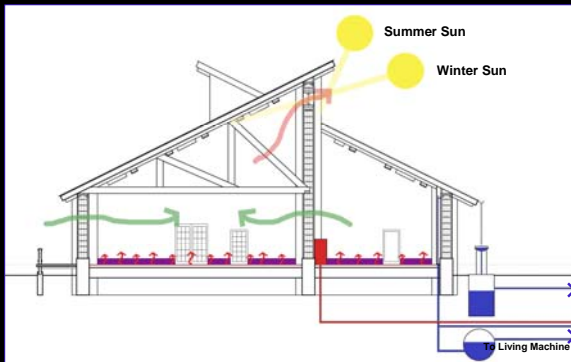
- Natural Ventilation
- Circulation
- Plumbing
- Hot Water Heater & Manifold



Horizontal & Vertical Services

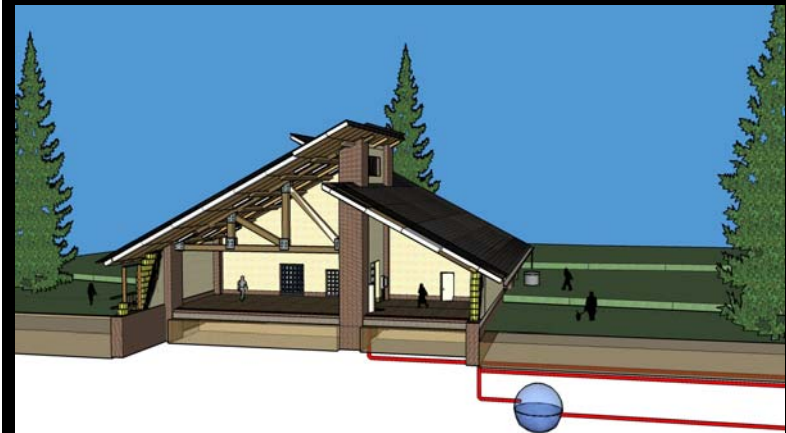
Dining/Auditorium Services & Building Methods

- Natural Ventilation
- Hot Air Venting
- Light Penetration
- Electrical Path
- Hot Water Heater/Radiant Flooring
- Water Collected on-site and Water Coming to and From Living Machine



Horizontal & Vertical Services

Dining/Auditorium Services & Building Methods



3-D Section of Horizontal & Vertical Services

Dining/Auditorium Building Methods



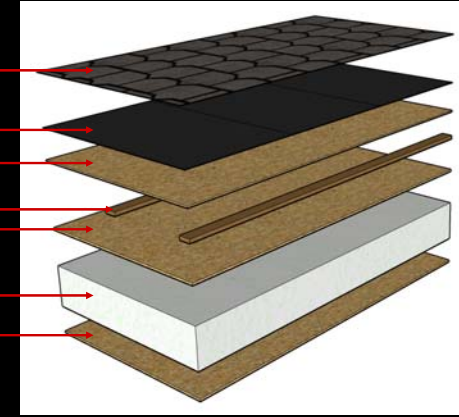
- 6:12 Roof Slope
- Cold Roof to prevent ice damming and snow build-up
- Roof system supported by 3 trusses, which transfers the loads to the load-bearing structural straw bales walls, which then transfers the loads to the rammed earth columns



- 4'x8' Structural Insulated Panels (SIPs)
- Glulam Rafters spaced 10' on center
- Glulam Rafters spaced 8' on center
- Glulam Truss

3-D Roofing System

Dining/Auditorium Building Methods



- Recycled Tire Shingles
- Felt
- 7/16" OSB
- 1" Thick for Air Space
- 5/8" Thick OSB
- 10 1/2" Thick Rigid Polyiso Insulation
- 5/8" Thick OSB

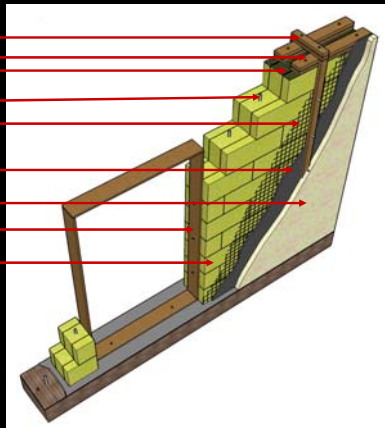
• R-Value: R – 47.5

3-D Structural Insulated Panel (SIP)

Dining/Auditorium Building Methods



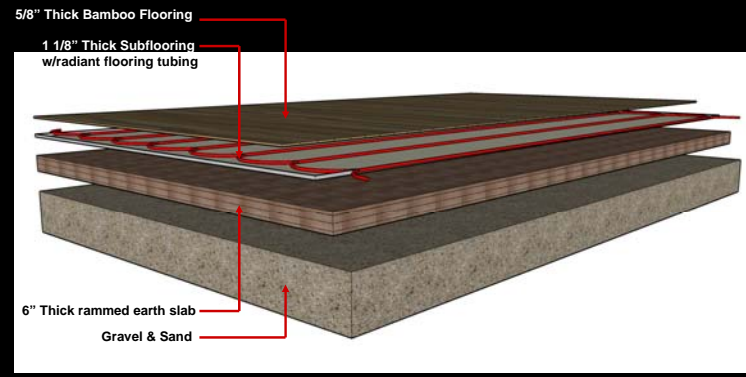
- 2"x4" Frames at 6'-0" O.C.
- 2"x6" Double Roof Plate
- Wire Mesh & Moisture Barrier
- #4 Rebar
- Galvanized Stucco Mesh Fastened to Wood Frame
- 1" Layer of Gunite Shot onto the Bales and Mesh
- 3" Layer of Stucco
- Window Frame
- 18"x14"x36" Two-String Wire Straw Bale



- 26" thick structural straw bale wall
- R-Value: R – 42.8 (for 2-string bale laid flat, 18" wide)
- Good for keeping the building cool in the summer and warm in the winter

3-D Structural Straw Bale Wall

Dining/Auditorium Building Methods



- 5/8" Thick Bamboo Flooring
- 1 1/8" Thick Subflooring w/radiant flooring tubing
- 6" Thick rammed earth slab
- Gravel & Sand

3-D Flooring system

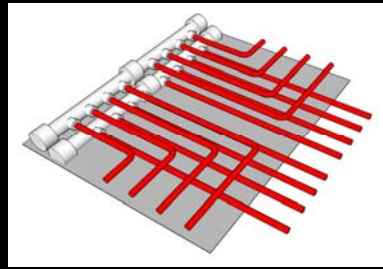
Dining/Auditorium Services



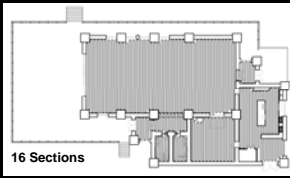
Hot Water Heater & Manifold in Mechanical/Storage Room

- Wood-fired boiler (on-site) heats water and sends hot water through insulated pipes that travel from main boiler to each building to a hot water heater through a closed water system.
- Hot Water Heater: Hot water from the wood-fired boiler via the bio-fuel plant will be piped to the hot water heater in the mechanical/storage room, where the water will be heated up to the right temperature.

Manifold



3-D Hydronic Radiant Flooring system

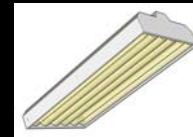


Radiant Flooring Layout

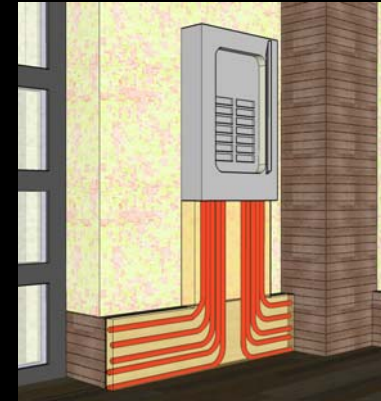


Dining/Auditorium Services

- Electric Box located in mechanical/storage room
- Electric wires run along the 14" tall rammed earth base wall
- Electrical Distribution: Most of the wiring is constructed before installing and because it is mounted to walls, it is easily serviced and updated. The wiring for ceiling lights is mounted to ceiling and concealed as best as possible.
- Fixtures: Uses low energy light bulbs, such as compact fluorescents, such as the fluorescent high bay HB5, which lights well up to 35'



Fluorescent High Bay HB5



3-D Electric system

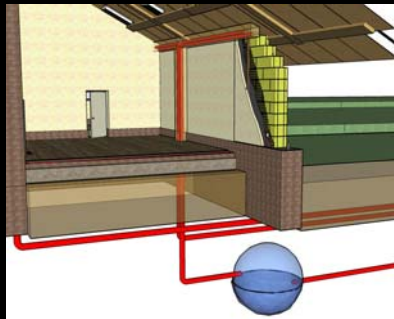


Dining/Auditorium Services

- Pre-fabricated plumbing box located in mechanical/storage room
- Plumbing Distribution: Water coming and leaving the dining/auditorium building goes through pipes located in the mechanical/storage room, where pipes leaving and returning going to the kitchen and restrooms located on either side of the mechanical/storage room. Located under the building is a storage tank where the black water goes before it goes back to the living machine.
- Rain Water: Collecting rain water in two cisterns which can each hold 1,500 gals (sized 5'x5'x8'). Using recycled tire roofing only allows for water to be used right away for fire use and landscaping. When the water gets to a certain level it will go to the living machine where it will be recycled and be returned.
- Supply: For drinking water getting water from the city or on-site well
- Water Saving Appliances: These include: spray taps, low flush toilets, and using on-demand water heater, which saves up to 50% of water. These all help in reducing water consumption.



Cistern



3-D Plumbing system



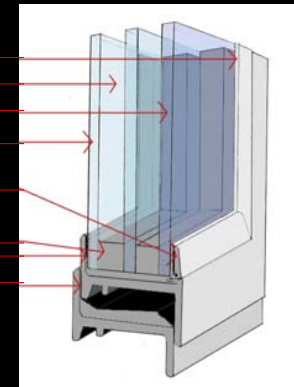
Dining/Auditorium Services

- Triple Glazed Argon-Filled Window: To help keep warm temperatures in.
- Ventilation/Exhaust: Natural ventilation system using operable windows on opposing walls for cross ventilation. Low hung windows and clerestories also help in getting rid of hot stale air especially in the kitchen.



Shoji Screen Styled Windows

- Silicone Capping
- 16mm Argon Filled Cavity
- 4mm Clear Float Glass (Outer Pane)
- 4mm Softcoat Low "E" Float Glass (Inner Pane)
- Aluminum Chamfered Glazing Bead 'Easi Bead' System
- Spacer Bar 'Gasket' Security Glazing Strip
- Weatherstripping



3-D Glazing system



Dining/Auditorium Services

Key:

- Services not in Building but on-site
- Services in Building

Mechanical Systems (Heating, Ventilation, Cooling, Exhaust)

HEATING: Bio-Fuel Power Plant

- Large enough to serve entire complex
- Wood-fired boiler (closed water system with antifreeze) used for radiant flooring. Insulated pipes go from main boiler to each building under the path system.

VENTILATION/EXHAUST: Natural ventilation system using operable windows on opposing walls for cross ventilation. Low hung windows and clerestories also help in getting rid of hot stale air especially in the kitchen.

COOLING: Natural ventilation using operable windows and thick, well-insulated walls (straw bale and rammed earth)

Distribution

Vertical

- Insulated heating network brought from the wood-fired boiler via the bio-fuel power plant
- Thick, well-insulated straw bale walls and rammed earth columns

Horizontal

- The insulated piping system that takes hot water from the wood-fired boiler via the bio-fuel power plant
- Insulated heating network brought from the bio-fuel power plant

Plumbing

Domestic Water (hot & cold)

SUPPLY: For drinking water getting water from the city or on-site well

Storm water

RAIN WATER: Collecting rain water in two cisterns which can each hold 1,500 gals (sized 5'x5'x8'). Using recycled tire roofing only allows for water to be used right away for fire use and landscaping. When the water gets to a certain level it will go to the living machine where it will be recycled and be returned.

Hot water & or steam

HOT WATER HEATER: Hot water from the wood-fired boiler via the bio-fuel plant will be piped to the hot water heater in the mechanical/storage room, where the water will be heated up to the right temp.

Distribution

PLUMBING DISTRIBUTION: Water coming and leaving the dining/auditorium building goes through pipes located in the mechanical/storage room, where pipes leaving and returning going to the kitchen and restrooms located on either side of the mechanical/storage room. Located under the building is a storage tank where the black water goes before it goes back to the living machine.

Fixtures

WATER SAVING APPLIANCES: These include: spray taps, low flush toilets, and using on-demand water heater, which saves up to 50% of water. These all help in reducing water consumption.

Dining/Auditorium Services

Key:

- Services not in Building but on-site
- Services in Building

Electrical

Service (panels, closets or vaults)

CEILING PANEL: Located in mechanical/storage room

Distribution

ELECTRICAL DISTRIBUTION: Most of the wiring is constructed before installing and because it is mounted to walls, it is easily serviced and updated. The wiring for ceiling lights is mounted to ceiling and concealed as best as possible.

Switches, outlets, fixtures

FIXTURES: Uses low energy light bulbs, such as compact fluorescents, such as the fluorescent high bay HBS, which lights well up to 35'.

Emergency generator

Miscellaneous

NATURAL LIGHTING: Using 20% of the square footage to get the right amount of glazing square footage. To help reduce glare, providing glazing on opposing walls, and adding clerestories to get good even light into the space.

Solid Waste (Chutes, collection systems)

Recyclables

WASTE: The site has recycling facilities as well as composting facilities located right outside of the kitchen.

Reuse

WASTE WATER TREATMENT INFRASTRUCTURE: A living machine that reduces water consumption by cleaning and then recycling the water to be used for irrigation and for flushing toilets, so as to not send any waste water off the site. Placed on compacted soil adjacent to visitor parking, set in greenhouse utilizing recycled glass, heated by wood-fired boiler via bio-fuel power plant with radiant flooring, and connected to well system for back-up.

Circulation Vertical

stairways

CIRCULATION: Uses prefabricated timber stairs from reclaimed timber to get on and off deck.

Miscellaneous

TRIPLE GLAZED ARGON-FILLED WINDOWS: To help keep warm temperatures in.

SITE WIDE SERVICES: Trenches and all the initial ground breaking/foundation work done at once such as cisterns.

Dining/Auditorium Performance Evaluation

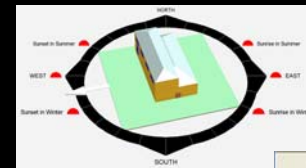
Target Energy Performance Results (estimated)			
Energy	Design	Target	Top 10%
Energy Performance Rating (1-100)	63	93	90
Energy Reduction (%)	10	40	33
Source Energy Use Intensity (kBtu/Sq. Ft./yr)	65.2	57.8	62.7
Site Energy Use Intensity (kBtu/Sq. Ft./yr)	28.3	19.2	20.8
Total Annual Source Energy (kBtu)	493,467.0	334,745.3	363,125.6
Total Annual Site Energy (kBtu)	163,776.0	111,100.3	120,519.6
Total Annual Energy Cost (\$)	\$ 2,400	\$ 1,620	\$ 1,766

Facility Information		Estimated Design Energy	
U of I Field Campus Moscow, ID 83638 United States		Energy Source	Units
Space Type	Gross Floor Area (Sq. Ft.)	Estimated Total Annual Energy Use	Energy Rate (\$/Unit)
K-12 School	5,795	Electricity kWh	48,000
Total Gross Floor Area	5,795		\$ 0.050/kWh

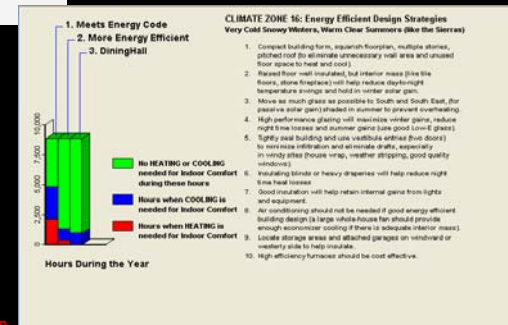
Source: Data adapted from DOE-EIA. See EPA [Technical Appendix](#).

Energy Star Calculations of Dining/Auditorium

Dining/Auditorium Performance Evaluation



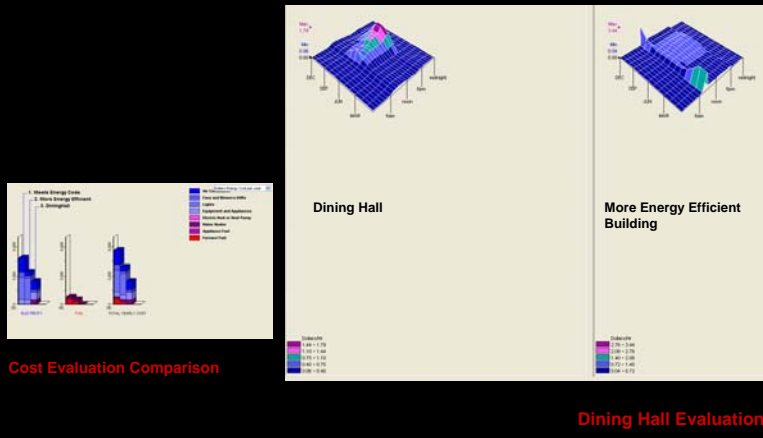
Dining Hall Orientation



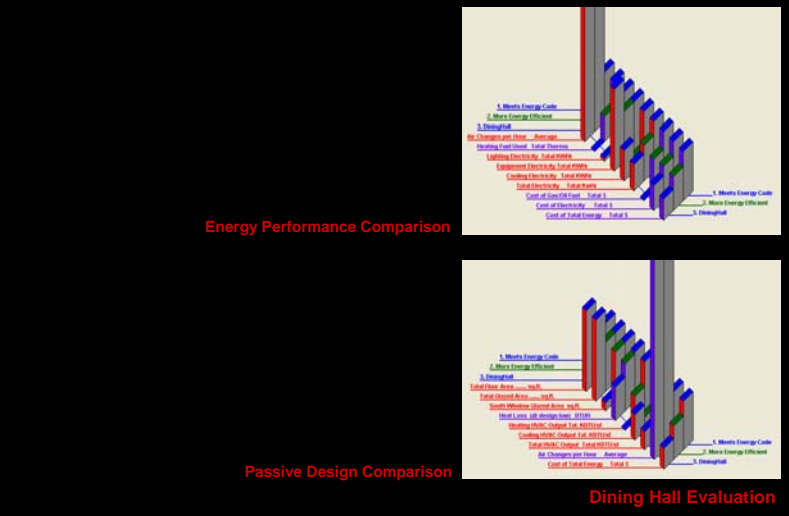
Energy Efficient Design

Dining Hall Evaluation

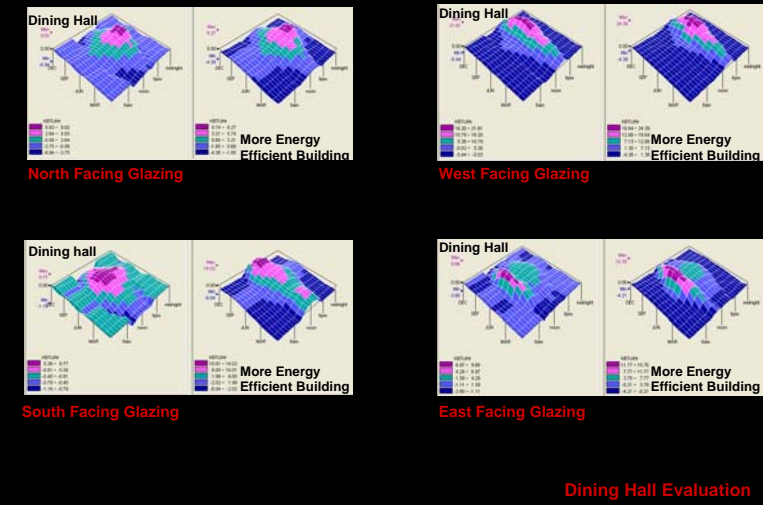
Dining/Auditorium Performance Evaluation



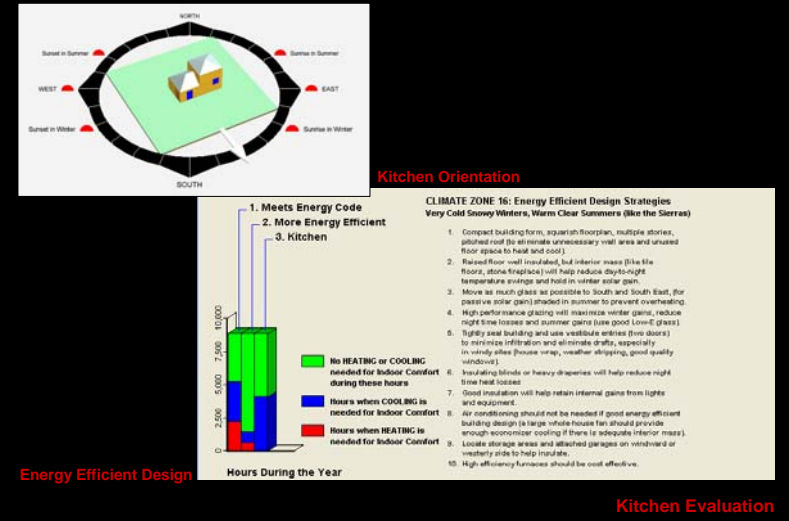
Dining/Auditorium Performance Evaluation



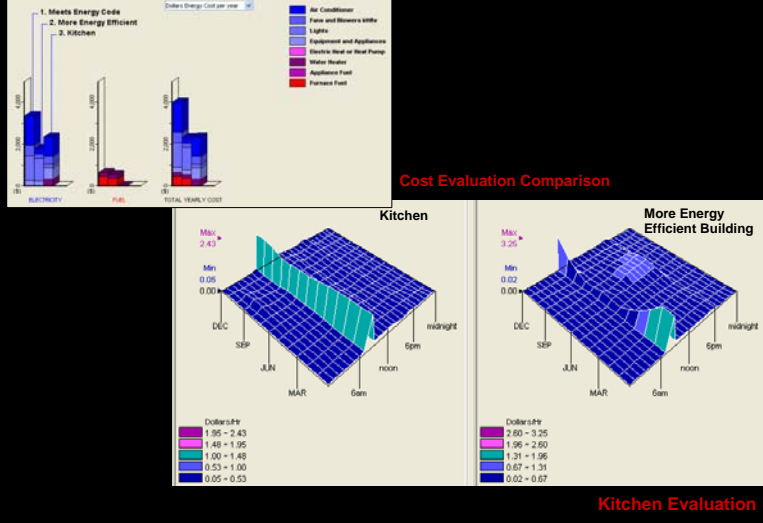
Dining/Auditorium Performance Evaluation



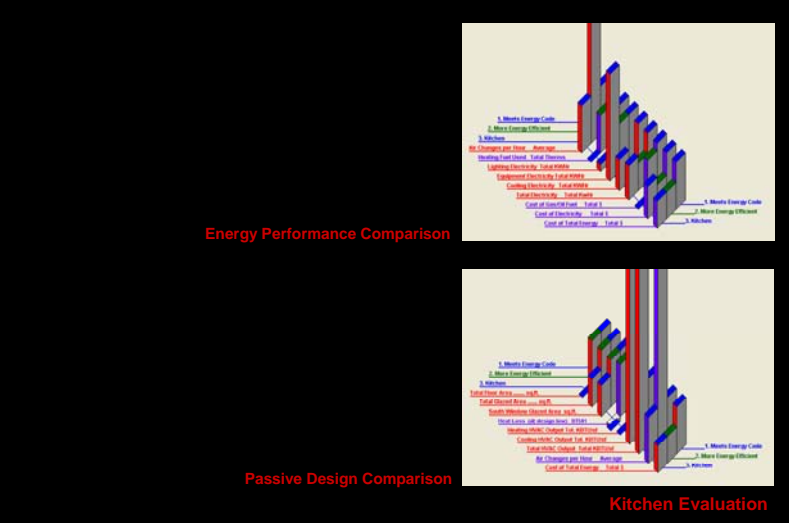
Dining/Auditorium Performance Evaluation



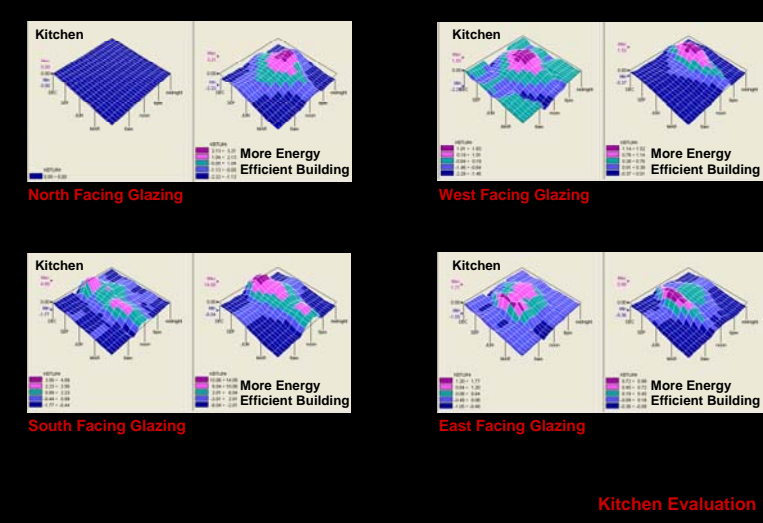
Dining/Auditorium Performance Evaluation



Dining/Auditorium Performance Evaluation



Dining/Auditorium Performance Evaluation



Dining/Auditorium Performance Evaluation

Building Materials	Cost of Making Material	Initial Cost of Material	Lifetime Cost of Material
OSB	Medium	Low	Low
Polyiso Insulation	High	High	Low
Recycled Tire Roofing	High	Low	Low
Straw Bales	Medium	Low	Low
Reclaimed Timber	Medium	Medium	Low
Glulams	Medium	Medium	Low
Rammed Earth Columns/Stem Walls/Foundation/Floor Slab	Medium	Low	Low
Bamboo Flooring	Medium	Medium	Low
Triple Glazed Argon-Filled Windows	High	High	Low
Rebar	High	Medium	Low
Stucco	Medium	Low	Low

Carbon Debt Analysis of Building Materials

Dining/Auditorium



West Side Perspective