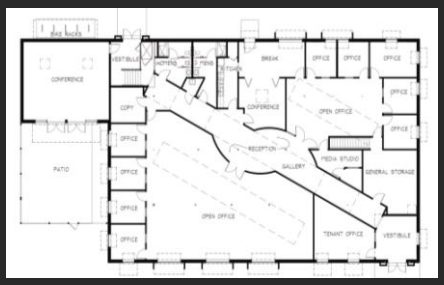
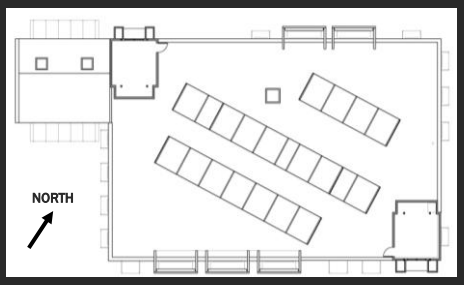
Design: Floor Plan



Main Floor Plan

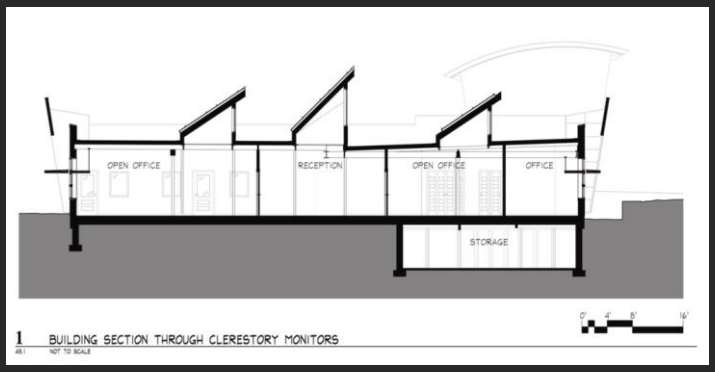


Roof Plan

- Gallery/circulation space runs diagonally to connect principal entrances
- Rooftop monitors correspond with gallery orientation (due east-west)

HIGH PLAINS ARCHITECTS

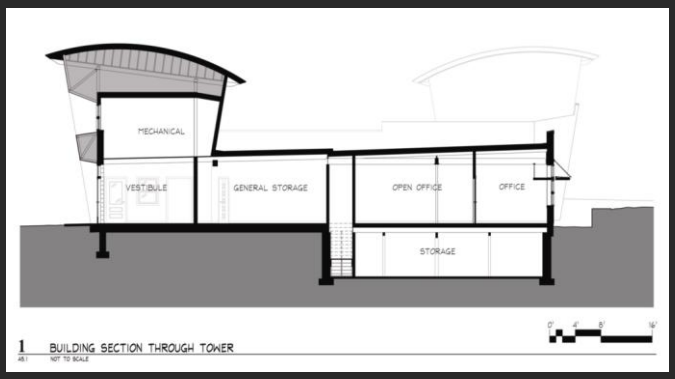
Design: Section thru Monitors



- Perimeter daylighting strategy: light shelves
- Building core daylighting strategy: north-facing clerestory monitors
- Solar panels on south-facing slope of monitor roofs

HIGH PLAINS ARCHITECTS

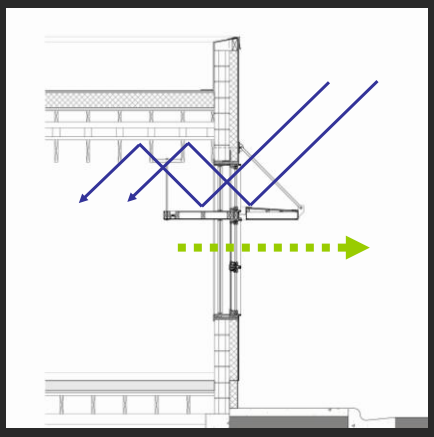
Design: Section thru Tower



- Entry towers double as mechanical rooms for evaporative cooling

HIGH PLAINS ARCHITECTS

Design: Typical Wall Section

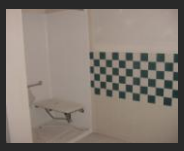


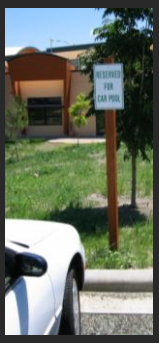
Light Shelf:

- reflects daylight onto ceiling plane on top
- Shades window on bottom for glare-free view

HIGH PLAINS ARCHITECTS

Site : Alternative Transportation





Bicycle Commuters

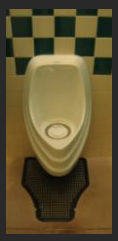
- Covered bike racks
- Showers

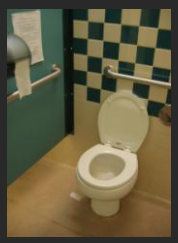
Auto Commuters

- Designated parking for carpools
- Hybrid vehicle for organization

HIGH PLAINS ARCHITECTS

Water : Efficiency Measures





Native Planting

- Drought resistant
- Uses drip irrigation system
- Water use reduced by more than 50%

Waterless Urinal

- Name says it all

Microflush Composting Toilets

- 1 pint per flush
- Water trap prevents odors, vectors
- Saves 30,000 gallons per year

HIGH PLAINS ARCHITECTS

Energy : Efficient Mechanical Systems

Evaporative Cooling

- 5x as efficient as refrigeration air conditioning
- Ideal in Montana's dry climate
- healthier: 100% outside air

Radiant Heating

- approximately 20% more efficient than air-based heating systems
- more comfortable—no drafts or heat stratification

HIGH PLAINS ARCHITECTS

Energy : Renewable Sources

Photovoltaic Panels

- 9.9 kW system generates 53% of total electricity use (32% of total energy cost—natural gas & electricity)

Solar Hot Water Panels

- estimated to reduce total building energy usage 5-10% (not modeled)

HIGH PLAINS ARCHITECTS

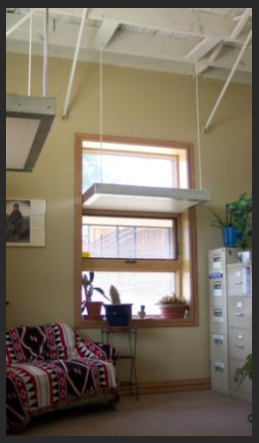
Daylighting: from the Exterior

Typical Light Shelf

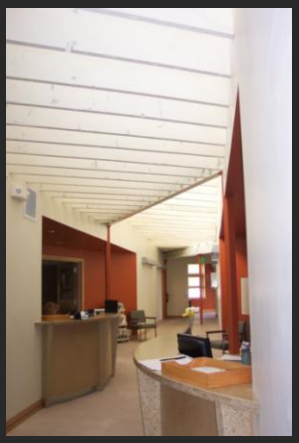
Virtual Bays & Clerestory Monitors

HIGH PLAINS ARCHITECTS

Daylighting: from the Interior



Office with daylight from Light Shelf

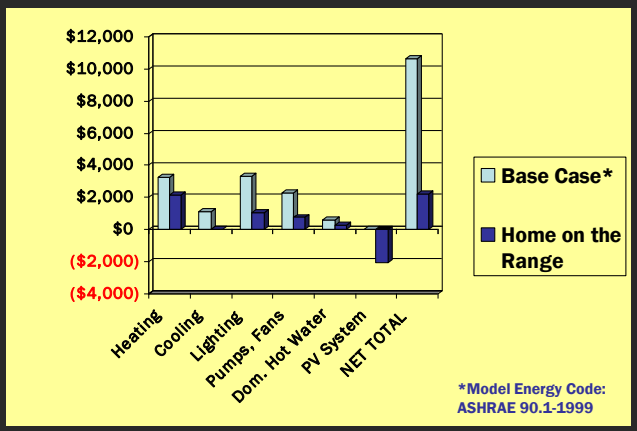


Gallery with daylight from Clerestory Monitor

HIGH PLAINS ARCHITECTS

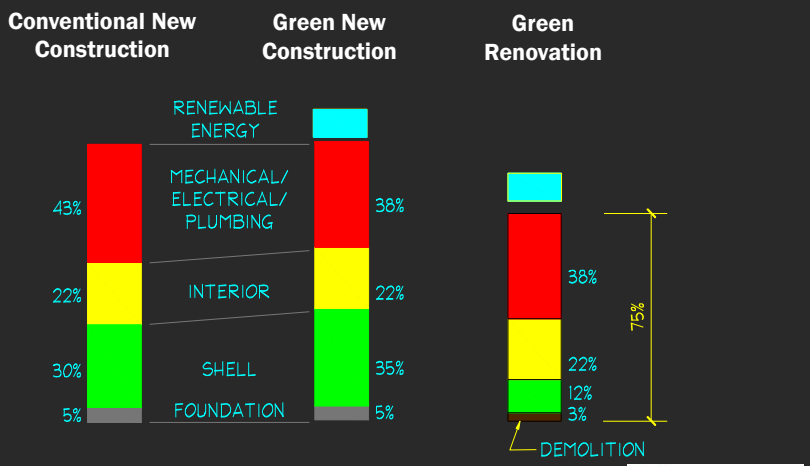
Energy Modeling: Post Construction

Annual Energy Cost Comparison ($)



HIGH PLAINS ARCHITECTS

Green Building: shifting rather than increasing upfront costs



HIGH PLAINS ARCHITECTS

Green Building: Capital Costs

Conventional Approach (Estimates*)			Green Building Approach (HOTR Actual)	
Property	$ 182,500		$ 182,500	Property
Professional Services (10%)	$ 134,790		$ 122,000	Professional Services
Demolition	$ 70,500		$ 15,000	Deconstruction (partial)
New Construction	$ 1,156,700		$ 839,200	Renovation
-			$ 66,200	Alternative Energy Systems
Site	$ 191,200		$ 165,700	Site Improvements
-			$ 12,800	LEED-related costs & fees
TOTAL CAPITAL COSTS	**$1,735,690**		**$1,403,400**	**TOTAL CAPITAL COSTS**

*Estimates from 2006 RS Means Building Construction Cost Data based on 8,300 SF commercial office @ $135/SF w/ 1,200 SF basement @ $30/SF

HIGH PLAINS ARCHITECTS

Capital + Operating Costs*

	Baseline Office Building meeting Model Energy Code**	Home on the Range
TOTAL CAPITAL COSTS	**$1,735,190**	**$1,403,400**
$331,790 capital savings		
Capital + 10 years of Operation Costs	$1,863,183	$1,429,813
$331,790 capital savings + $101,580 operational savings = $433,370		
Capital + 20 years of Operation Costs	$2,051,903	$1,468,912
$331,790 capital savings + $251,201 operational savings = $582,991		
Capital + 30 years of Operation Costs	$2,331,256	$1,526,787
$331,790 capital savings + $472,679 operational savings = $804,469		

* All figures assume annual 4% energy escalation rate

**ASHRAE 90.1-1999 modeled using eQuest energy software

HIGH PLAINS ARCHITECTS

Home on the Range: LEED by the numbers

Sustainable Site

- Provides alternative transportation amenities for bicyclists, carpoolers, & a hybrid vehicle
- 100% of stormwater treated on-site
- Minimizes urban heat island effect

Water Efficiency

- 50% less irrigation water for landscaping
- 90% less wastewater
- 60% less potable water

Energy & Atmosphere

- 79% less energy used (by value)
- 52% of electricity generated on-site
- 100% of remaining electricity from wind sources for one year

HIGH PLAINS ARCHITECTS

Home on the Range: LEED by the numbers

Materials & Resources

- 95% of existing building reused
- 92% of construction & demolition waste diverted from landfill (by weight)
- 16% of materials were salvaged (by value)
- 10% of materials have recycled content (by value)
- 23% of materials from sources within 500 miles (by value)
- 60% of wood from FSC certified forests

Indoor Environmental Quality

- 100% outside air used to cool building
- 100% of materials contain no urea formaldehyde
- 100% of regularly occupied rooms have high levels of daylight and views outside

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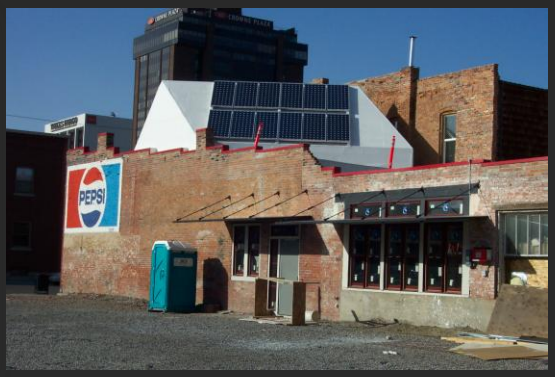
HIGH PLAINS ARCHITECTS

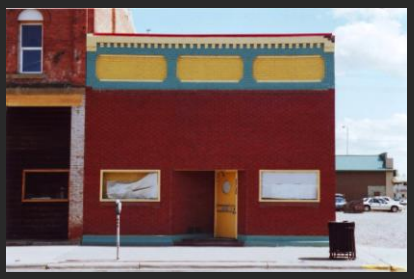
HIGH PLAINS ARCHITECTS

Klos Building Remodel



HIGH PLAINS ARCHITECTS

Klos Building Remodel

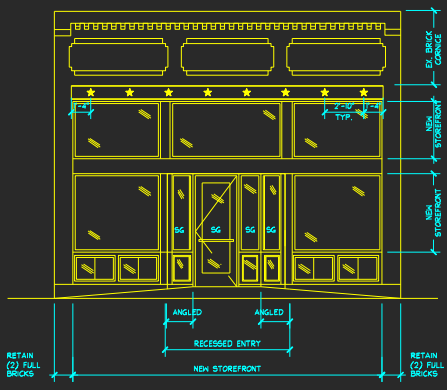


Existing Klos Building:
- 1893 construction
- Unfortunate mid-century façade change
- No floor
- But roof & wall are OK

Another unlikely LEED candidate

HIGH PLAINS ARCHITECTS

Klos Building Remodel



Klos Building – proposed façade changes

Klos Building Green Measures

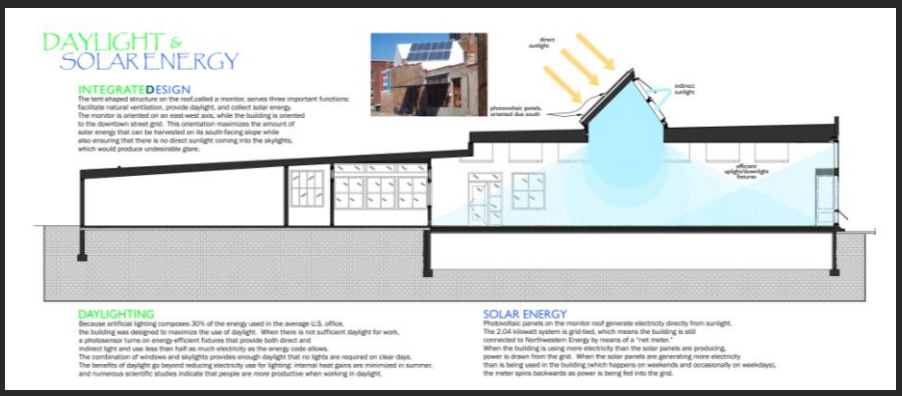
1. Super-insulating attic, rigid insulation under drywall
2. Low-E glazing in windows
3. Advanced daylighting strategies
4. Natural ventilation
5. Radiant floor heating
6. Evaporative cooling
7. Rainwater collection
8. Photovoltaic panels
9. 100% fly ash & recycled glass concrete slab
10. Extensive salvaged doors, trim

HIGH PLAINS ARCHITECTS

Klos Building Remodel

Rooftop Monitor:

- Facilitates natural ventilation
- Provides north-facing daylight
- Mounting surface for 2.04 kW photovoltaic array

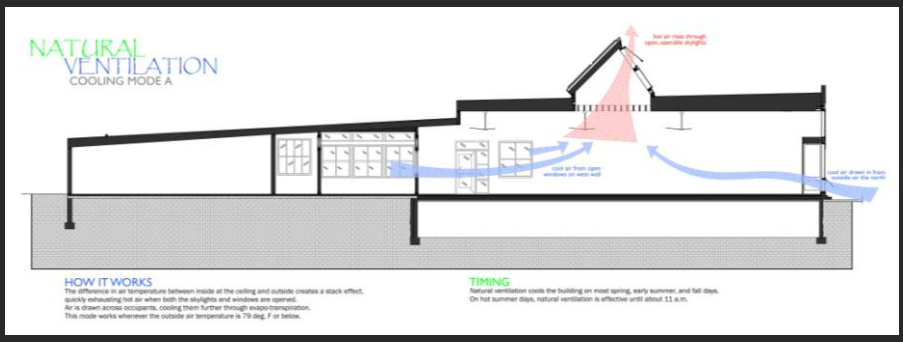


HIGH PLAINS ARCHITECTS

Klos Building Remodel

Cooling Mode A:

- Stack ventilation with monitor skylights and windows
- Completely passive
- Works all day in early summer and fall; works until approximately 11 am on hot summer days



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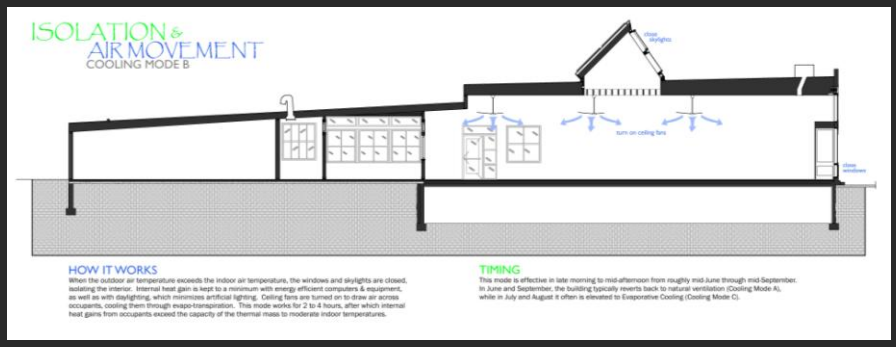
HIGH PLAINS ARCHITECTS

Klos Building Remodel

Cooling Mode B:

- Close windows & operable skylights in monitor
- Turn on ceiling fans
- Works for about 3-4 hours, then Cooling Mode A or Cooling Mode C, depending on outside temp.



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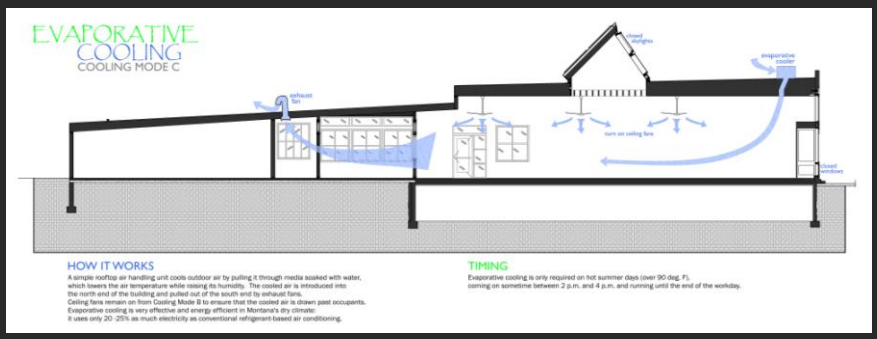
Klos Building Remodel

Cooling Mode C:

- Evaporative cooling
- Keep ceiling fans on, windows closed
- Rooftop unit dumps cool air in front, and exhaust fans pull it out at rear of office

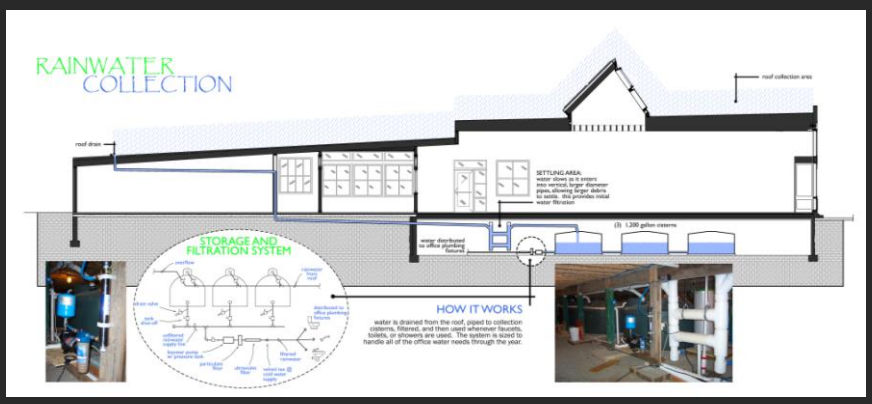


HIGH PLAINS ARCHITECTS

Klos Building Remodel

Rainwater Collection System:

- 3,000 sq. ft. roof collection area
- 3,600 gallon cistern storage
- Provides 100% of annual office needs



HIGH PLAINS ARCHITECTS

Klos Building Remodel

Crawlspace with collection tanks, booster pump, particulate and UV filters. Sediment catcher in foreground.

HIGH PLAINS ARCHITECTS

Klos Building Remodel

Currently compiling LEED documentation.

Gold or Platinum certification is anticipated.

HIGH PLAINS ARCHITECTS

Klos Building Remodel: LEED by the numbers

Sustainable Site

- Provides alternative transportation amenities for bicyclists, carpoolers, & a hybrid vehicle
- 100% of stormwater used on-site
- Development density & community connectivity

Water Efficiency

- 100% of water from rainwater

Energy & Atmosphere

- 66% less energy used than code (by value)
- 28% of electricity generated on-site
- 100% of remaining electricity from wind sources for one year

HIGH PLAINS ARCHITECTS

Klos Building Remodel: LEED by the numbers

Materials & Resources

- 95% of existing building reused
- 66% of construction & demolition waste diverted from landfill (by weight)
- 21% of materials were salvaged (by value)
- 11% of materials have recycled content (by value)
- 36% of materials from sources within 500 miles (by value)
- 6% of materials from rapidly renewable sources (by value)

Indoor Environmental Quality

- 100% outside air used to cool building
- 100% of materials contain no urea formaldehyde
- 100% of regularly occupied rooms have high levels of daylight and views outside

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HIGH PLAINS ARCHITECTS

Swift Building Lofts

- Conversion of 1916 refrigerated warehouse into 9 loft apartments
- Seeking LEED for Homes Platinum certification

HIGH PLAINS ARCHITECTS

Swift Building Lofts

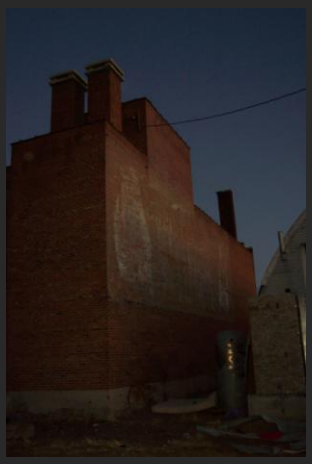
Existing first floor

Green Building Measures

1. Superinsulate roof and walls
2. Low-E glazing in windows
3. Radiant floor heating
4. Radiant floor cooling
5. Dual flush toilets, 1.6 gpm showerheads
6. Rainwater collection
7. Solar hot water panels (120 SF of collector area)
8. Photovoltaic panels (4 kW array)
9. Extensive salvaged doors, trim
10. FSC certified wood interior framing

HIGH PLAINS ARCHITECTS

Swift Building Lofts



33% reduction in Potable Water compared to code baseline

- 23% reduction due to fixture efficiency
- 10% reduction due to using rainwater and well water for toilet flushing

HIGH PLAINS ARCHITECTS

Costs & Benefits of Green Building

Cost Shifting

- Applying Integrated Design Process & End Use / Least Cost Planning
- No higher upfront cost

Life Cycle

- Using higher quality, more durable materials and higher efficiency mechanical equipment
- Higher upfront cost, but also higher value (ie. lower cost per year of product lifetime or total efficiency savings over life exceeds incremental upfront cost
- These types of investments may have much higher returns than stock market with lower risk

HIGH PLAINS ARCHITECTS

Costs & Benefits of Green Building

Reduced Risks

- Improving Indoor Environmental Quality with non-toxic, healthier materials and better ventilation
- Perhaps minor higher upfront costs, which are offset by reduced liability for sick building syndrome or employee sick time

Productivity

- Improving Indoor Environmental Quality with daylighting and views
- Potentially higher upfront costs, but savings through improved employee productivity or resident comfort are calculated to exceed all other financial benefits (reduced utilities, O&M, etc.) by more than 2x (Greg Kats, Capital E, 2003)

Costs & Benefits of Green Building

Internalizing Externalities

- Benefits are not directly realized by owner
- Big Picture, influenced by public policy
- Benefits to society include:
  1. Avoided environmental remediation costs (mine reclamation, Superfund toxic cleanups, loss of wildlife due to pollution)
  2. Avoided medical expenses (asthma, cancer, etc.)

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Costs & Benefits of Green Building

Internalizing Externalities

- **Benefits to society, continued:**
  3. **Avoided global climate change costs (levees, forest fires, drought relief, flood insurance, etc.)**
  4. **Avoided political and financial costs of securing foreign energy sources (eg. War in Iraq)**

HIGH PLAINS ARCHITECTS

Energy & Water Relationship

Electricity use in California:

California consumes about 250 Billion kWh/yr

Up to 50 Billion kWh/yr is related to water

Thus, water-related energy use is about 20% of total electric consumption in California

Source: Southern California Edison

HIGH PLAINS ARCHITECTS

Energy & Water Relationship

How is Energy Used with Water?

1. Increase Water Quality
2. Increase Elevation or Pressure (potential energy)
3. Increase Water Temperature

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Energy for Water Treatment

Water treated by U.S. public water systems each day: 43 billion gallons Source: US EPA

Electricity to treat public water & sewage each day: 153,425 kilowatt-hours (kWh) Source: US EPA

Thus, 3.56 watt-hours (Wh) are required for each gallon of water

3.5 gallons / flush

=

7 min. 30 sec.

1.2 gallons / flush

=

60 watt bulb

2 min. 45 sec.

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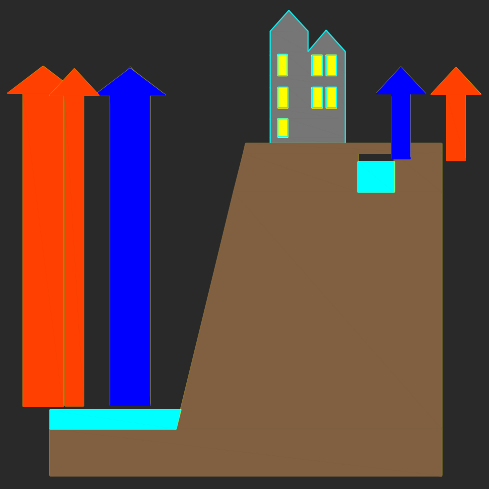
Energy for Water Treatment

Strategies for reducing water treatment energy:

1. Use less water through efficiency & conservation
2. Match water quality to end use

HIGH PLAINS ARCHITECTS

Energy for Pumping



The greater the elevation difference, the more pump energy required

- Municipal
- Well

Strategies for reducing pumping water:

1. Use less water through efficiency & conservation
2. Use rainwater & greywater

HIGH PLAINS ARCHITECTS

Energy for Water Heating

Strategies for reducing water heating energy:

1. Use less hot water through efficiency & conservation
2. Use high efficiency water heaters and boilers (+90%)
3. Solar hot water panels