



ALTERNATIVE SYSTEMS DESIGN REVIEW

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The Building **STIMULUS**
THE GREEN BUILDING SPECIALISTS

Overview

- Enclosure
- Daylighting Study
- “Double Skin” Facades
- Air Distribution: Chilled Beams
- Alternative Energy Sources
- Alternative Floor Systems

Enclosure

Existing Enclosure: Precast Panels



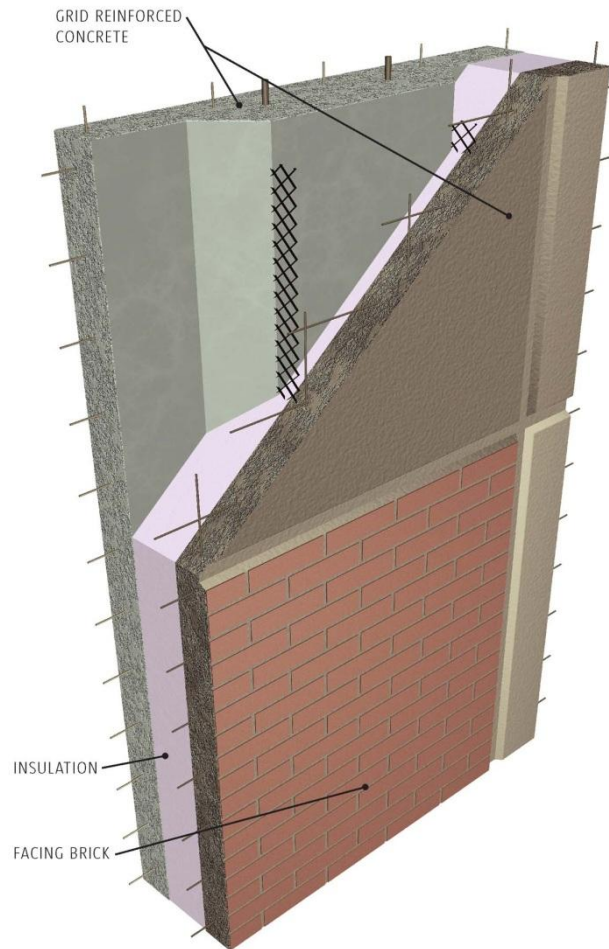
□ Advantages

- Variety of finishes
- Customizable
- Shortens Schedule

□ Disadvantages

- Adds significant dead-load to structure (1.088 Kip/LF)
- Additional on-site equipment
- \$65.00 / SF

Alternative #1: Precast Panel w/Carbon Fiber Reinforcement



□ Advantages

- Variety of finishes
- Customizable
- Significant weight reduction

□ Disadvantages

- Additional on-site equipment
- Additional costs

Alternative #2:

Architectural Metal Panels



□ Advantages

- Variety of metallic finishes
- Significant weight reduction
- Quick installation
- \$35.00 / SF

□ Disadvantages

- Change in architecture
- Change in thermal conductivity
- Sub frame and Scaffolding

Alternative #3:

Glass Curtain Wall



□ Advantages

- Significant weight reduction
- \$45.00 / SF
- Quick installation

□ Disadvantages

- Change in architecture
- Change in thermal conductivity
- Sub frame needed

Final Recommendation

- Utilize Benefits of Alternatives
 - ▣ Shorten Schedule
 - ▣ Cost Savings
 - ▣ Weight Reduction
- Work Around Disadvantages of Alternatives
 - ▣ On-Site Coordination
 - ▣ Change in Architecture
 - ▣ Thermal Study on Façade with New Loads

- Replace Precast with Carbon Fiber Reinforcement
- Expand on Metal Panel and/or Glass Curtain Wall

Existing Daylighting Study

Glazing

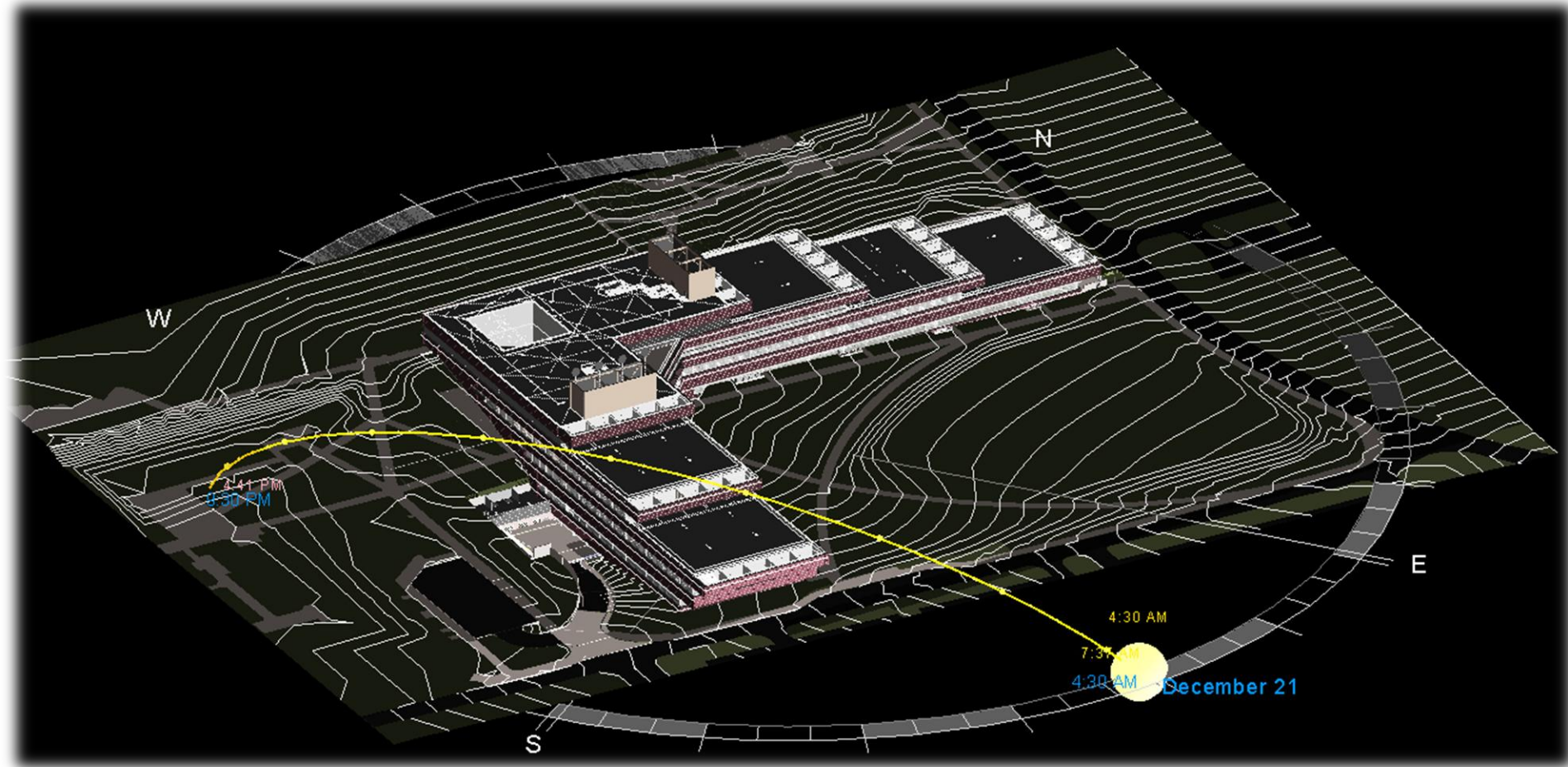
Non-Fritted Lower Glazing (GL-1)

- Viracon: VE1-2M
 - LSG = 1.84
 - Transmittance
 - 70% Visible
 - 32% Solar
 - 10% U-V
 - U-Value
 - Winter: 0.29
 - Summer: 0.26
 - SHGC = 0.38

Fritted Upper Glazing (GL-2)

- Viracon: VE1-2M - 40% Frit
 - LSG = 1.67
 - Transmittance
 - 45% Visible
 - 23% Solar
 - 6% U-V
 - U-Value
 - Winter: 0.29
 - Summer: 0.26
 - SHGC = 0.28

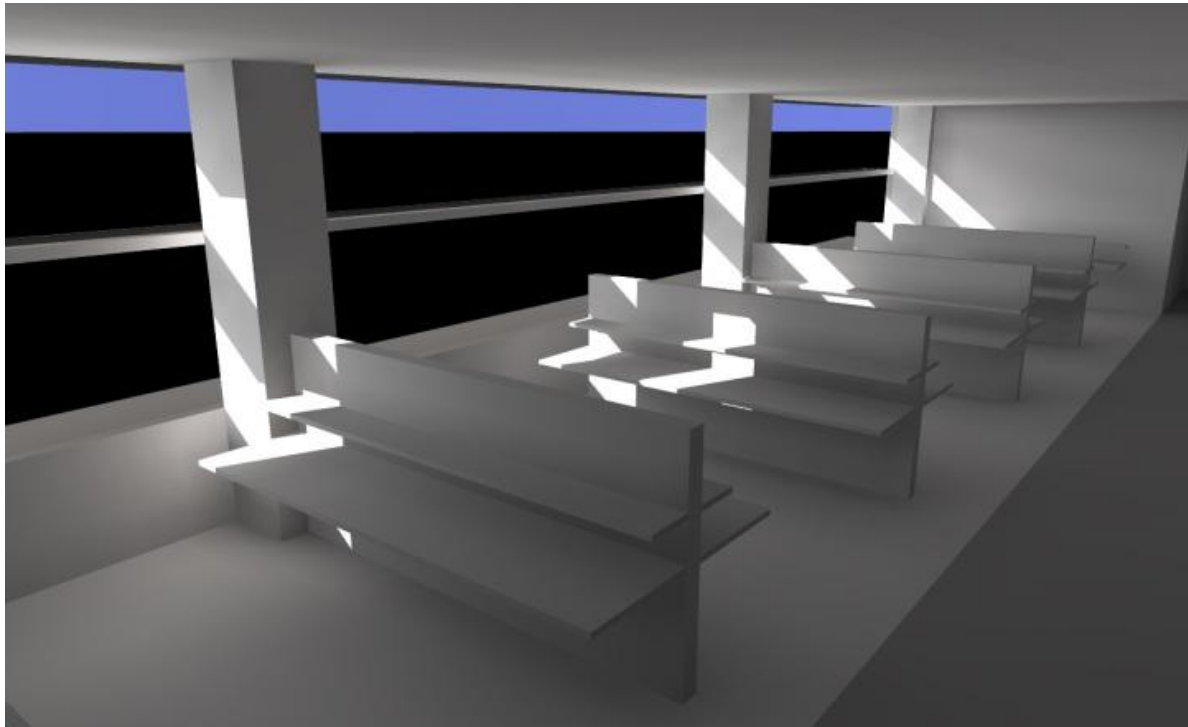
December 21 Sunpath



Daylighting Issues

□ Winter Months

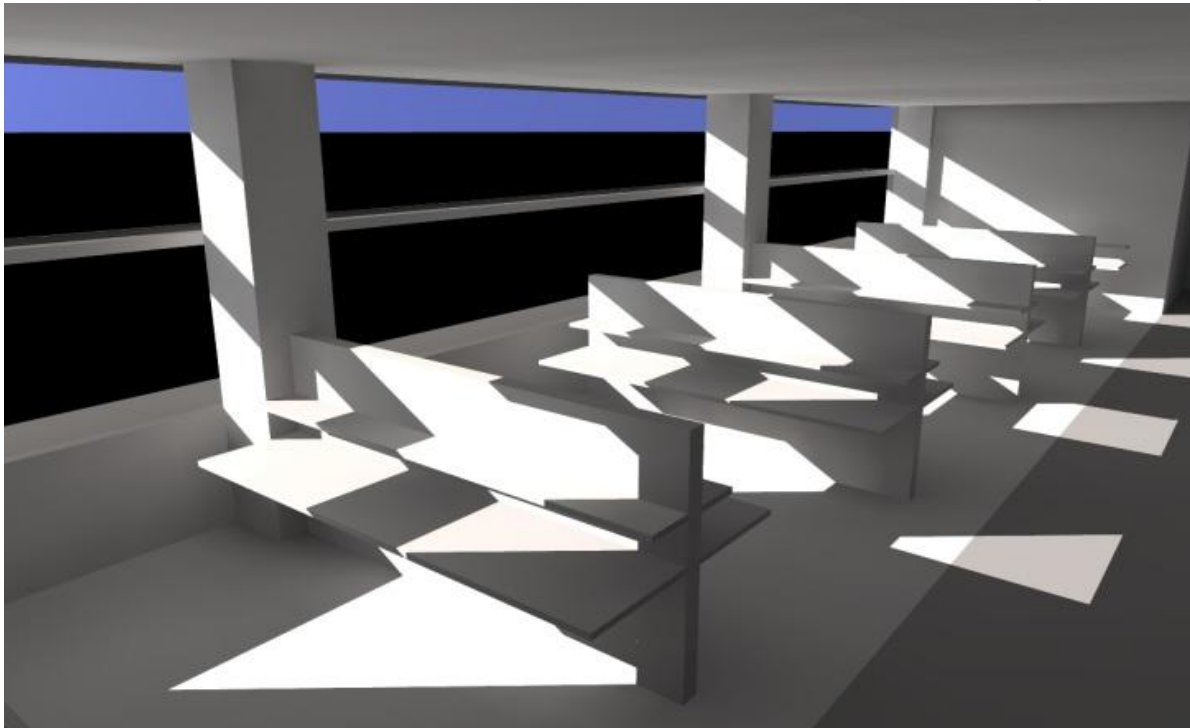
- Southwest Facing Life Science Wing: (12/21 – 10:00A)



Daylighting Issues

□ Winter Months

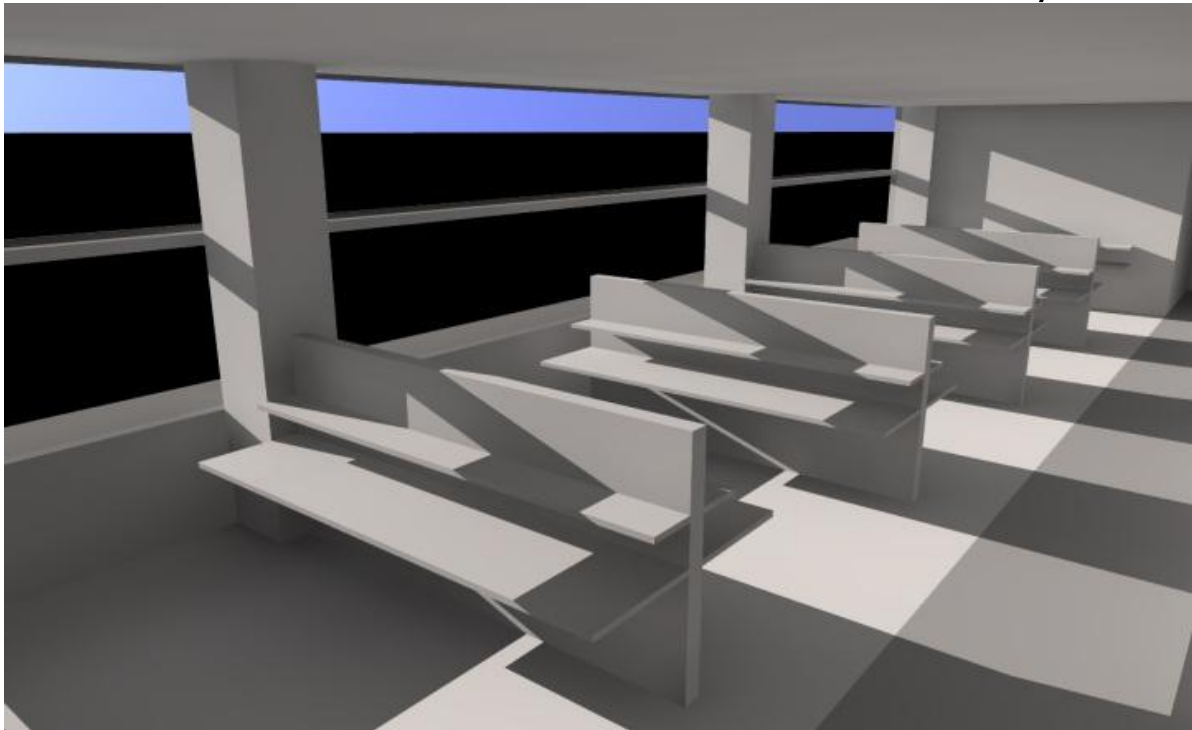
- Southwest Facing Life Science Wing: (12/21 – 12:00P)



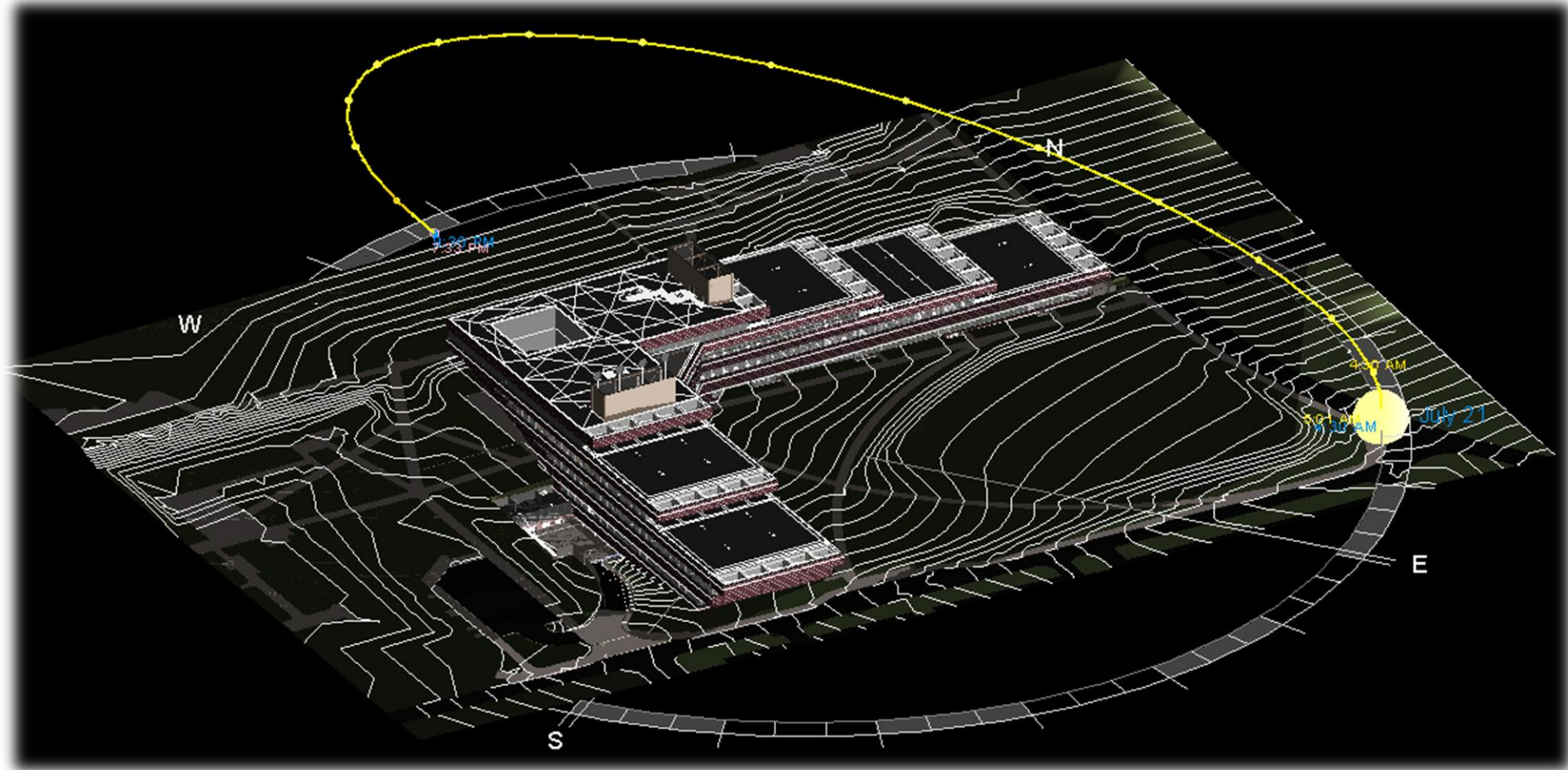
Daylighting Issues

□ Winter Months

- Southwest Facing Life Science Wing: (12/21 – 2:00P)



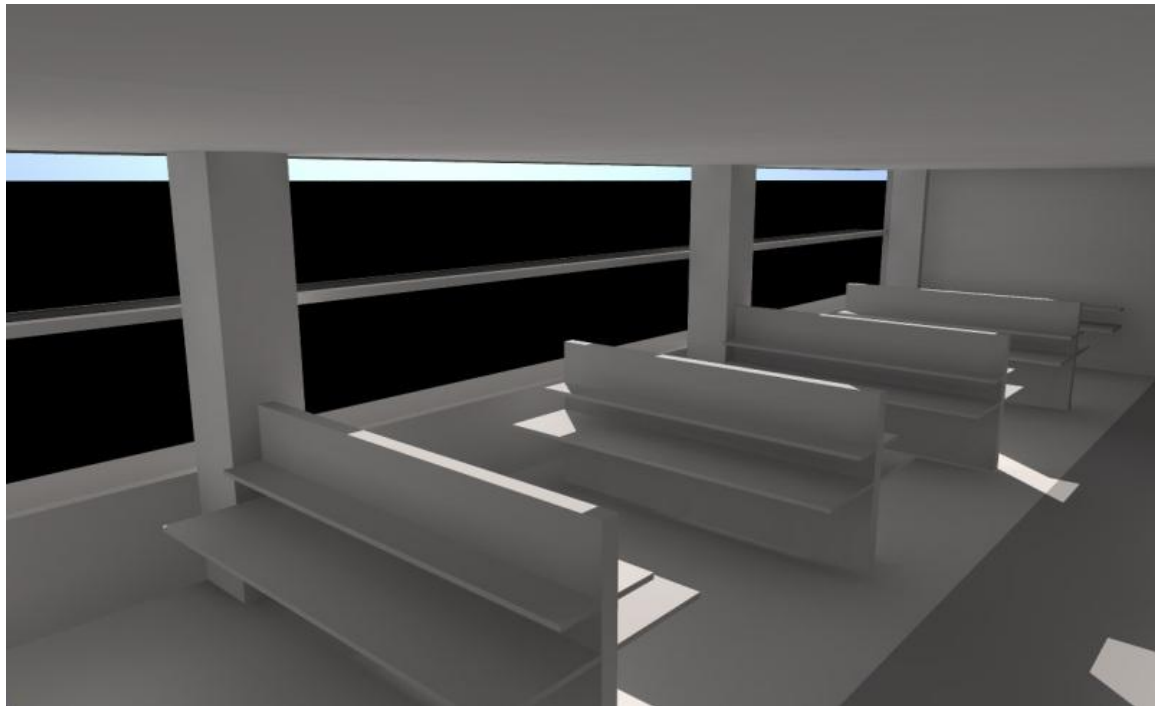
July 21 Sunpath



Daylighting Issues

□ Summer Months

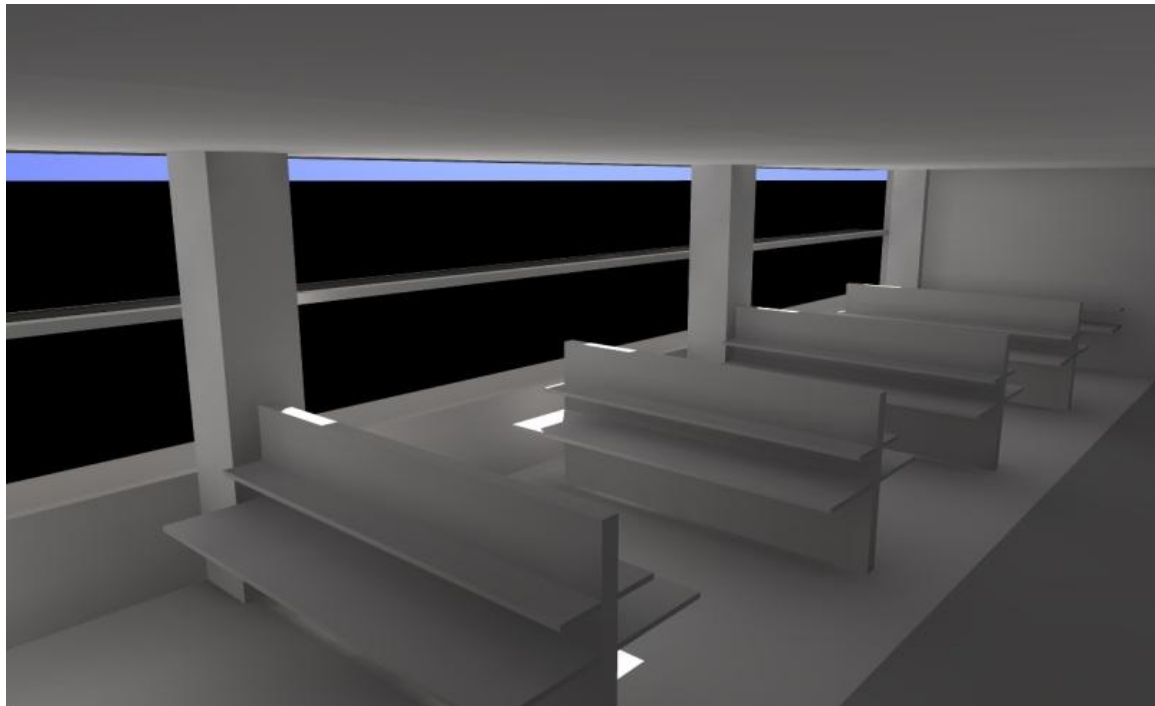
- ▣ Southeast Facing Mat. Science Wing: (7/21 – 6:30A)



Daylighting Issues

□ Summer Months

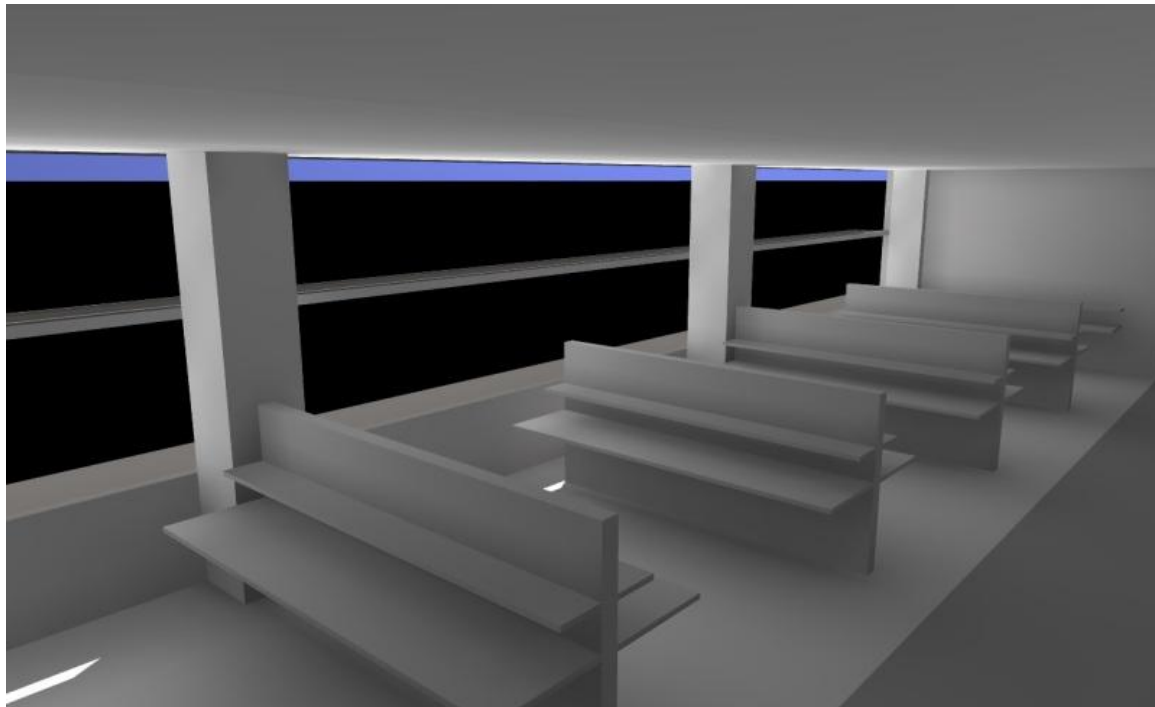
- ▣ Southeast Facing Mat. Science Wing: (7/21 – 7:30A)



Daylighting Issues

□ Summer Months

- Southeast Facing Mat. Science Wing: (7/21 – 8:30A)



Current Daylight Design

Advantages

- ❑ Visual uniformity
- ❑ Lightweight
- ❑ Somewhat easy installation
- ❑ Cost vs. Alternatives

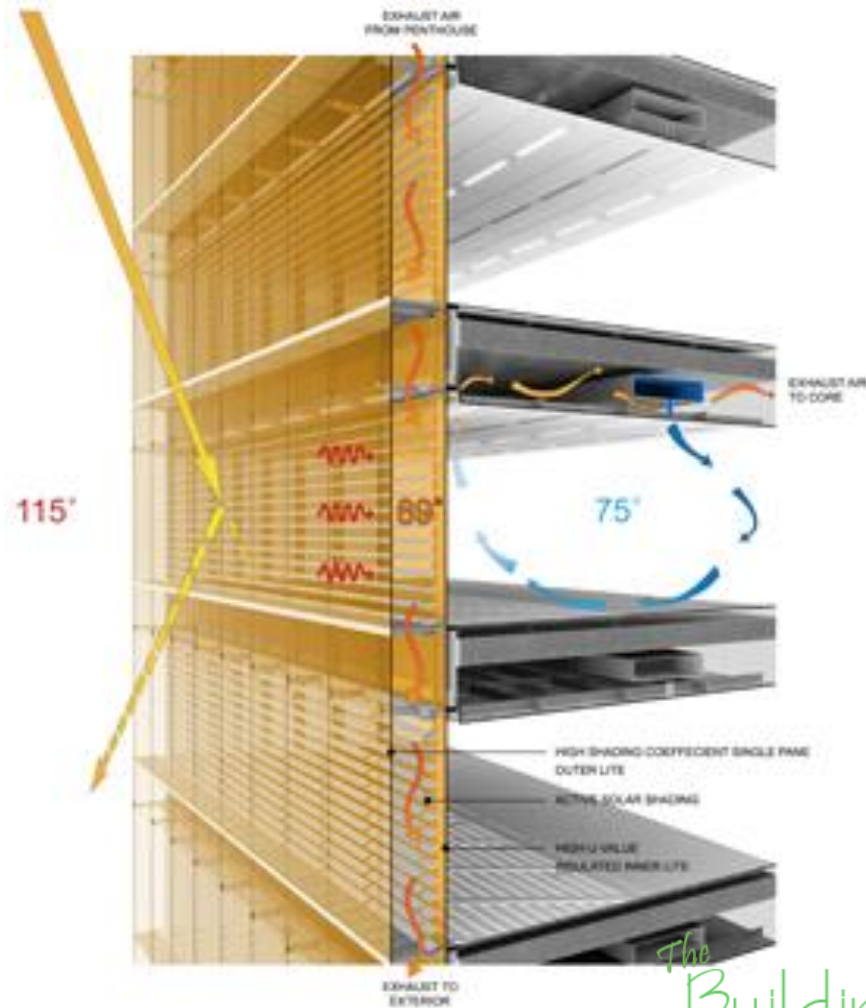
Disadvantages

- ❑ Not designed for specific orientations.
- ❑ No low solar angle shading
- ❑ High heat gain at low solar angles



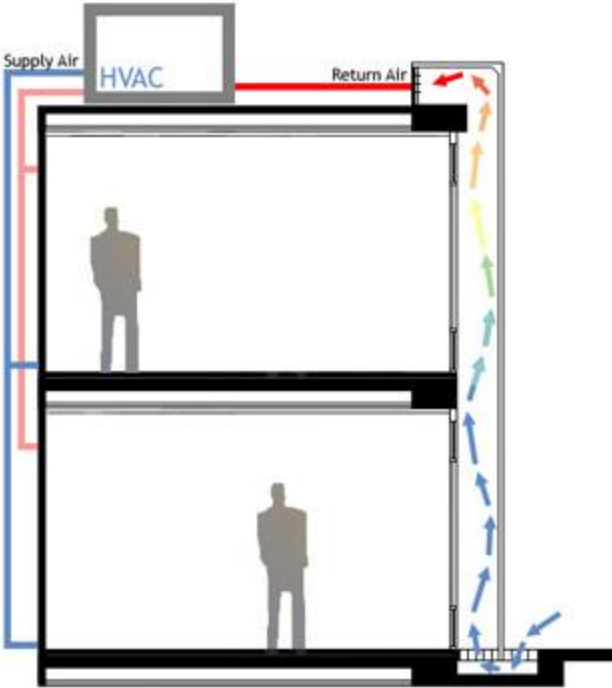
“Double Skin” Facade

Double Skin Façade

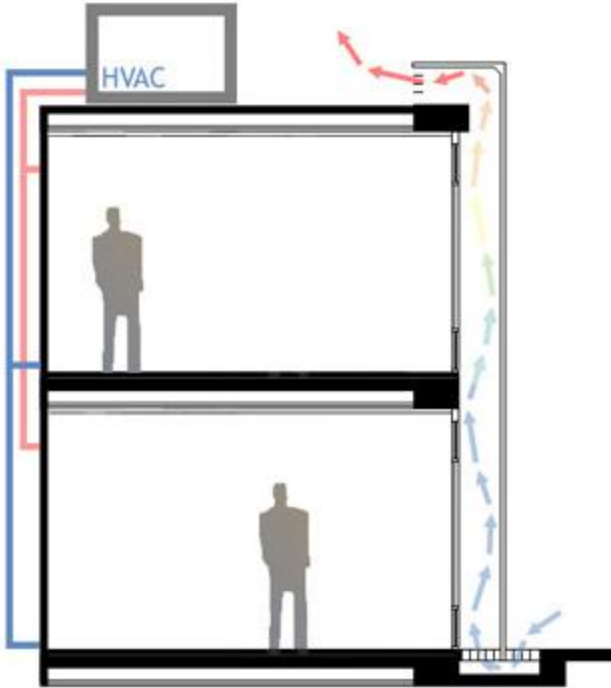


Double Skin Façade

Heat Recovery

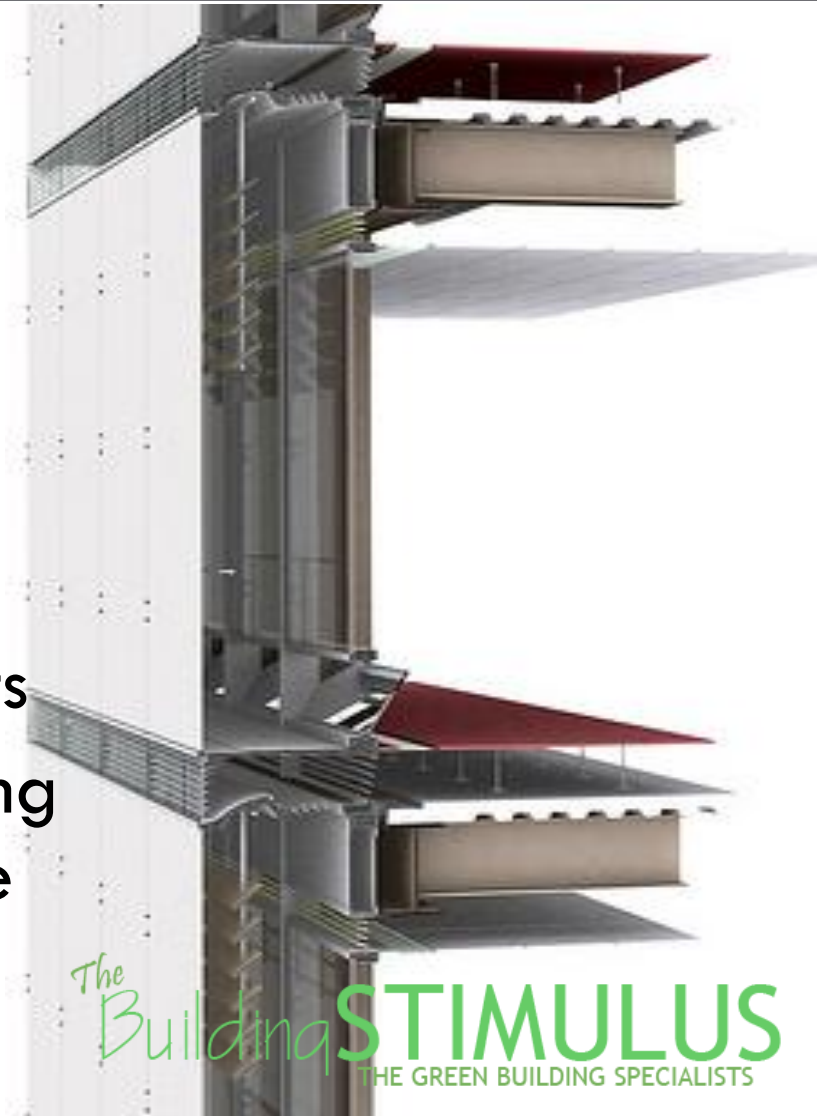


Heat Extraction



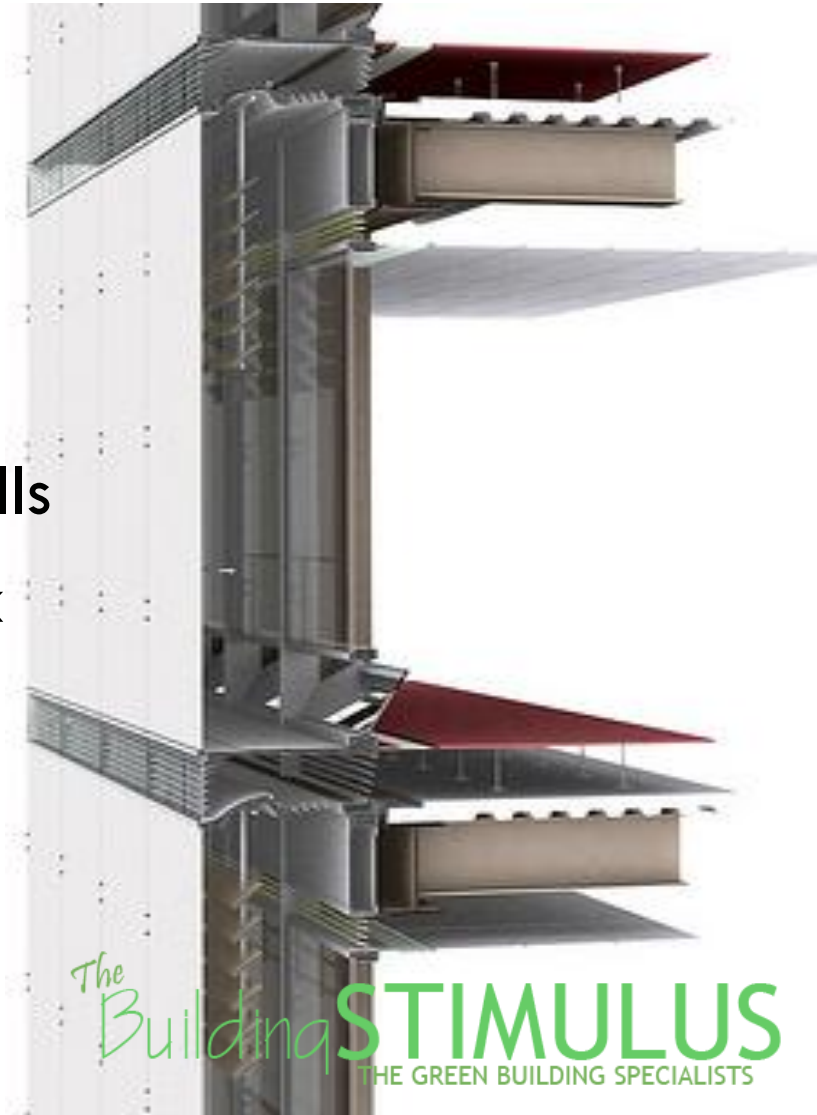
Double Skin Façade: Advantages

- Increased Acoustic Insulation
- Increased Thermal Insulation
- Reduced Energy Use
- Shading and Lighting Device Protection
- Maintain exterior uniformity
- Reduced wind pressure effects
- Create individual solar shading techniques for specific façade orientations



Double Skin Façade: Disadvantages

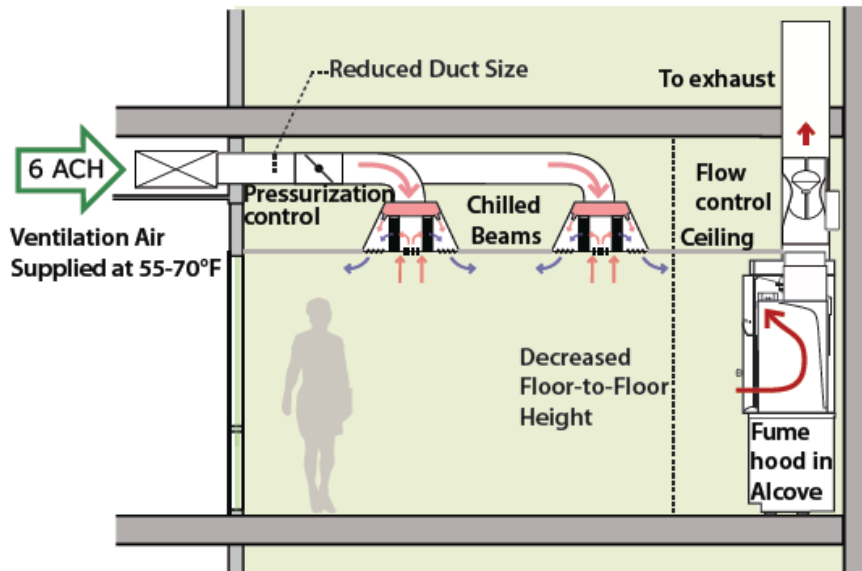
- ❑ Higher construction cost
- ❑ Reduced occupied space
- ❑ Overheating
- ❑ Increased construction weight compared to typical curtain walls
- ❑ Possible issues maintaining brick face façade



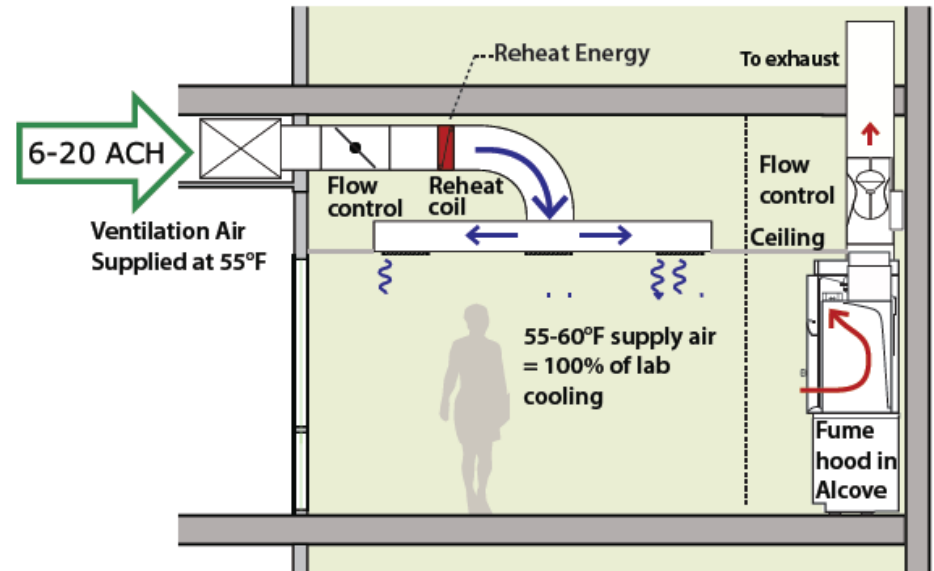
Air Distribution: Chilled Beams

Chilled Beams

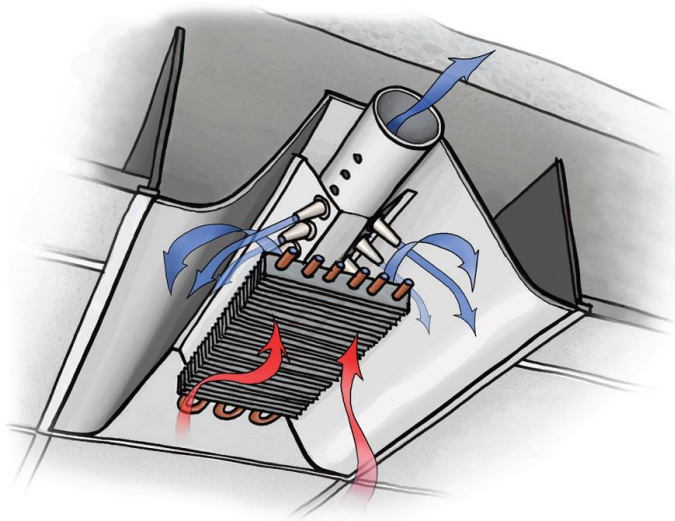
Chilled Beam System



VAV-Reheat System

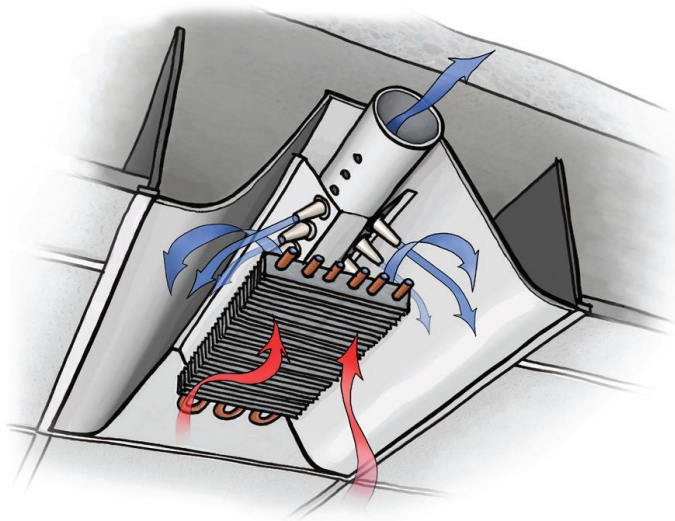


Chilled Beams: Advantages



- ❑ Reduced floor to floor height—increased plenum space
- ❑ Reduced duct sizes
- ❑ Reduced fan energy
- ❑ Reduced AHU sizes
- ❑ Decoupled heating and cooling / ventilation
- ❑ Higher chilled water and lower hot water temperatures

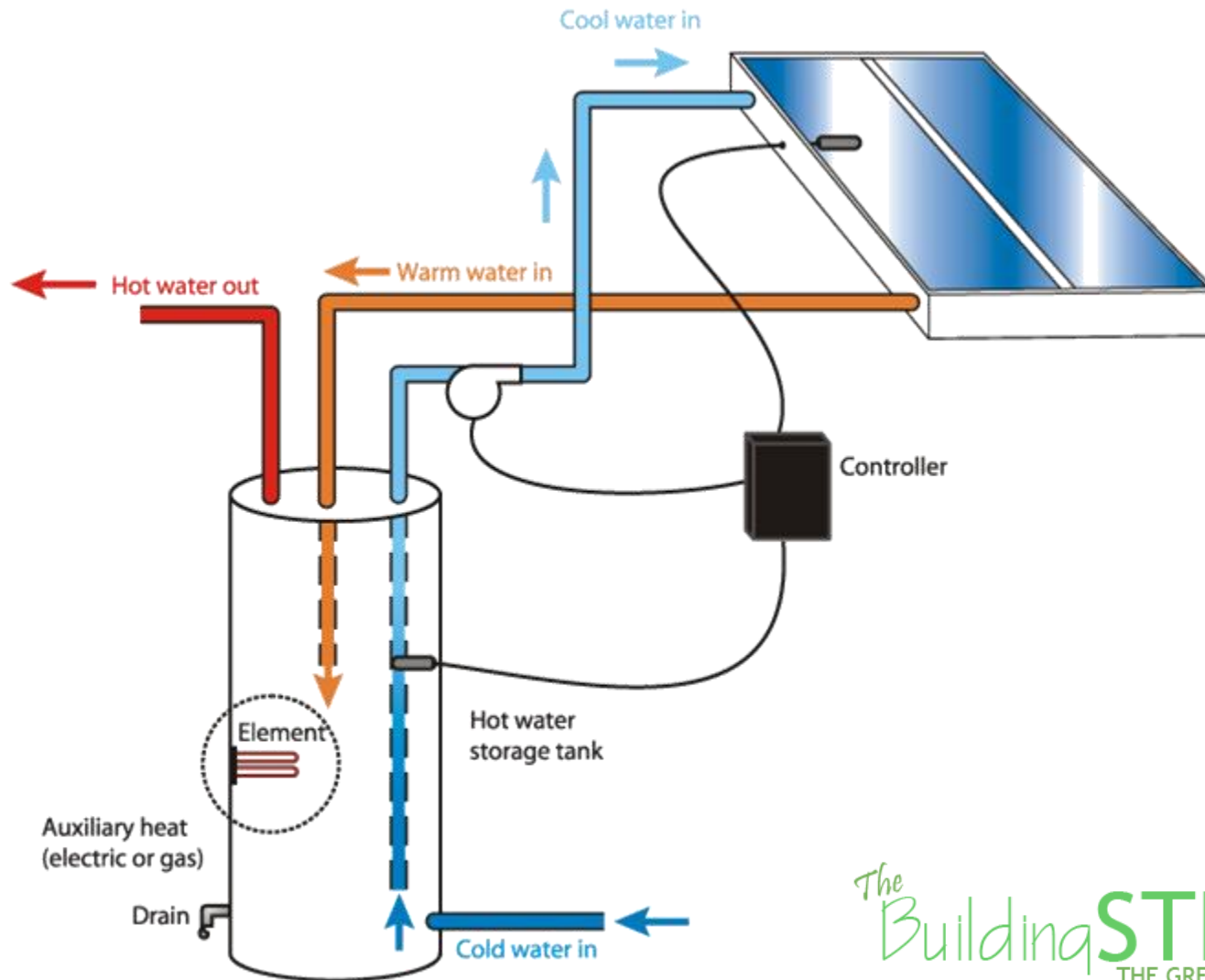
Chilled Beams: Disadvantages



- ❑ Condensation risk
- ❑ Moisture sensors required
- ❑ Additional piping
- ❑ Increased initial costs
- ❑ Minimal benefits for labs with high density of fume hoods or process exhaust
- ❑ Increased water use
- ❑ Increased pumping energy

Alternative Energy Sources

Energy Sources: Solar Thermal



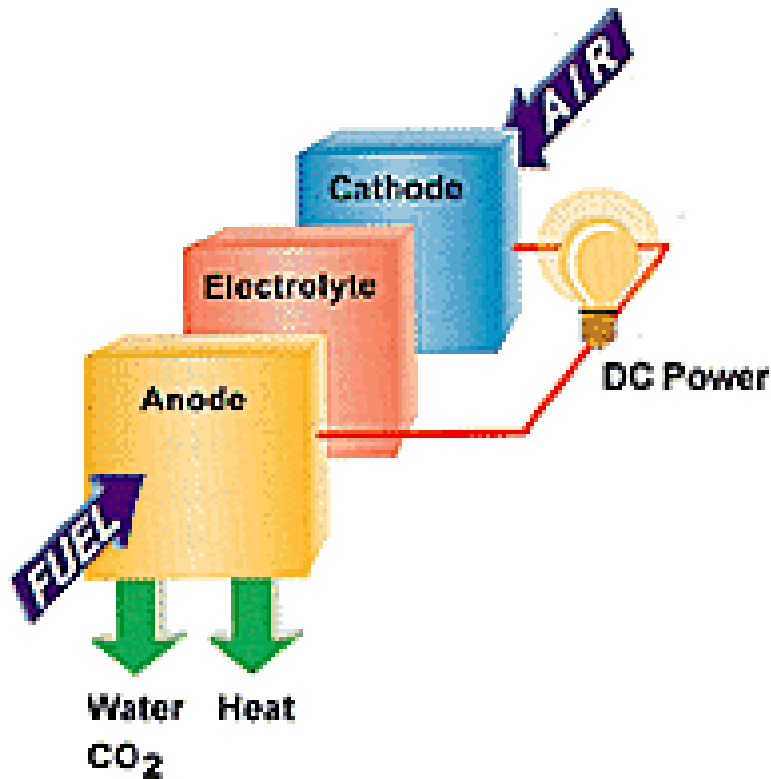
Energy Sources: Photovoltaic



Energy Sources: Wind Energy



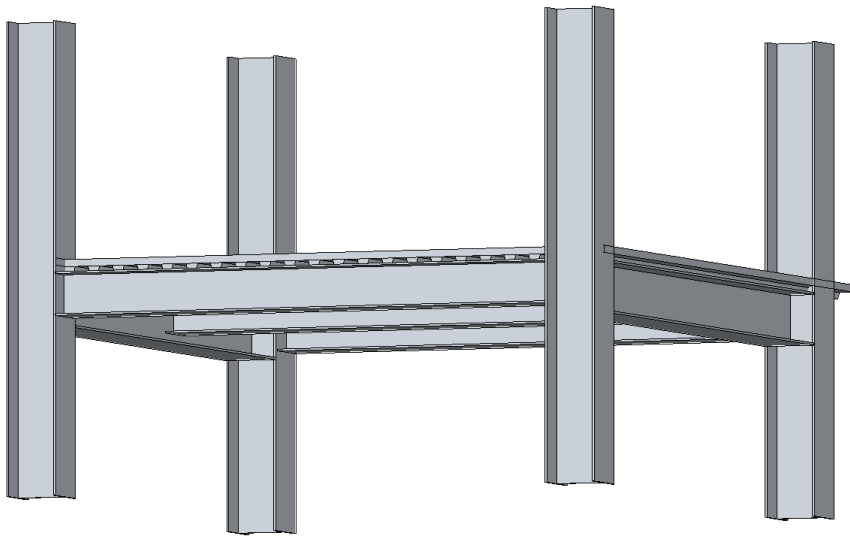
Natural Gas Powered Fuel Cells



- Minimal Emissions
- Compact Size
- 70% Efficiency
- Dependable
- Possible Tax Incentives

Alternate Floor Systems

Existing Floor System: Concrete on Metal Decking with Steel Framing



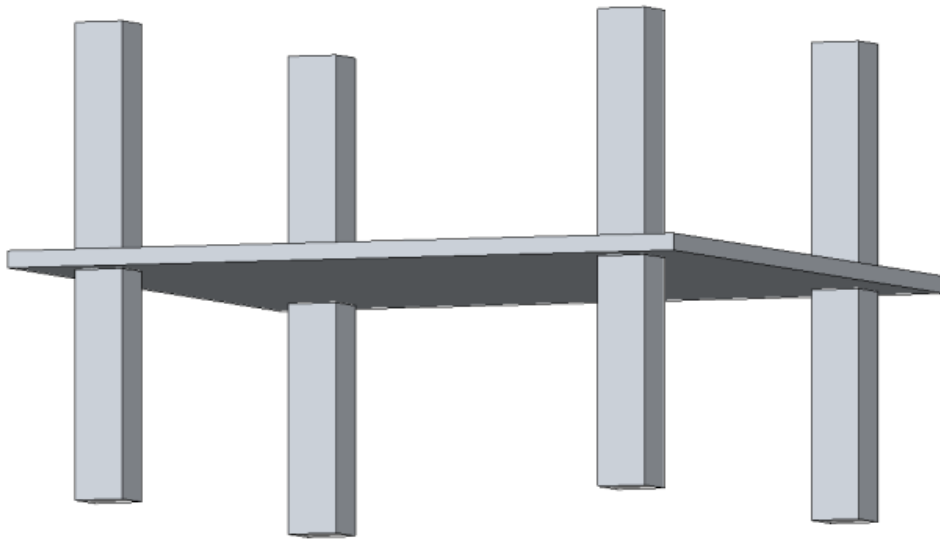
□ Advantages

- ▣ Ease of Construction
- ▣ Load Carrying Capacity
- ▣ Weight

□ Disadvantages

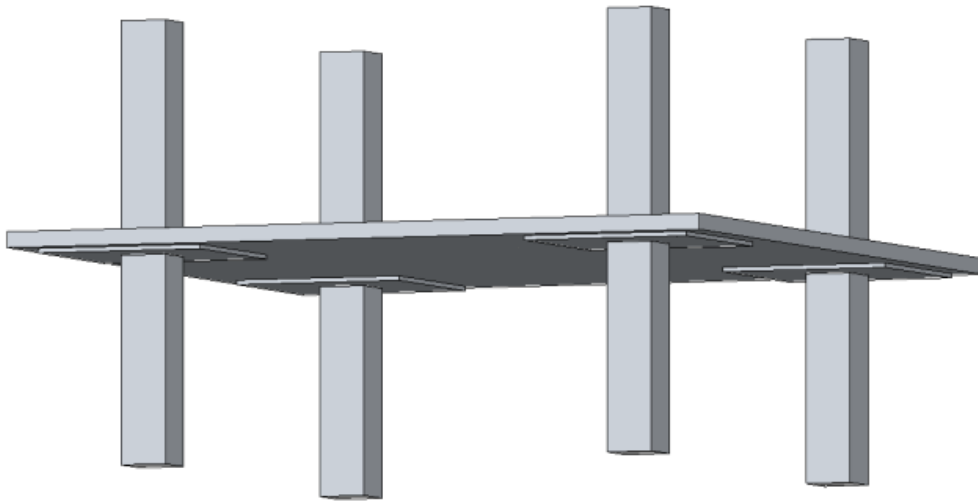
- ▣ Structure Depth

Flat Plate Floor System



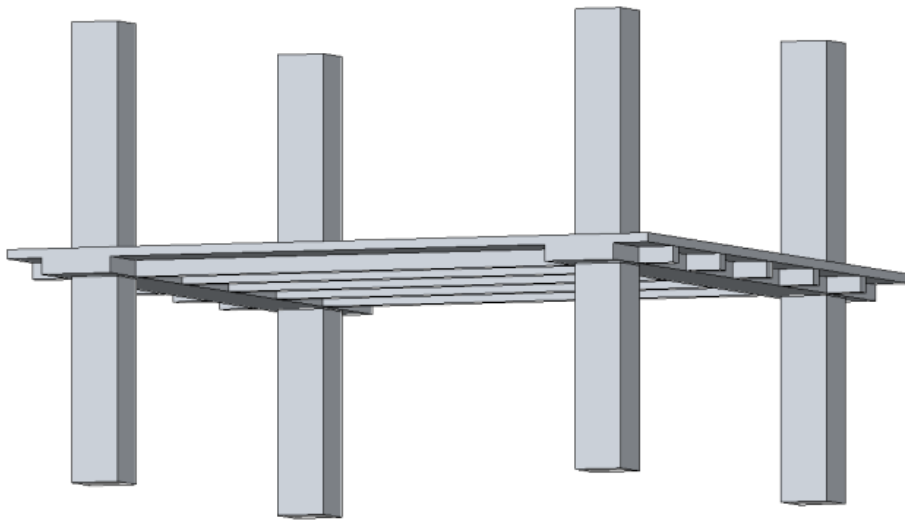
- Advantages
 - ▣ Structure Depth
 - ▣ Simple Formwork
 - ▣ Flat Soffits
- Disadvantages
 - ▣ Deflection Control
 - ▣ Punching Shear at Columns
 - ▣ Future Core Drilling

Flat Slab Floor System



- Advantages
 - ▣ Structure Depth
 - ▣ Simple Formwork
 - ▣ Relatively Flat Soffits
- Disadvantages
 - ▣ Deflection Control
 - ▣ Future Core Drilling

One-way Joist Floor System



- Advantages
 - ▣ Larger Column Spacing
 - ▣ Inherent Vibration Resistance
 - ▣ Reduced Dead Load
 - ▣ Easier Future Renovations
- Disadvantages
 - ▣ Structure Depth
 - ▣ Complexity/Availability of Formwork



Questions