

Learning Objectives

Attendees will be able to:

- Identify the role glazing plays in building energy consumption
- Apply strategies for reducing building energy consumption through changes in glazing
- Evaluate alternative building glazing schemes

Why so much glass?

Key Points I Hope to Make

- Opaque has better thermal properties than transparent, and is cheaper
- 30% glazing is adequate for daylight and views
- With reduced lighting power densities in today's buildings, daylight dimming is less effective
- Lots of glass is an aesthetic choice, not an environmental one

Environmental Building News

WHAT REALLY MATTERS IN SUSTAINABLE DESIGN & CONSTRUCTION

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Rethinking the All-Glass

Feature from **Environmental Building News**

Rethinking the All-Glass Building

Is it time to end our love affair with the all-glass building? A lot of proponents of high-performance, green design certainly think so—while other respected architects, including some leading green designers and energy experts, argue that all-glass can work well if done right.

From Shanghai to Las Vegas, Abu Dhabi to Frankfurt, highly glazed façades have been in the vanguard of high-rise, high-design

buildings for the past half-century. Some of the world's most prominent "green" skyscrapers, including New York City's One Bryant Park (the LEED Platinum Bank of America skyscraper) and the New York Times Tower, wear the mantle of green with transparent façades. But there is a high environmental cost to all that glitter: increased energy consumption. Until new glazing technologies make technical solutions more affordable, many experts suggest that we should collectively end our infatuation with heavily glazed, all-glass buildings.

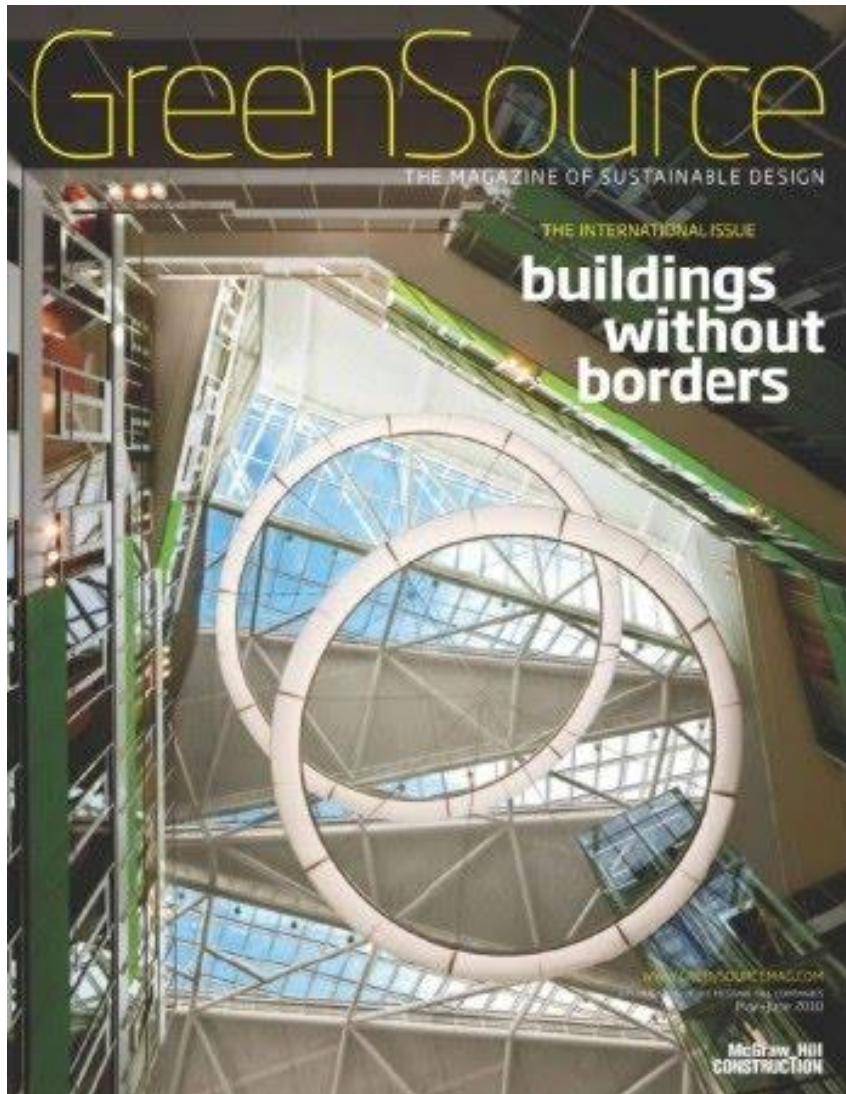
Why Are Glass Buildings So Popular?

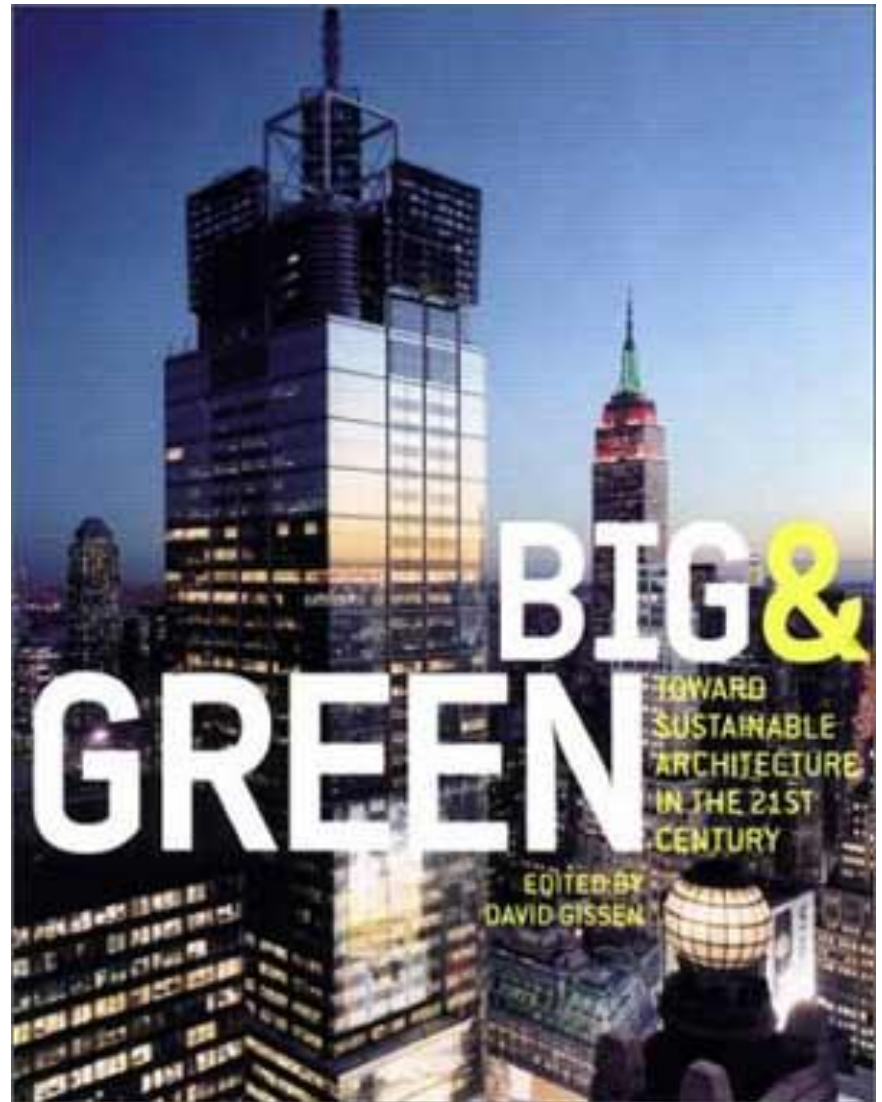
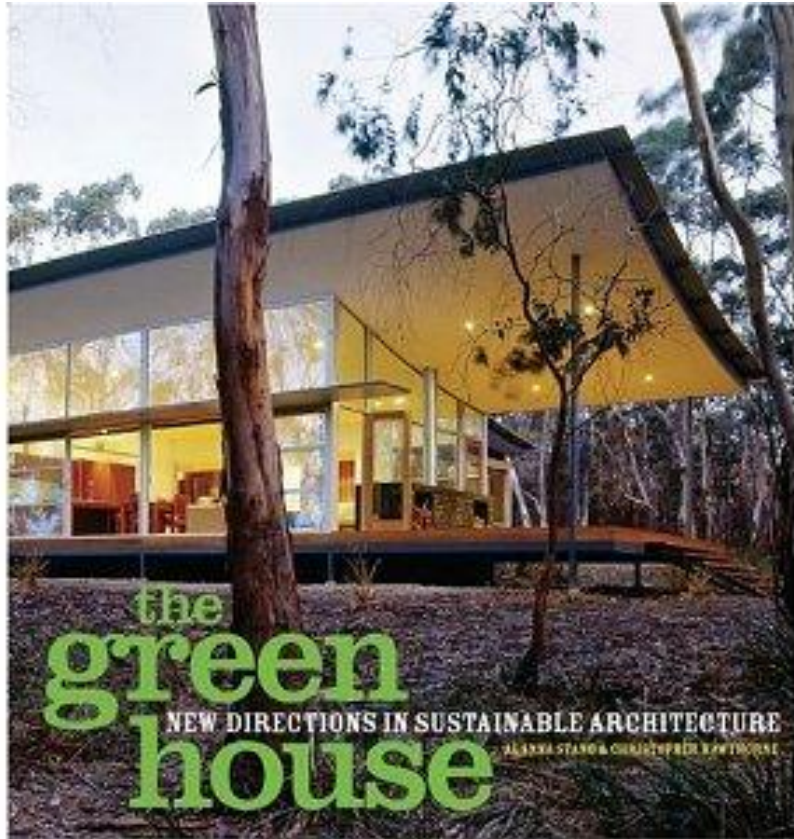
There are a lot of reasons why all-glass buildings

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The highly glazed CORE Building on 7th Avenue in the Chelsea neighborhood of New York City. Upper floors are residential.









Trends in Green Building

- A return to modernism- architects love glass
- Fascination with double facades
- Obsession with daylight, views and transparency
- High tech vs. crunchy granola

Energy Efficiency - STRATEGY FOR SUCCESS

- 1) REDUCE DEMAND
- 2) HARVEST SITE ENERGY
- 3) MAXIMIZE EFFICIENCY
- 4) OPERATIONS AND MAINTENANCE

FOR HOMES THAT HAVE WAITED

for quality refrigeration at the lowest prices

The New
YUKON
Model

Millions of families have long been waiting for just such an electric refrigeration value. Here is genuine Kelvinator quality . . . quality that extends to every detail . . . at a price far below that ever set on any Kelvinator model.

The new Yukon is BIG, with five cubic feet of interior space and more than nine square feet of shelf room. It supplies forty-two big ice cubes at a single freezing.

The shelves are wide, deep, roomy, and properly spaced for easy placing of foods. The Temperature Selector and Defrosting Switch are placed at your finger tips; door opens at a light touch, yet latches securely with the same lack of effort. Five different freezing speeds are instantly available, including extra rapid freezing for ice cubes and desserts.

The handsome Yukon cabinet is of steel construction, finished in a beautiful white enamel. The interior is glistening white porcelain with all corners rounded for easy cleaning. The heavy door presents a striking contrast with an edging of black porcelain against the snowy white. An improved rubber tray makes it easy to remove ice cubes. The Yukon can be attached to any electric light socket and can be moved anywhere without difficulty.

The new Yukon and the new Standard and De Luxe Kelvinator models are now being shown by dealers everywhere. The line ranges from the lowest priced quality refrigerator of its capacity ever produced, to models which include the utmost in refinements, improvements and beauty.

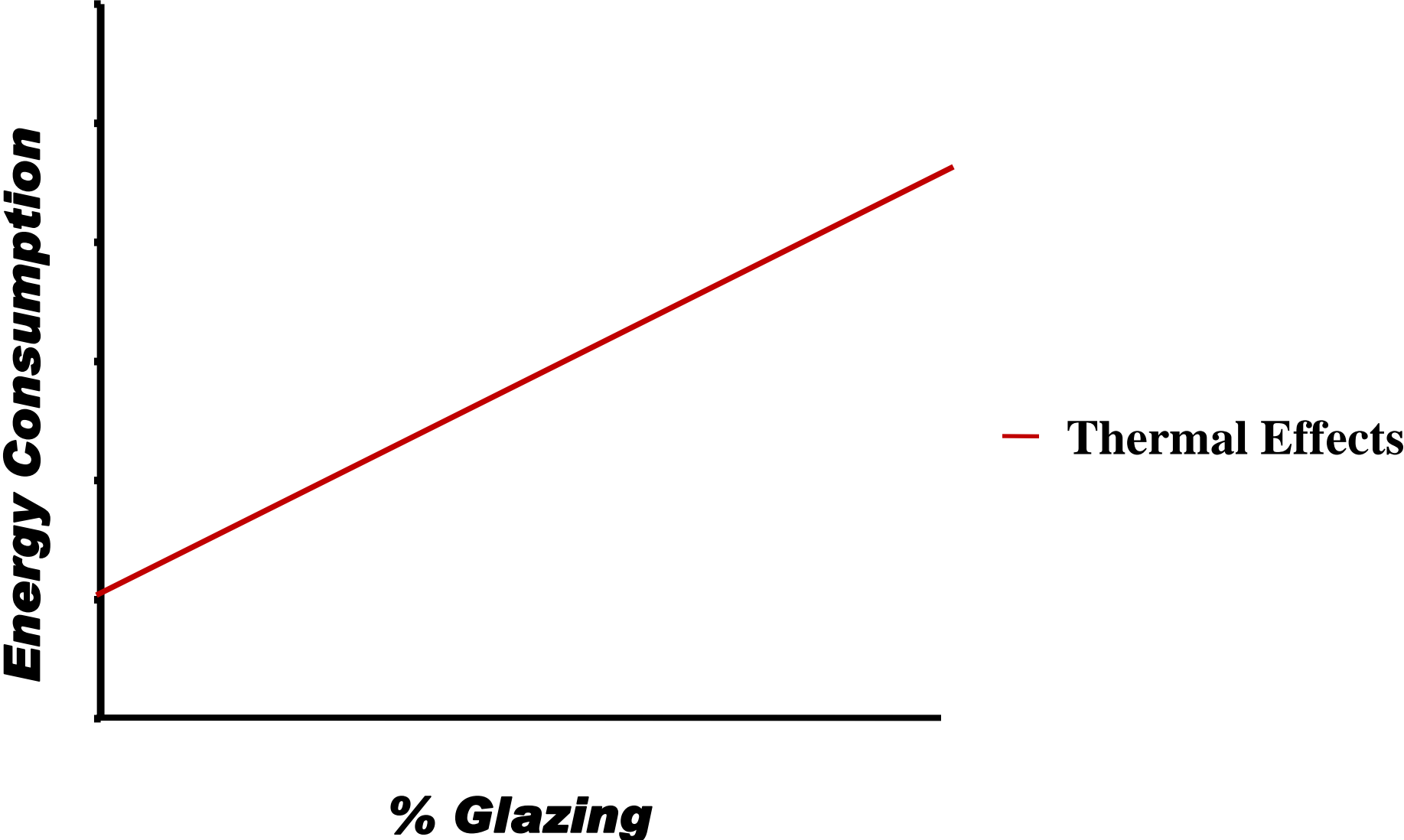
Like all Kelvinators, the Yukon can be purchased on extremely attractive terms through Kelvinator's ReDeCo Monthly Budget Plan.

KELVINATOR CORPORATION
 14252 Plymouth Road, Detroit, Michigan
 Kelvinator of Canada, Limited, London, Ontario
 Kelvinator, Limited, London, England

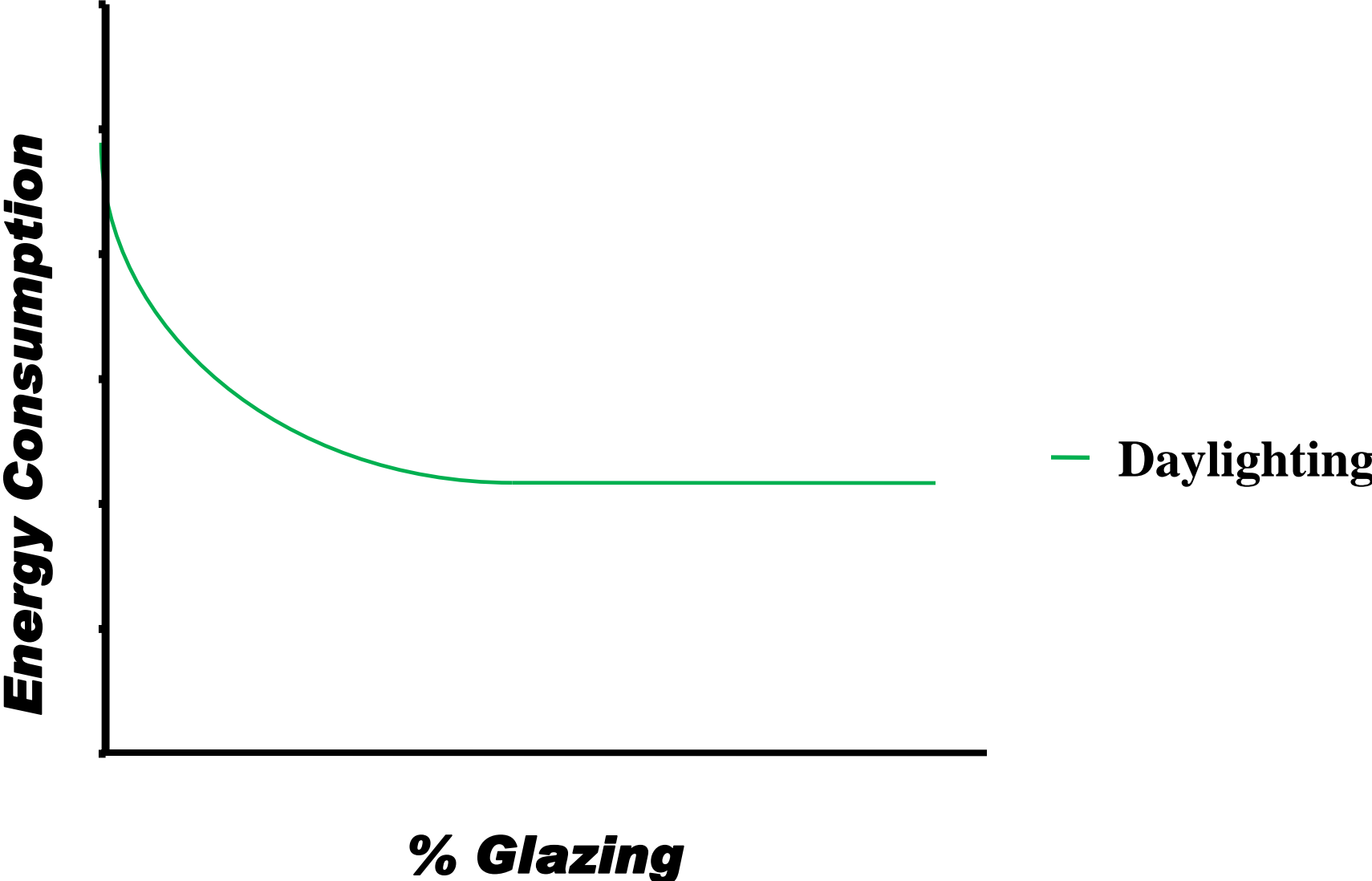


Kelvinator

Energy Consumption Vs. Amount of Glazing



Energy Consumption Vs. Amount of Glazing



Energy Consumption Vs. Amount of Glazing



Daylight Energy Benefits

- As LPDs drop, energy benefits of daylight dimming also drop

Office LPD

90.1 – 2001 – 1.5 w/sf

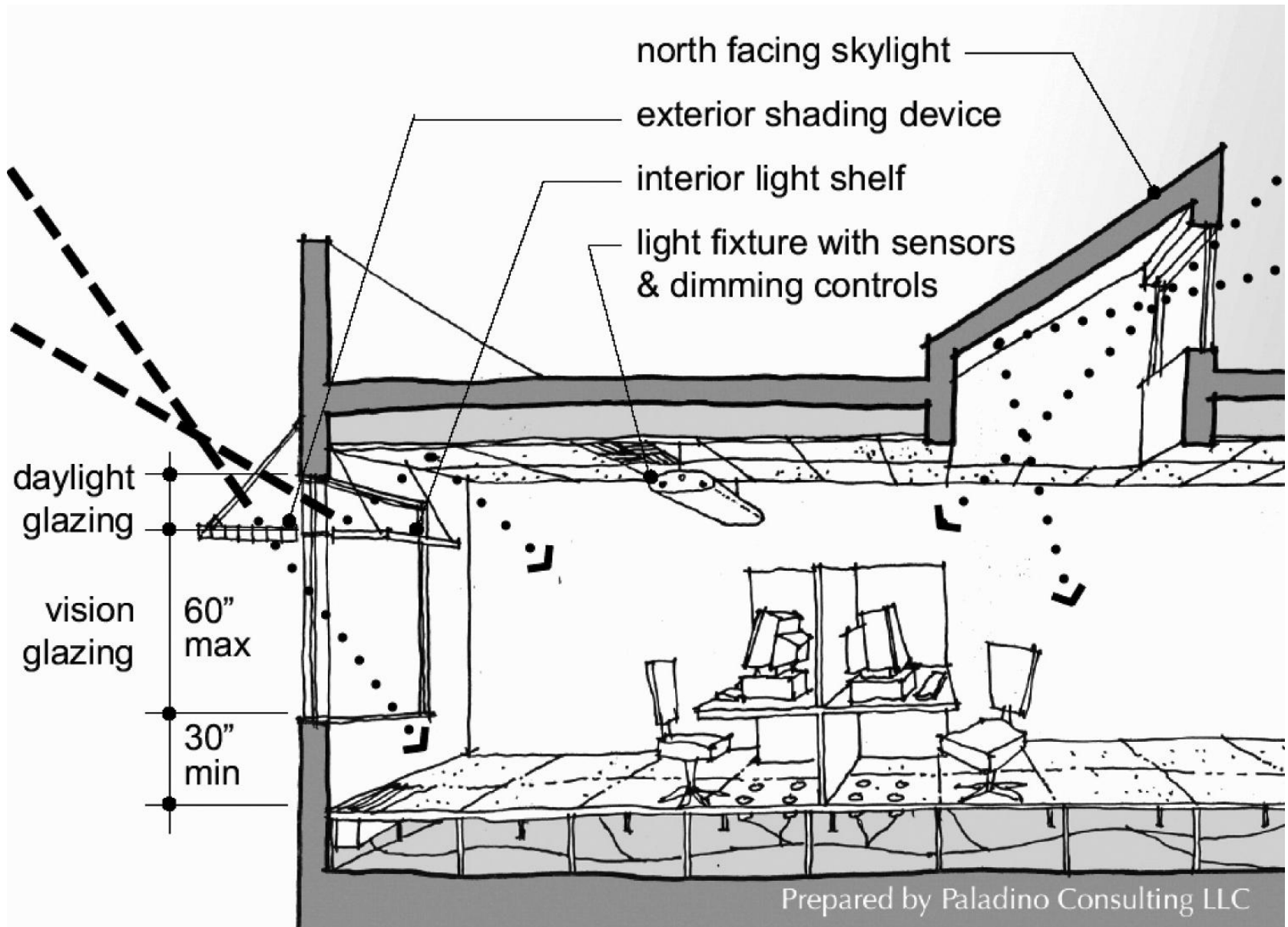
90.1 – 2007 - 1.0 w/sf

MA Stretch Code – 0.85 w/sf

90.1 – 2010 – 0.9 w/sf

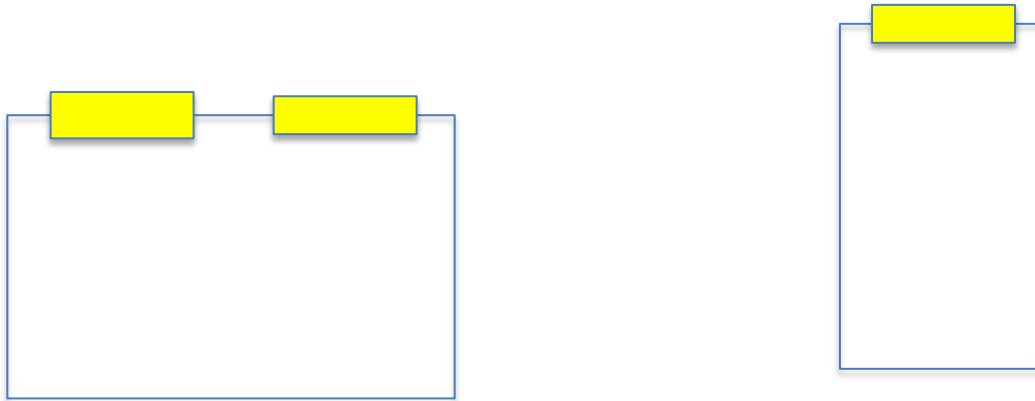
National Grid Waltham – 0.54 w/sf

Strategies to Provide Daylight & Views



Daylight Strategies

- Instead of More Glass, Thinner Building Footprint



Alternate classroom arrangements

Design Considerations

WINDOW ORIENTATION

SOUTH: Optimal Orientation for Max .Heat Gain in Winter and Min. Heat Gain in Summer

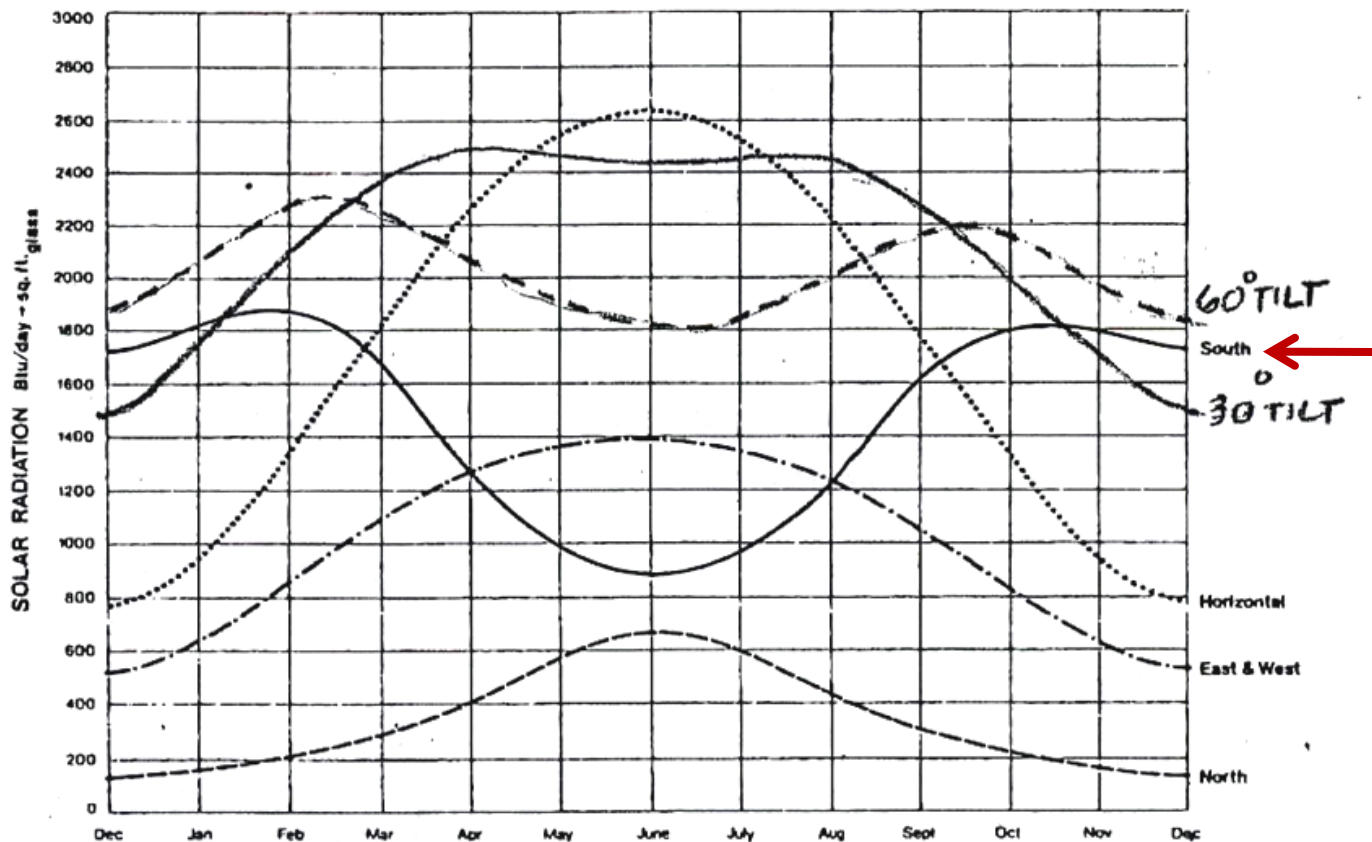


Fig. IV-6b: Comparison of window orientations.

Note: This graph represents clear-day solar radiation values, on the surfaces indicated, for 40°N.L.

Energy Codes

- 90.1 – Prescriptive Path max 40% glazed
- 90.1 – Modeling Path, basecase is max 40% glazed

Hard to meet the Stretch Code with more than 40% glazing

Framing Effects

- The glazing may be good – but what about the framing?
- Modelers often use glass ratings only

Example –

Glass only: Viracon VNE3-63 $U = 0.21$

With Framing: Kawneer 2500 PG framing system
 $U = 0.46$

220% increase!

Opaque vs. Transparent

- Code wall R = 15.6
- Code Window R = 2.2

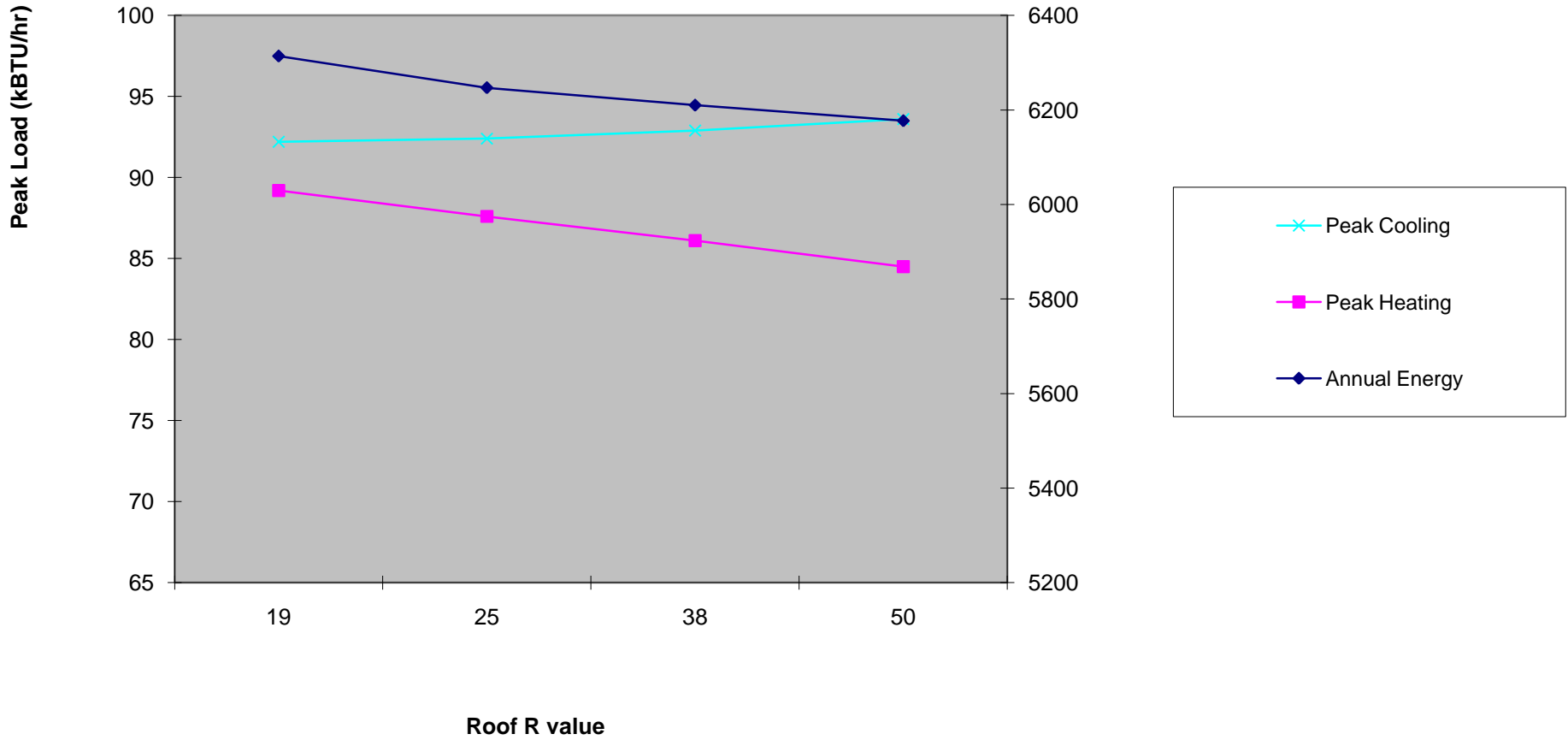
- Code Window SHGC = 0.4
- Code Wall SC = ?

Modeling Example

- 3-story Multi-Family in Jamaica Plain
- Options modeled:
 - A – Green Roof
 - B – Better Wall Insulation
 - C – Better Windows
 - D – Smaller Windows

Roof Options

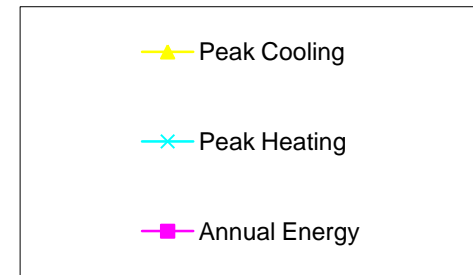
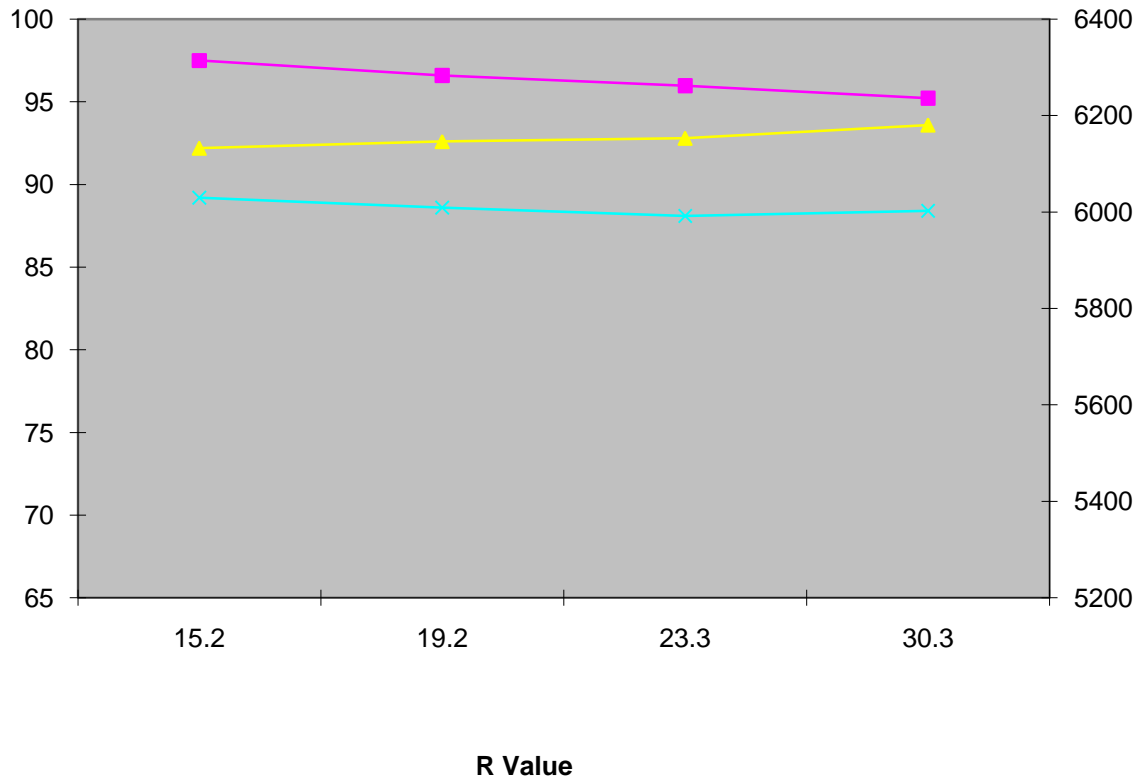
Energy Cost (\$/sf/yr)



Wall Options

Energy Cost (\$/sf/yr)

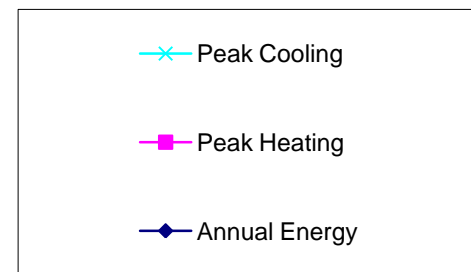
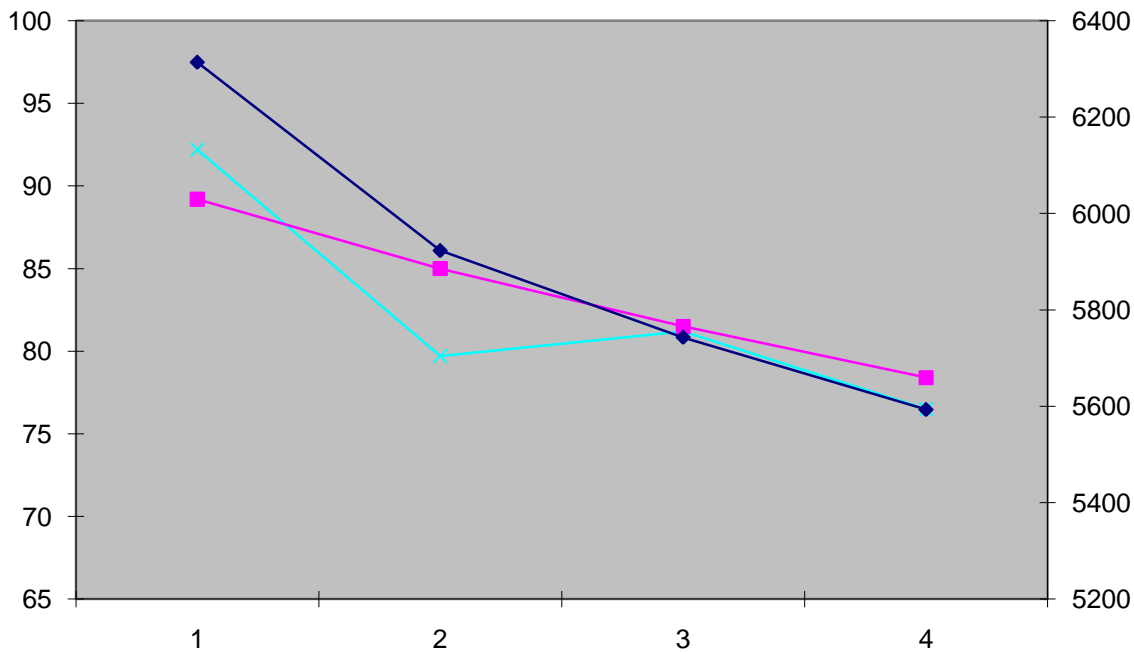
Peak Load (kBTU/hr)



Window Performance

Energy Cost (\$/sf/yr)

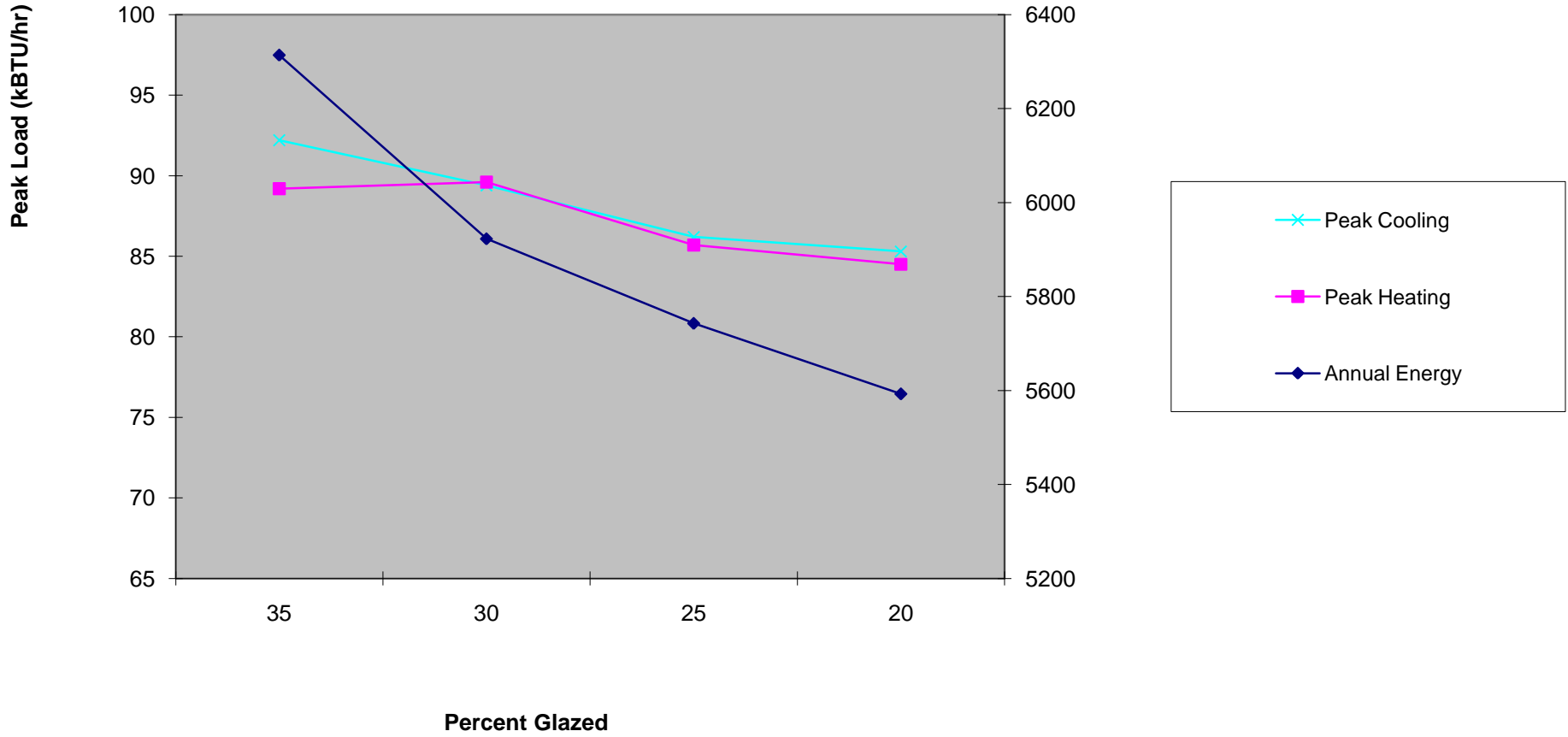
Peak Load (kBTU/hr)



Option

Window Size

Energy Cost (\$/sf/yr)



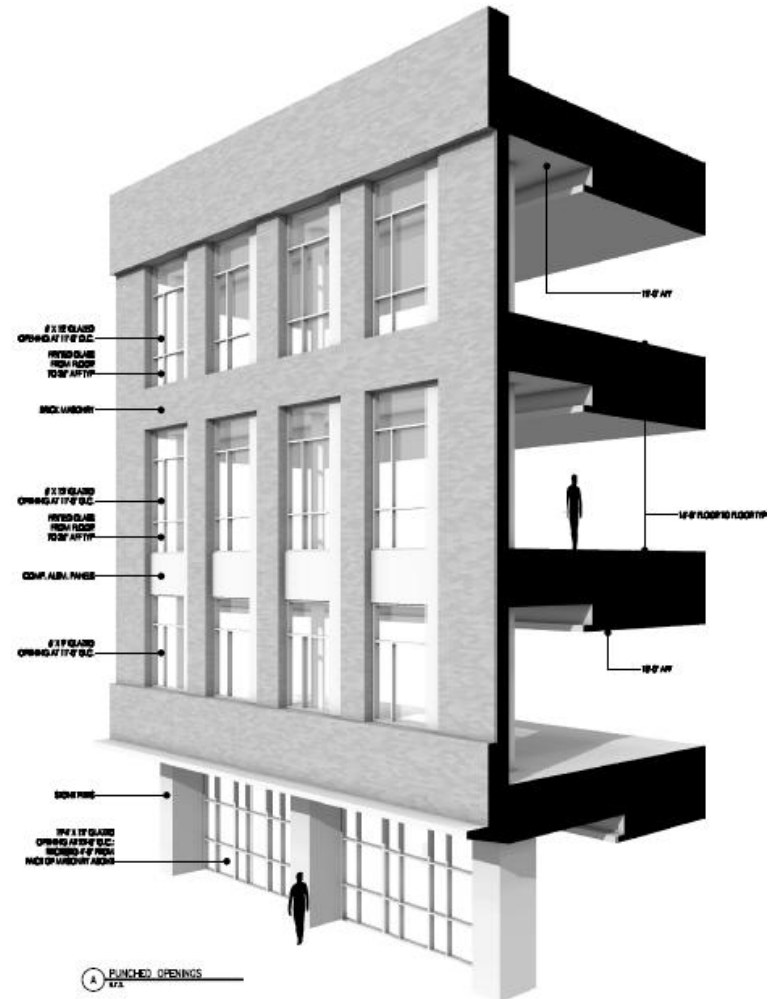
Results

Reducing Window Area saves the most energy, and is the only options that reduces first cost.

OPTIMIZING SHADES FOR A FULLY GLAZED WEST FAÇADE

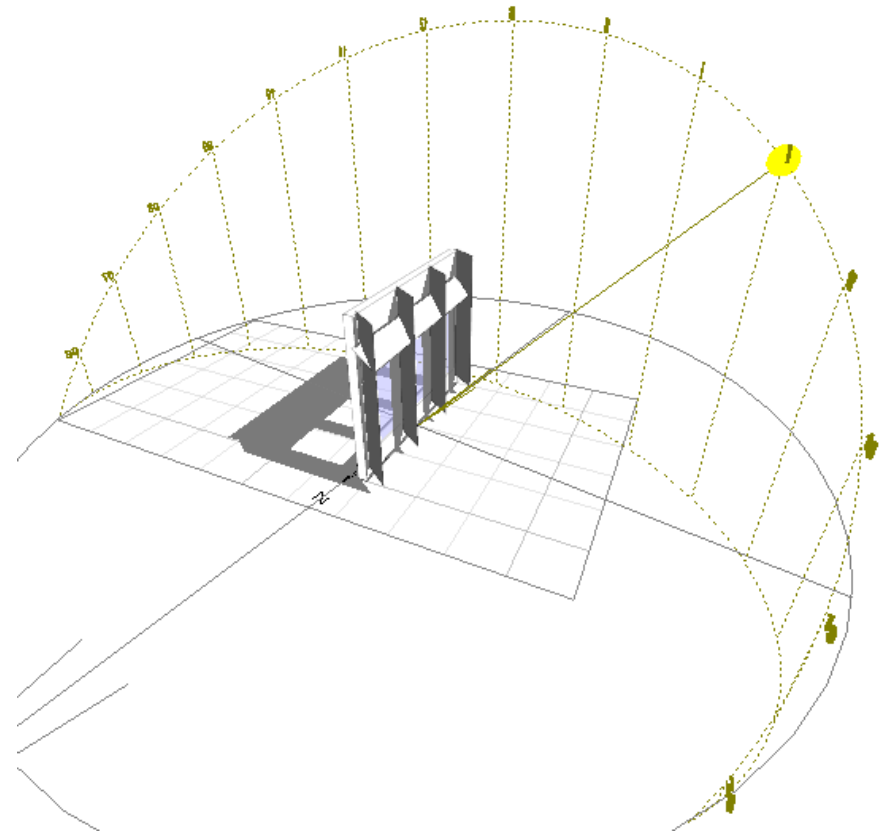
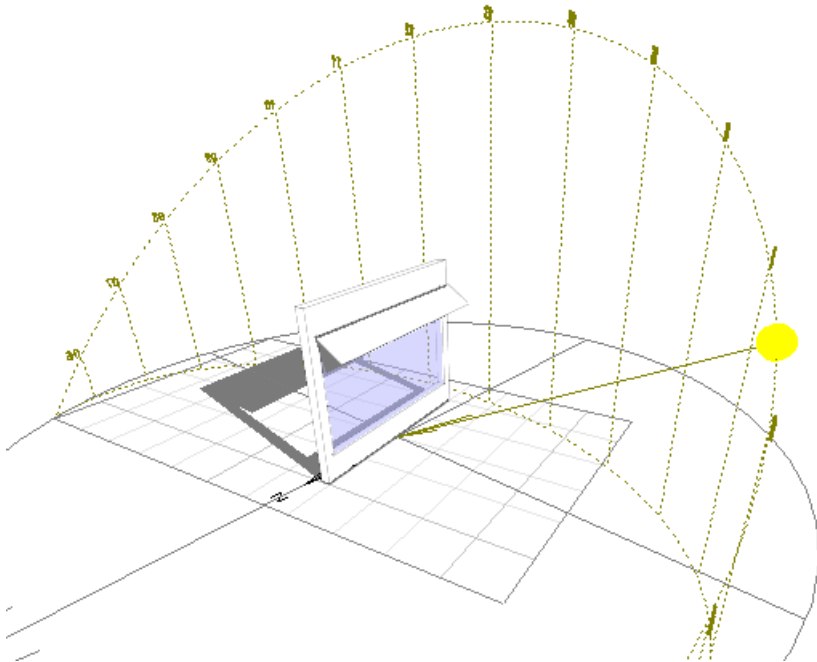
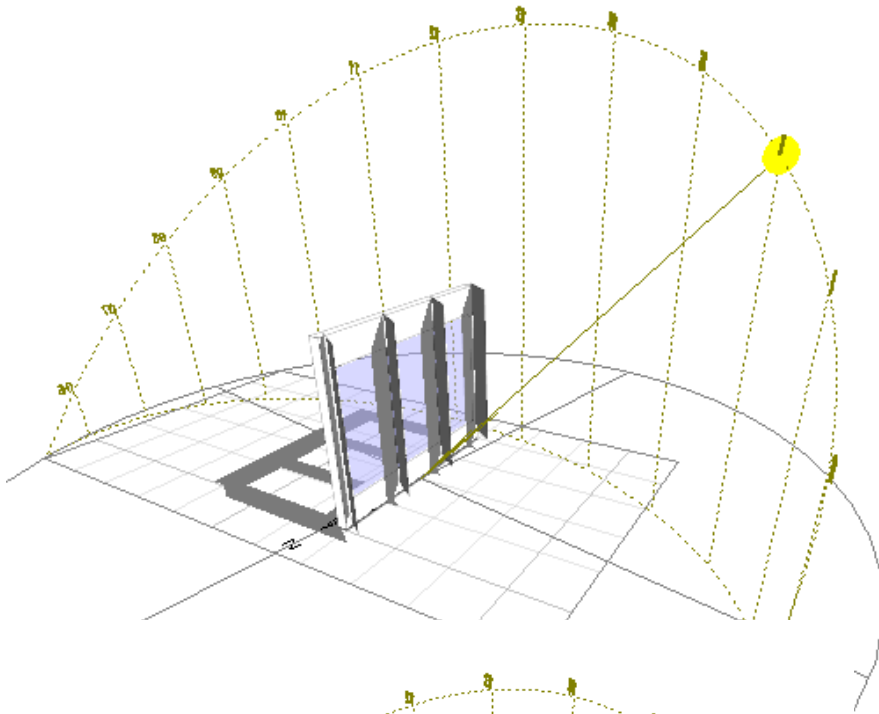
PROJECT: FLEXIBLE LAB BUILDING IN MA REGION WITH EXTERIOR VIEWS ON THE WEST SIDE

SCOPE: MINIMIZING SOLAR GAINS AND OPTIMIZING DAYLIGHT USE IN THE LAB SPACES



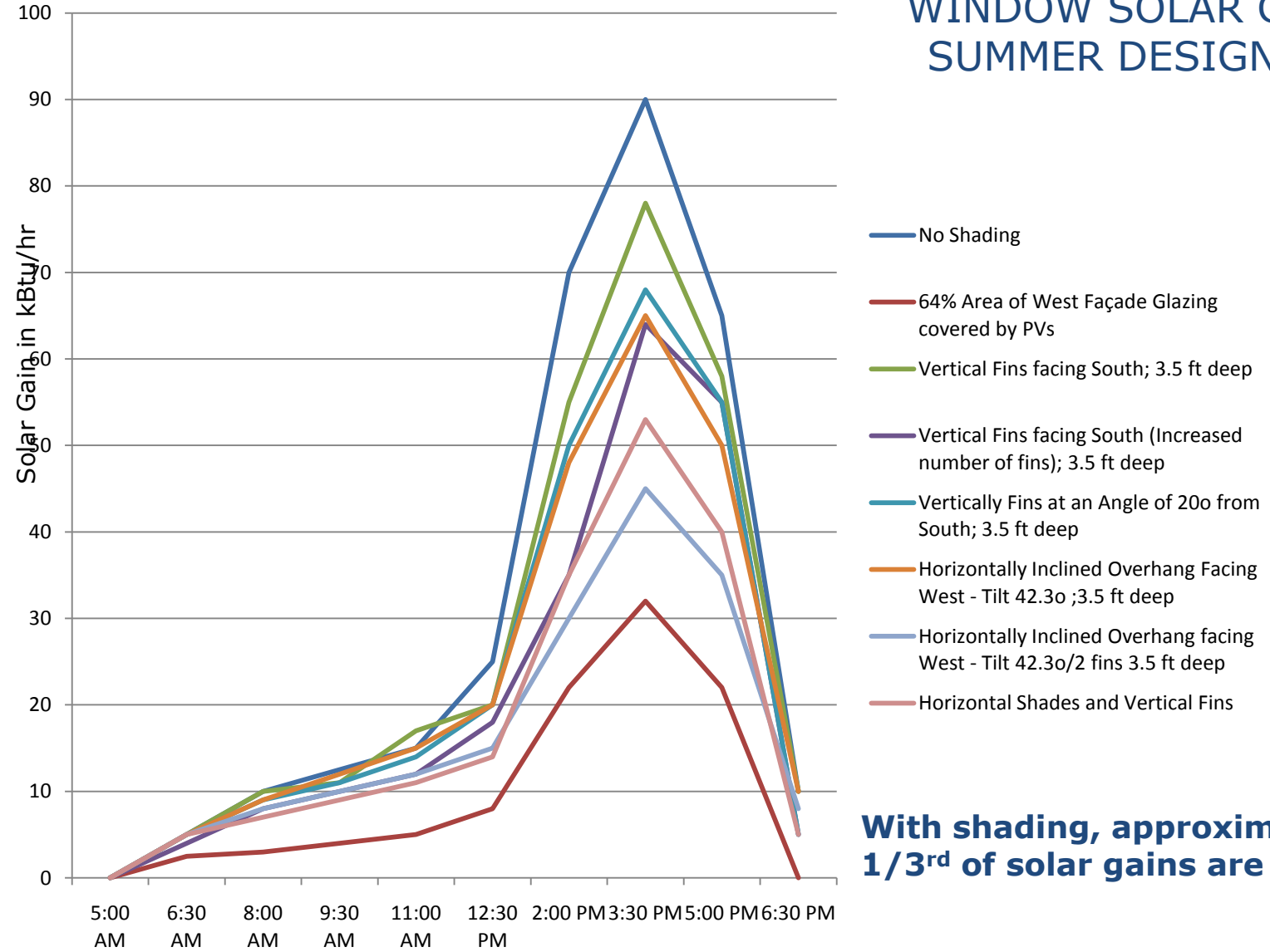
West Façade Shading Options

1st June – 4 pm



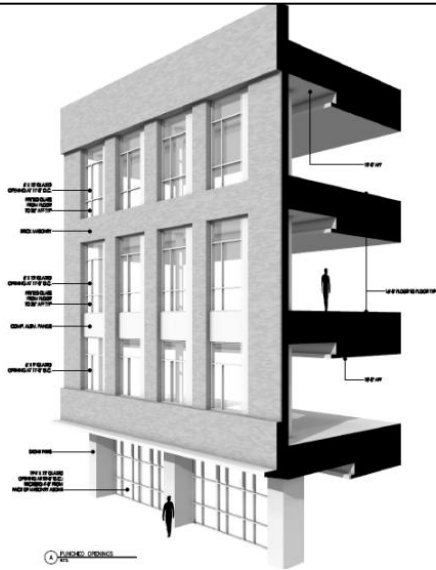
OPTIMIZING SHADES FOR A FULLY GLAZED WEST FAÇADE FOR A LAB BUILDING

WINDOW SOLAR GAIN - SUMMER DESIGN DAY

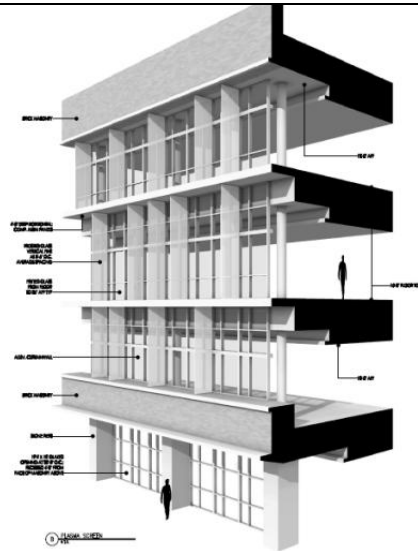


With shading, approximately 1/3rd of solar gains are cut off

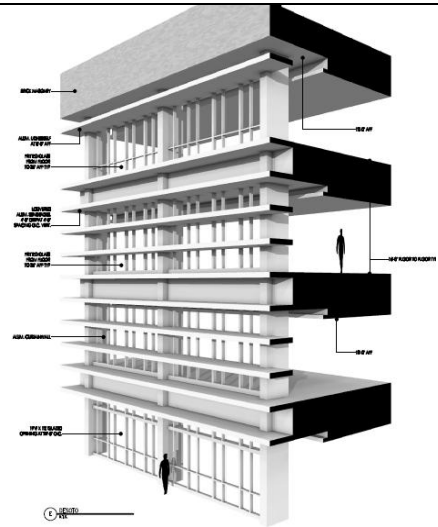
Option A – Punched Windows



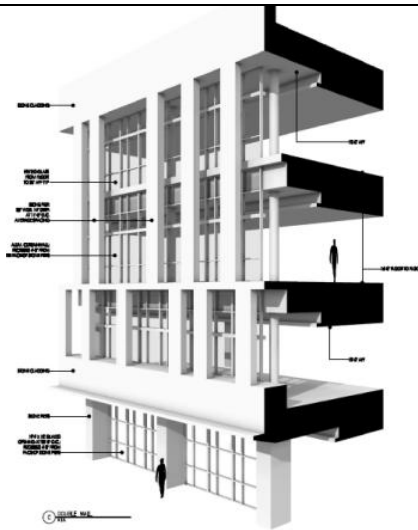
Option B – Plasma Screen



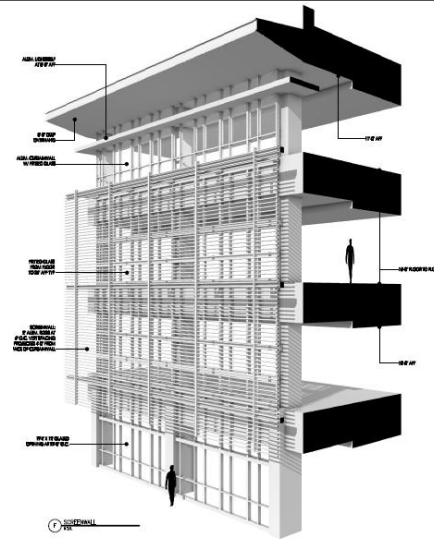
Option C – Double Wall



Option E – Desoto

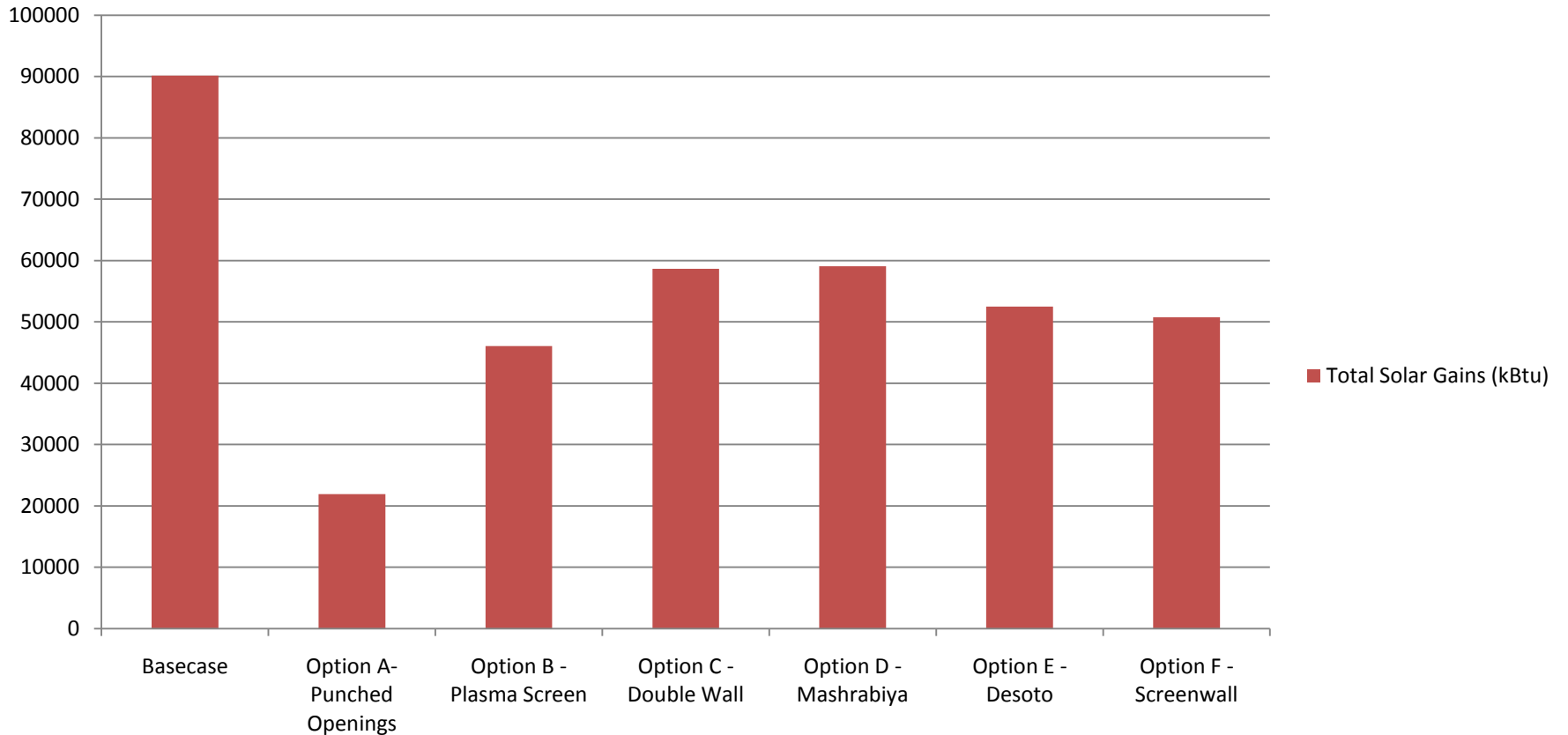


Option F – Screenwall



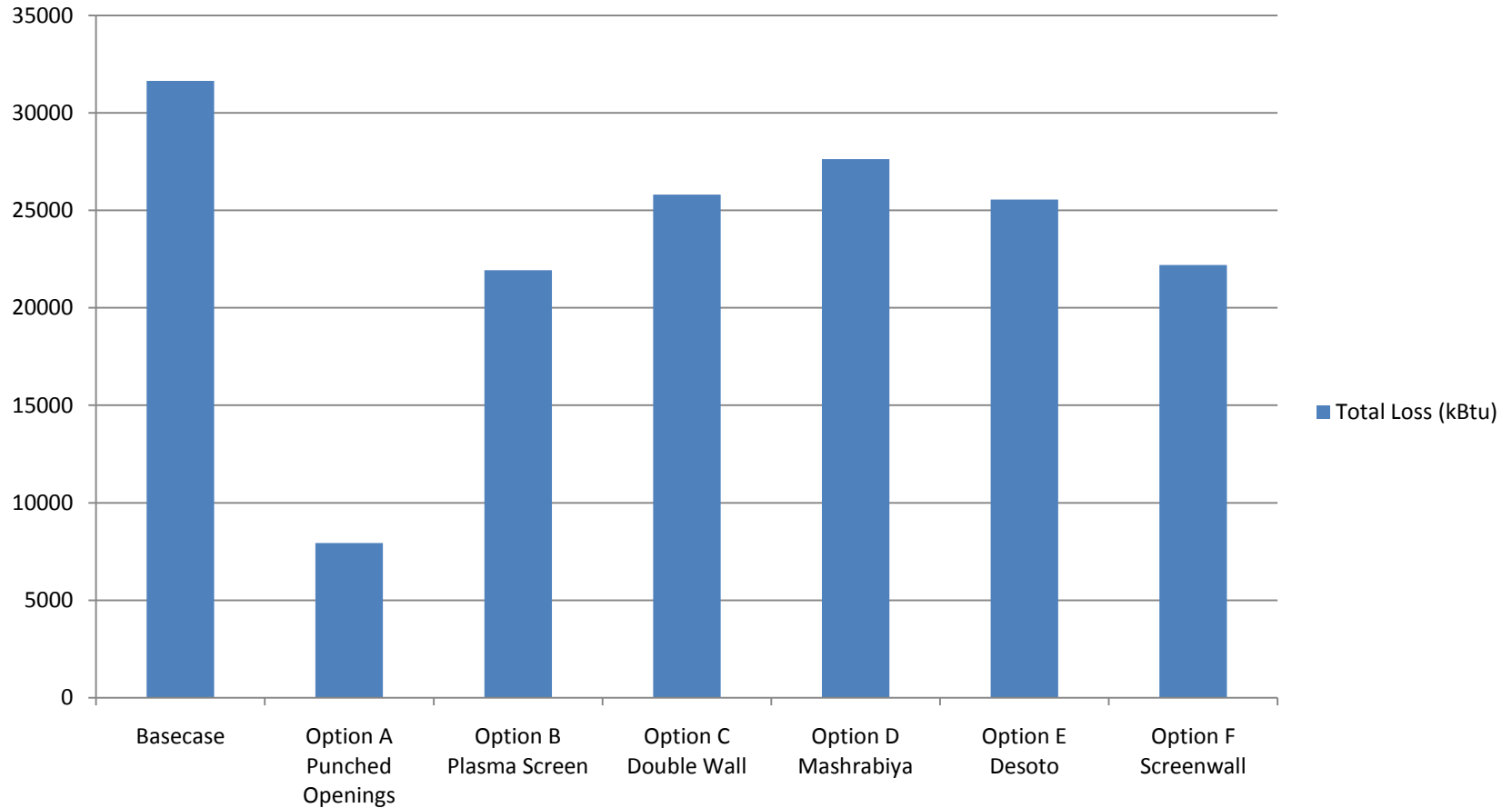
SOLAR GAINS THROUGH THE WEST FAÇADE GLAZING

Total Solar Gains (kBtu)



THERMAL LOSSES DURING HEATING SEASON THROUGH THE WEST FAÇADE GLAZING

Total Loss (kBtu)



Cost Info

- Complete system (excluding penthouses)
- 2.1 Option A (Punched Openings) \$1,091,179
- 2.2 Option B - Curtain wall (Plasma Screen) \$5,251,357
- 2.3 Option C - Curtain wall (Double Wall) \$4,294,070
- 2.4 Option D - Curtain wall (Mashrabiyya) \$5,072,401
- 2.5 Option E - Curtain wall (Desoto) \$1,745,516
- 2.6 Option F - Curtain wall (Screen Wall) \$2,906,578

Conclusions

- Less Glass = Cheaper to Build
- Less Glass = Lower Energy Consumption
- Less Glass still allows good daylight and views (30% is adequate)
- Codes Require Less Glass
- Use Less Glass