Sustainability 09

Sustainable Window Selection

for the people
for the planet
Populus
Sustainable Design Consulting

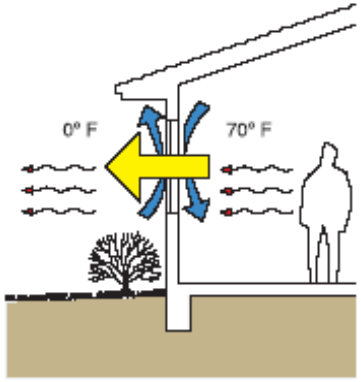
MARVIN
DESIGN GALLERY
by SOLARGLASS WINDOW & DOOR

Presentation Overview

- Introductions
- Elements of Window Performance
- Energy Star Changes
- Windows and HERS (Performance-based Sustainability)
- HERS Examples

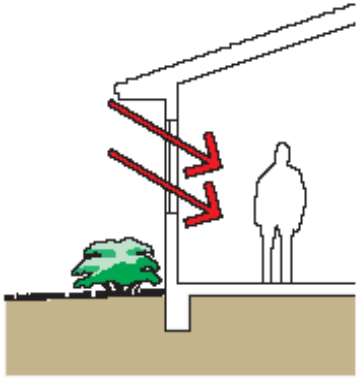
Elements of Window Performance

Window Performance Factors



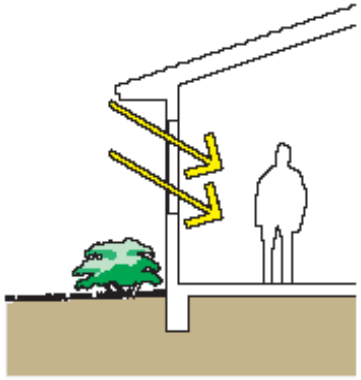
U-Factor

The rate of heat loss is indicated in terms of the U-factor (U-value) of a window assembly. The insulating value is indicated by the R-value which is the inverse of the U-value. The lower the U-factor, the greater a window's resistance to heat flow and the better its insulating value. U=U-factor in Btu/hr-sf-°F.



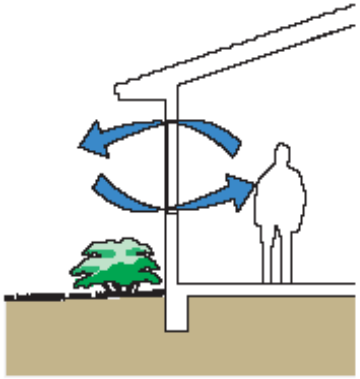
Solar Heat Gain Coefficient (SHGC)

The SHGC is the fraction of incident solar radiation admitted through a window. SHGC is expressed as a number between 0 and 1. The lower a window's solar heat gain coefficient, the less solar heat it transmits. Use a computer program such as RESFEN to understand heating and cooling trade-offs. SHGC=Solar Heat Gain Coefficient in fraction of incident solar angle.



Visible Transmittance (VT)

The visible transmittance (VT) is an optical property that indicates the amount of visible light transmitted. The NFRC's VT is a whole window rating and includes the impact of the frame which does not transmit any visible light. While VT theoretically varies between 0 and 1, most values are between 0.3 and 0.8. The higher the VT, the more light is transmitted. A high VT is desirable to maximize daylight. VT=Visible Transmittance in fraction of incident visible radiation.



Air Leakage (AL)

Heat loss and gain occur by infiltration through cracks in the window assembly. Air leakage is expressed in cubic feet of air passing through a square foot of window area. The lower the AL, the less air will pass through cracks in the assembly. While many think that AL is extremely important, it is not as important as U-factor and SHGC. AL=Air Leakage in cfm/sf.

Quality of Installation Perhaps Most Important

Source: www.efficientwindows.org

Window Performance Considerations

- Glazing Unit Structure (lites, spacing)
- Low-E Coatings
- Suspended Films
- Low-Conductance Gas Fills
- Spacer Systems
- Thermally Improved Sash and Frame
- Improved Weather stripping

Window Component Performance

Spacer	5 - 8% Improvement				
Gas Fill	16% - 25% Improvement (argon, krypton, xenon)				
Frame Type	Aluminum	Thermally-Broken Aluminum	Aluminum Clad Wood	Fiberglass	
Glazing		Single Pane	Dual Low-E		Heat Mirror
U Value	2.6	1.8	1.0	.2	.09
R Value	.38	.56	1.0	5	11

Selection Considerations

Sustainability
Initial Cost
Product Lifecycle
Warranty
Energy Savings

Performance/ Comfort
VT / U /
SHGC/UV
Installation
Air Infiltration
(initially and
over time)

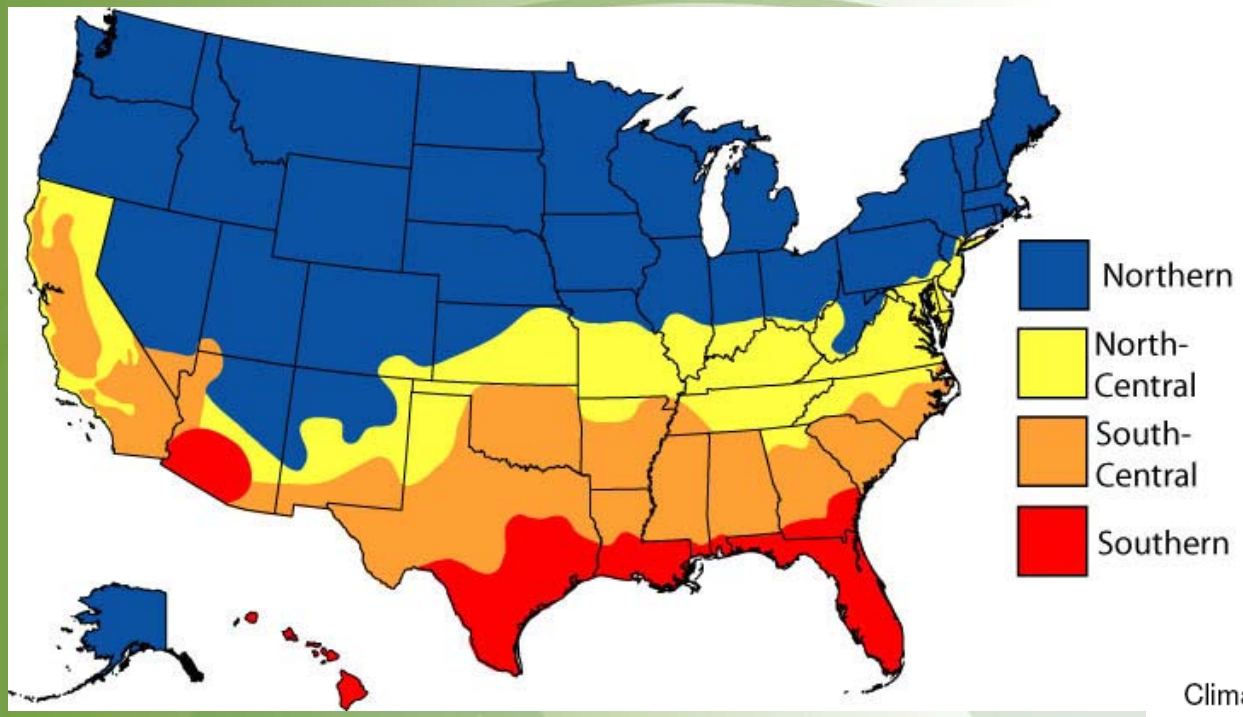
Aesthetics

Design
Flexibility

Degree of
Customization

Energy Star and Future Technologies

Energy Star Windows 2010

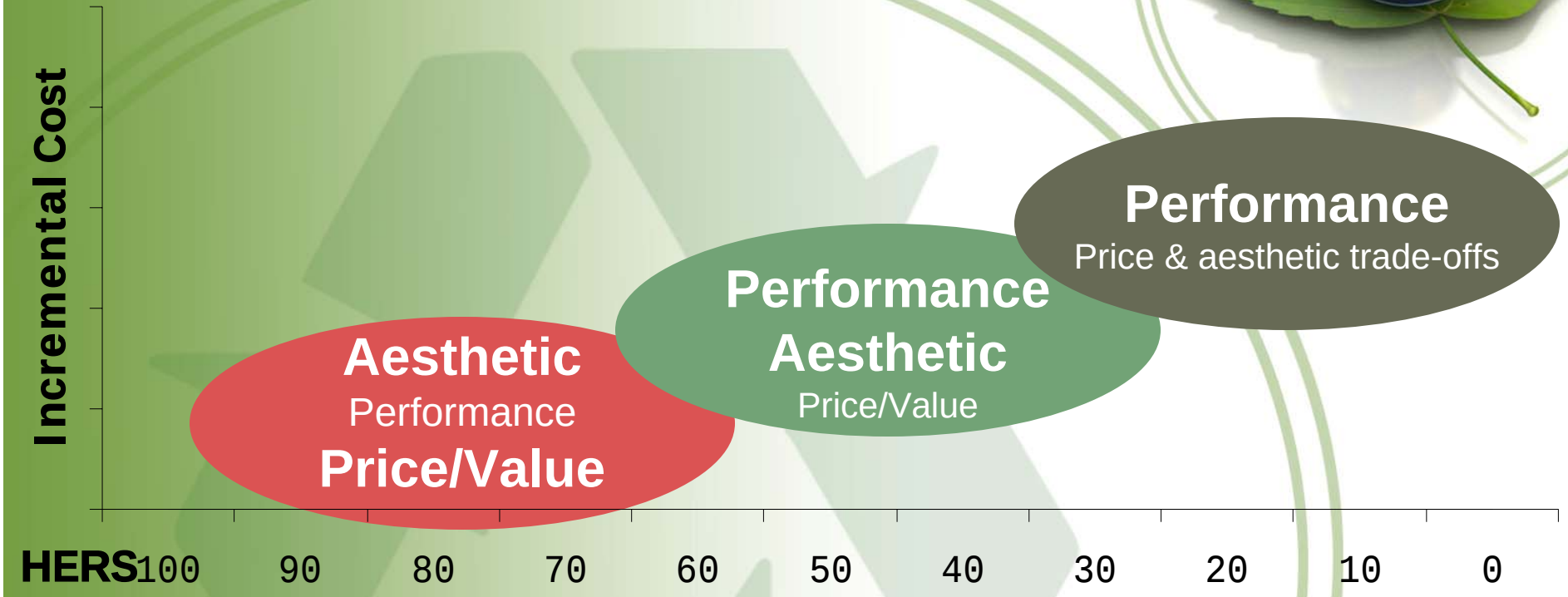


Windows

Climate Zone	U-Factor[1]	SHGC[2]	
Northern	≤ 0.30	Any	Prescriptive
	=0.31	≥ 0.35	Equivalent Energy Performance
	=0.32	≥ 0.40	
North-Central	≤ 0.32	≤ 0.40	
South-Central	≤ 0.35	≤ 0.30	
Southern	≤ 0.60	≤ 0.27	

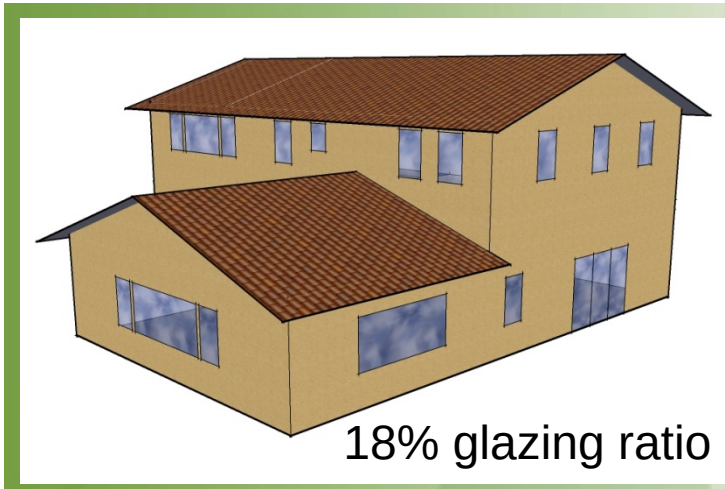
Windows and HERS Scores

Windows and HERS

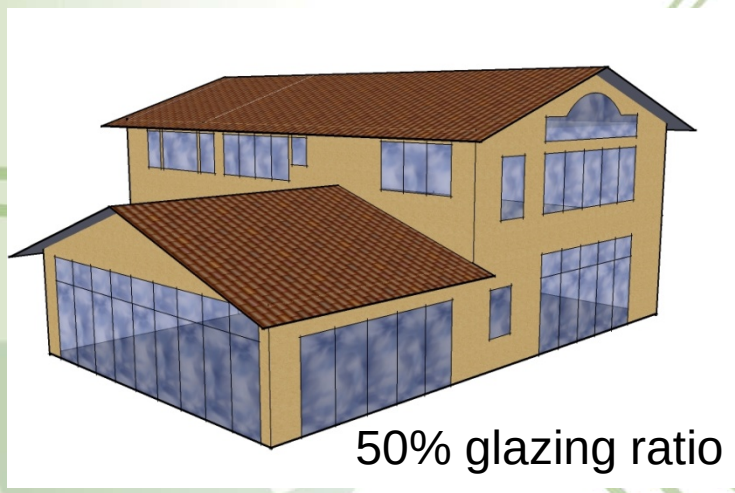


Key Variables: G/FAR, Sq. Ft., Glazing Orientation, Performance targets

HERS Examples



18% glazing ratio

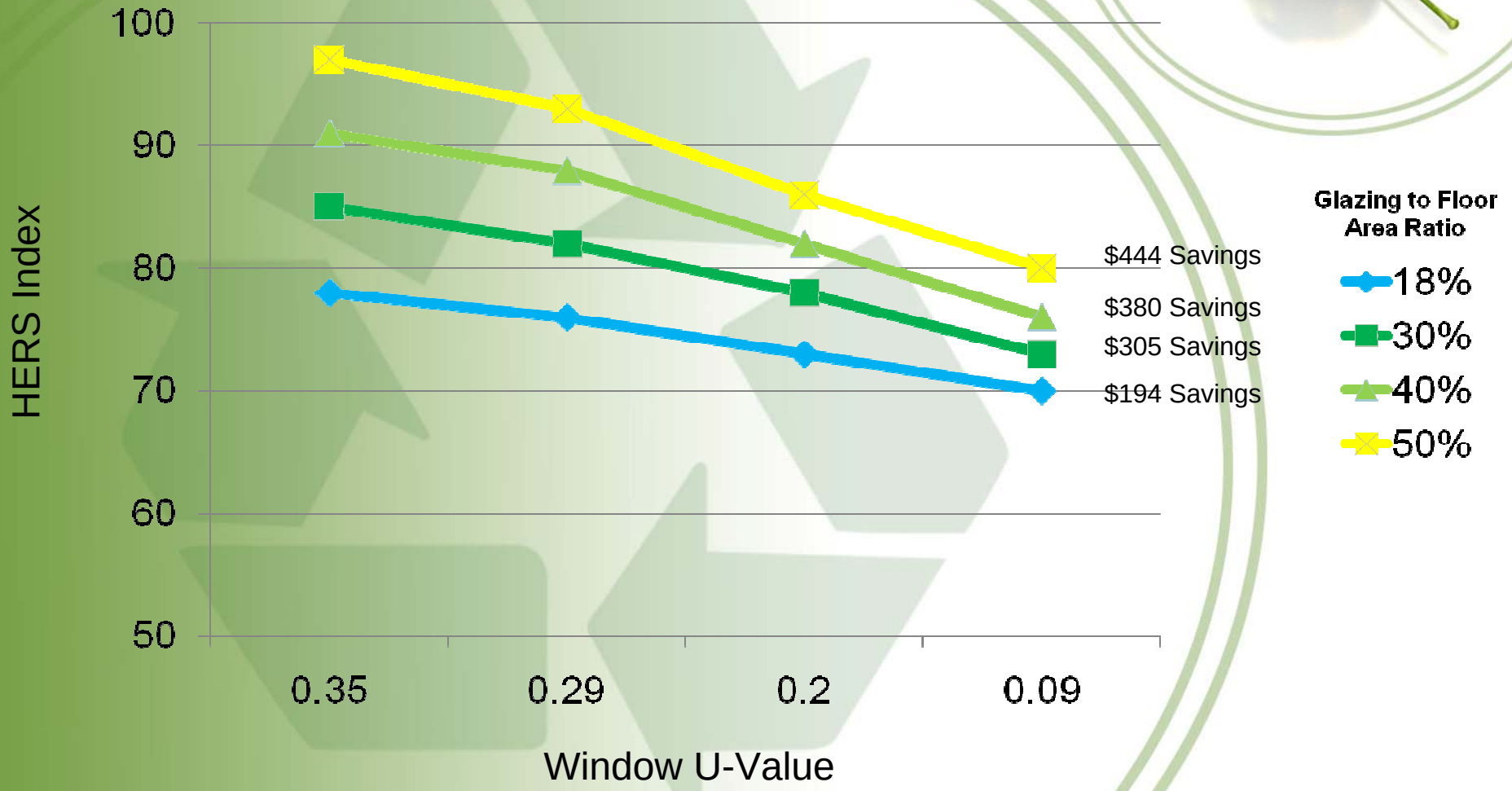


50% glazing ratio

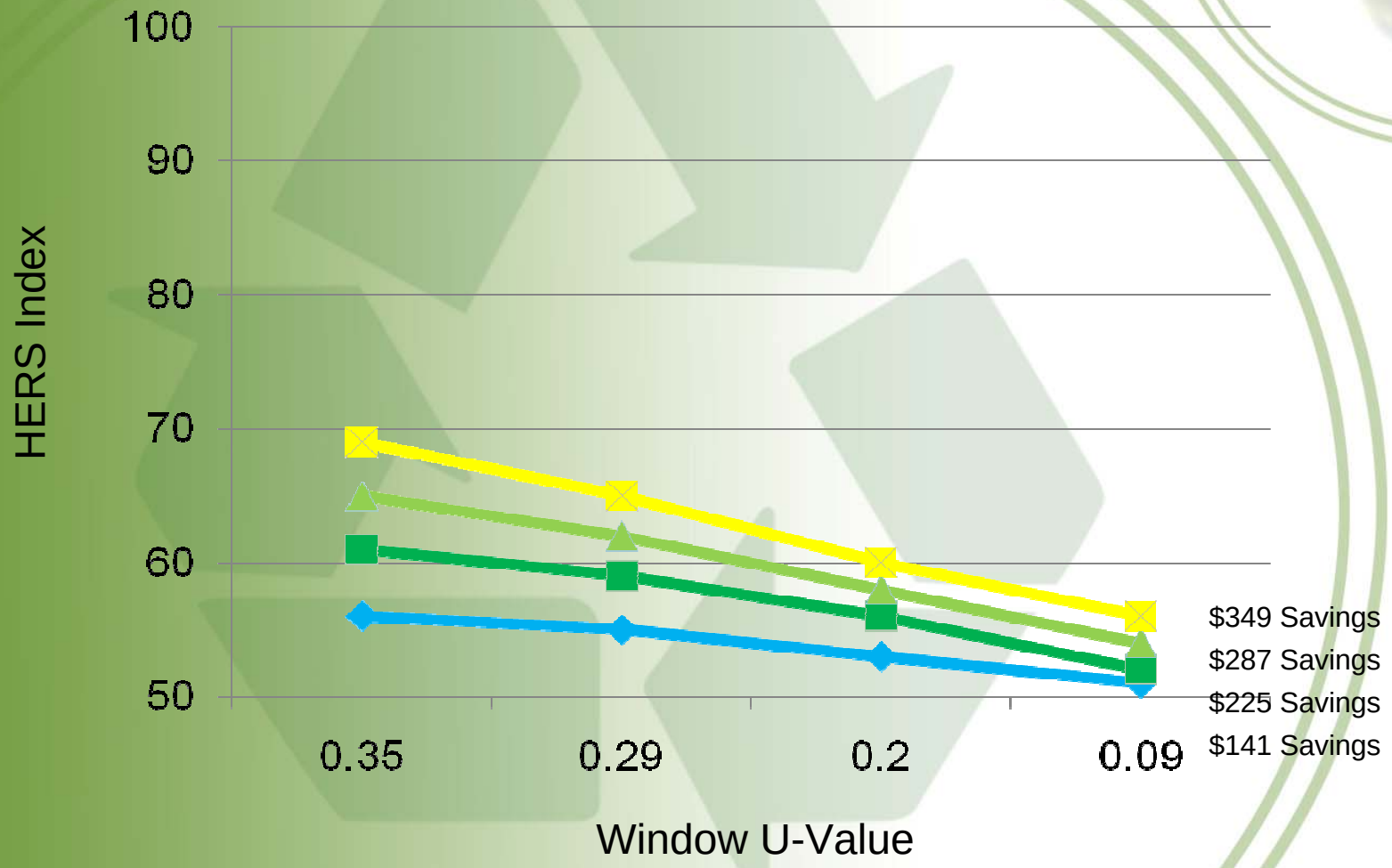
Base model specifications

- 3,000 square foot home
- Slab-on-grade with R-10 perimeter insulation (Eco-Block)
- R-30 insulation in floors over unconditioned space
- R-19 rim and band joist insulation
- R-19 cavity insulation (no insulated sheathing)
- R-38 insulation at flat (trussed) and vaulted (stick-framed) ceilings
- Ducts located 70% in conditioned space, 20% in attic (R-8 wrap), 10% in ceiling over garage - ENERGY STAR duct leakage levels
- Whole-house infiltration - 0.35 NACH (no mechanical ventilation)
- All incandescent lighting
- ENERGY STAR refrigerator
- No solar photovoltaics or solar thermal systems

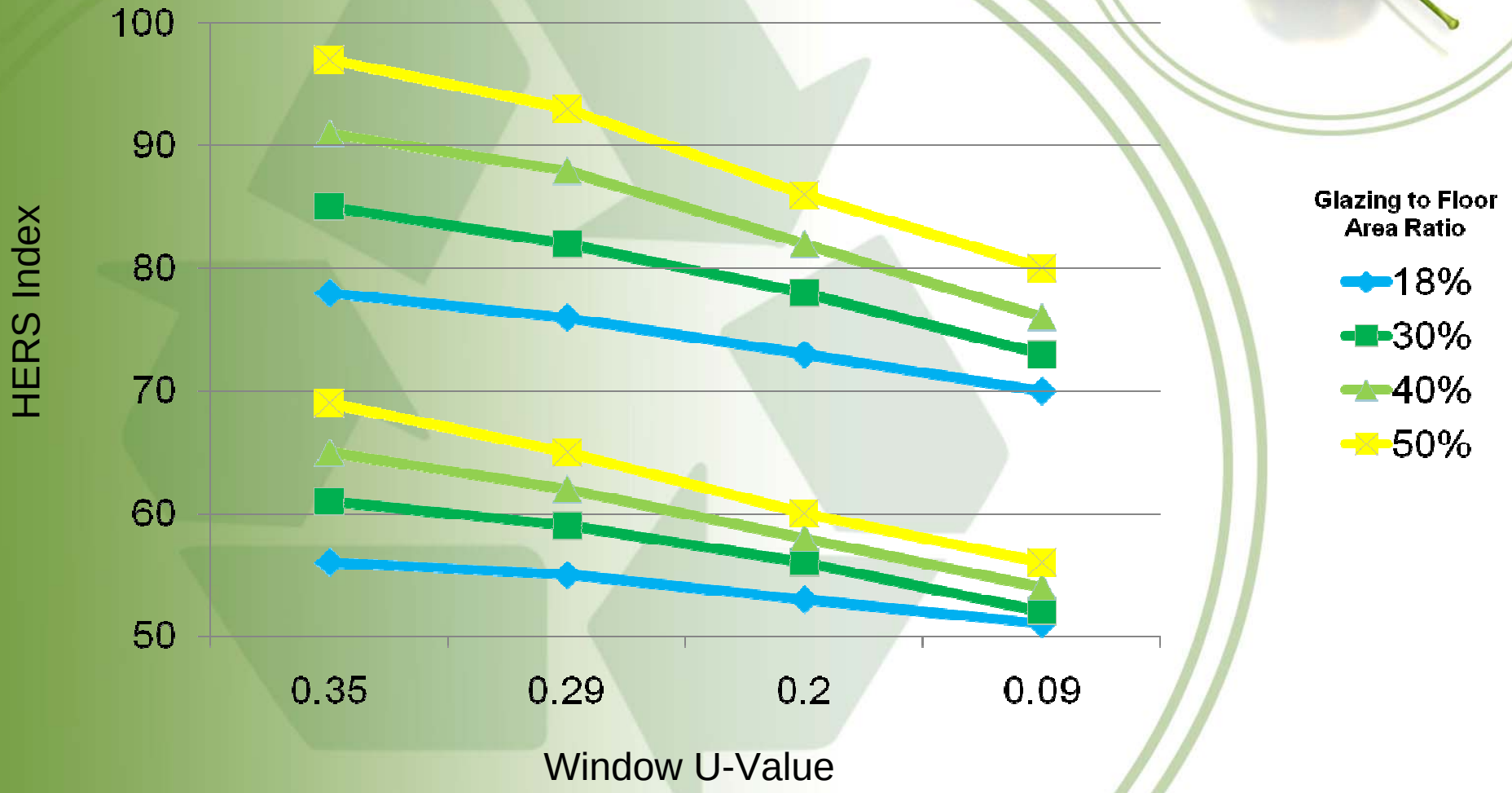
3,000 Square Foot Residence
92% Efficient Furnace

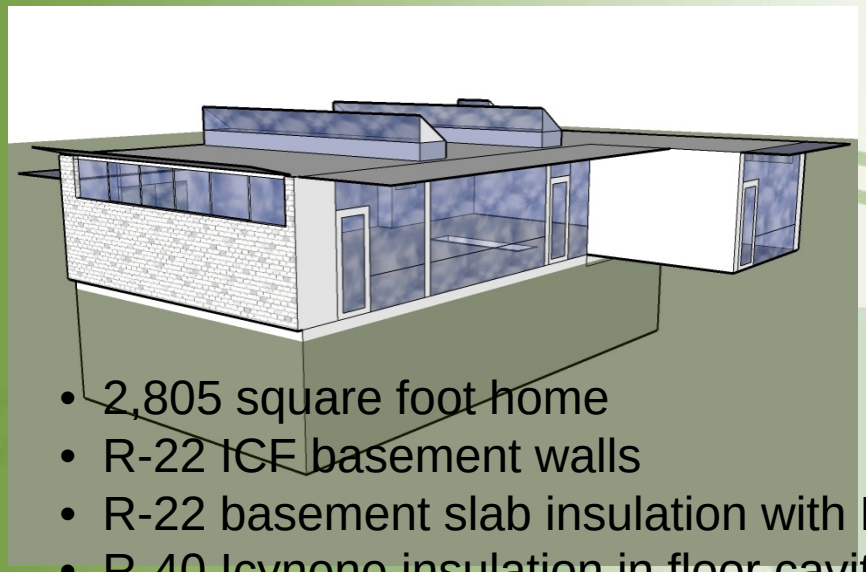


3,000 Square Foot Residence
Ground Source Heat Pump
EER 14.6, COP 3.4



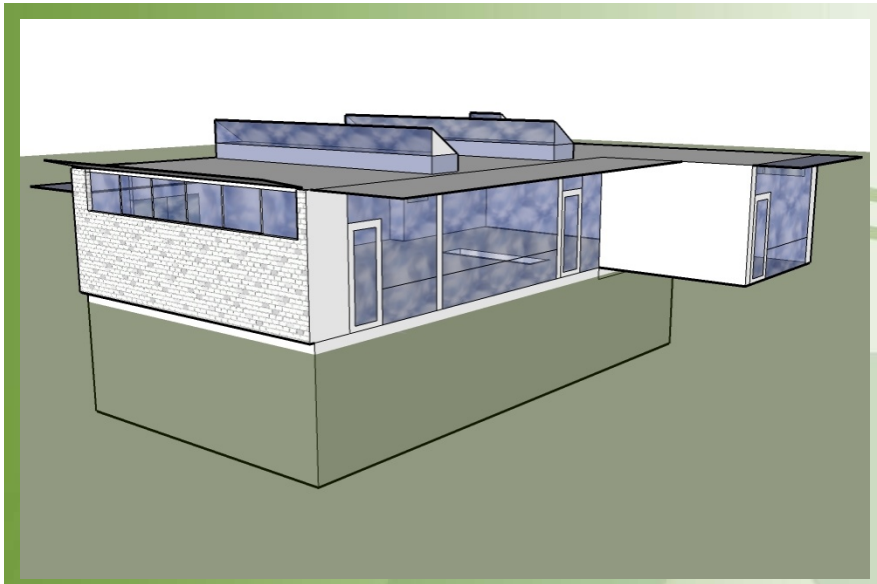
Glazing Performance vs. Overall System Performance





LEED Platinum House
Platinum
HERS -4
Projected Utility Costs -$26/yr

- 2,805 square foot home
- R-22 ICF basement walls
- R-22 basement slab insulation with R-13 under-slab insulation
- R-40 Icynene insulation in floor cavity over unconditioned space
- R-26 Icynene cavity insulation in 2x8 LVL framing, 24” o.c. + R10 exterior rigid insulation
- High-performance windows (U-value of 0.31 to 0.27; SHGC 0.70 to 0.38) south glazing tuned to optimize passive solar gain
- R-58 Icynene insulation in 16” deep TJI framing, 24” o.c.
- Ground source heat pump (EER 18.8; COP 3.66)
- ENERGY STAR duct leakage rate
- Whole-house infiltration - 0.10 NACH projected
- Heat recovery ventilator
- 100% fluorescent lighting
- ENERGY STAR refrigerator
- 10 kW solar photovoltaic array
- No solar thermal



LEED Platinum House
HERS -4
Projected Utility Costs
-$26/yr

If all else remains equal, changing this spec:

- High-performance windows (U-value of 0.31 to 0.27; SHGC 0.70 to 0.38)
  South glazing tuned to optimize passive solar gain

to this spec:

- 2009 ENERGY STAR Compliant windows (U-value of 0.35; SHGC 0.30
  No passive solar tuning

results in a HERS Index increase of 3 points and an increase in projected annual utility costs of $99.

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