

Santa Fe Area HBA Green Building Council

High Performance Windows



MARVIN
DESIGN GALLERY

by  SOLARGLASS
WINDOW & DOOR

SeriousWindows™
SAVES MORE ENERGY THAN ANY OTHER WINDOW. PERIOD.

Presentation Overview

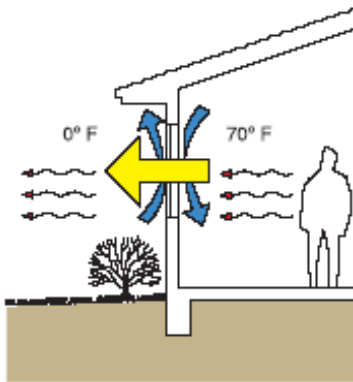
- Introductions
- Elements of Window Performance
- Energy Star Changes
- Windows and HERS (Performance-based Sustainability)
- HERS Examples



Elements of Window Performance

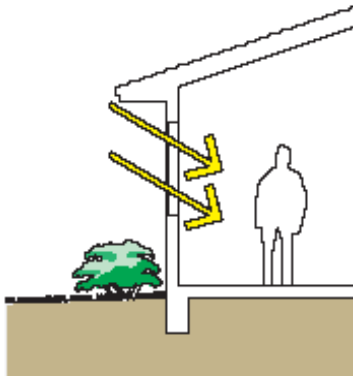


Window Performance Factors



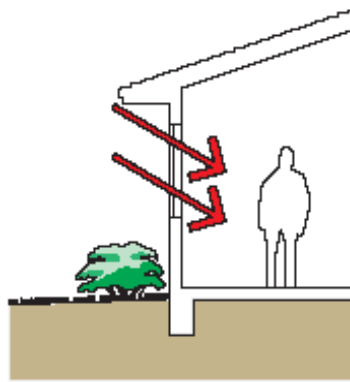
U-Factor

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. $U=U\text{-factor in Btu/hr-sf-}^{\circ}\text{F}$.



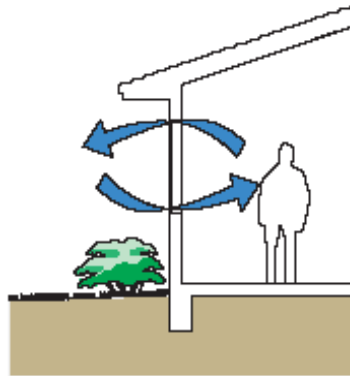
Visible Transmittance (VT)

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. $VT=Visible\ Transmittance\ in\ fraction\ of\ incident\ visible\ radiation$.



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. $SHGC=Solar\ Heat\ Gain\ Coefficient\ in\ fraction\ of\ incident\ solar\ angle$.



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. $AL=Air\ Leakage\ in\ cfm/sf$.

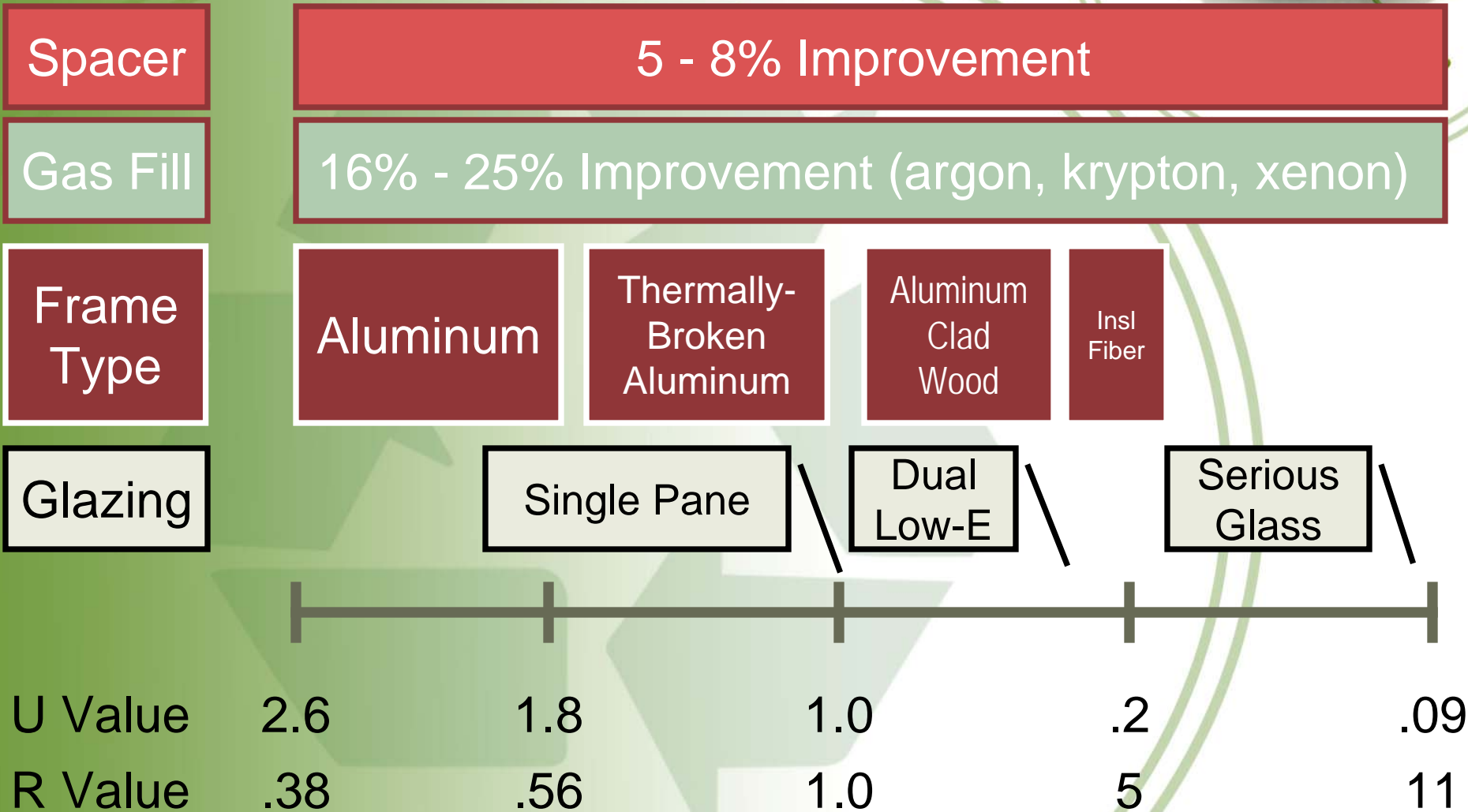
Source: www.efficientwindows.org

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



Selection Considerations



Sustainability

Initial Cost
Product Lifecycle
Warranty
Energy Savings

Performance/

Comfort

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

Aesthetics

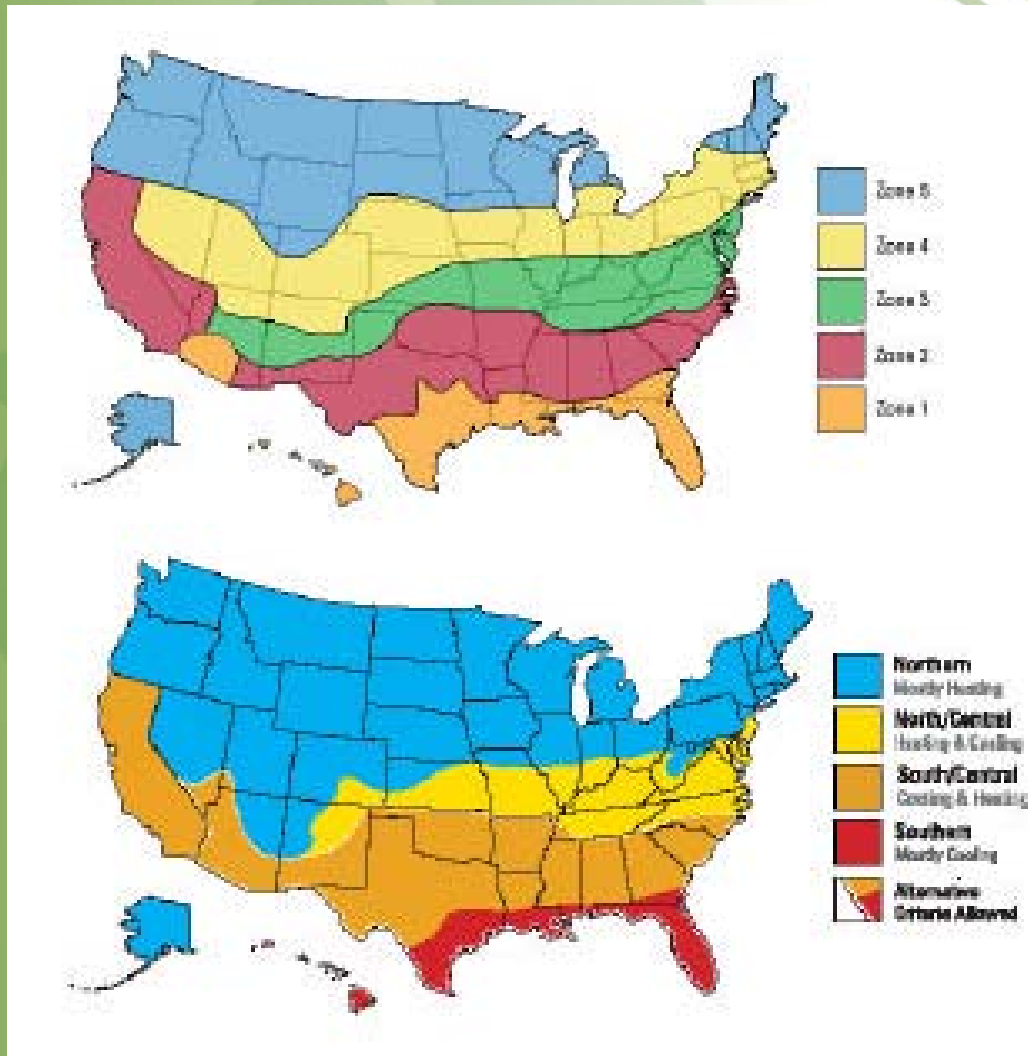
Design
Flexibility

Degree of
Customization

Energy Star and Future Technologies



Proposed Energy Star Zone Revisions



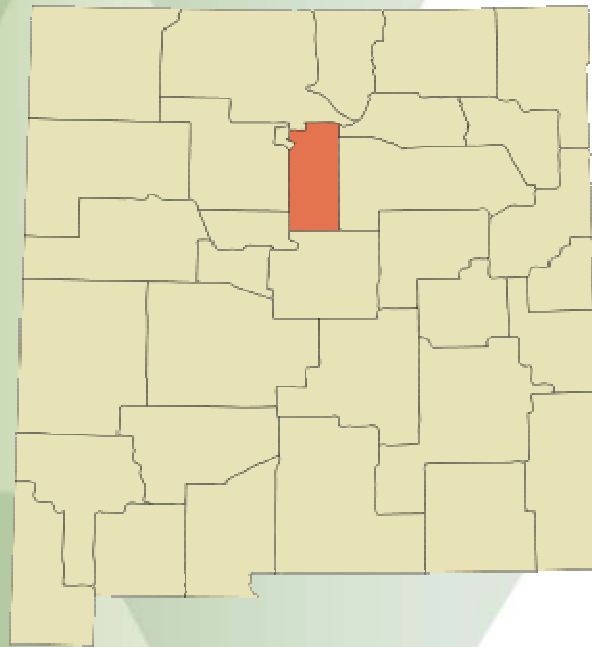
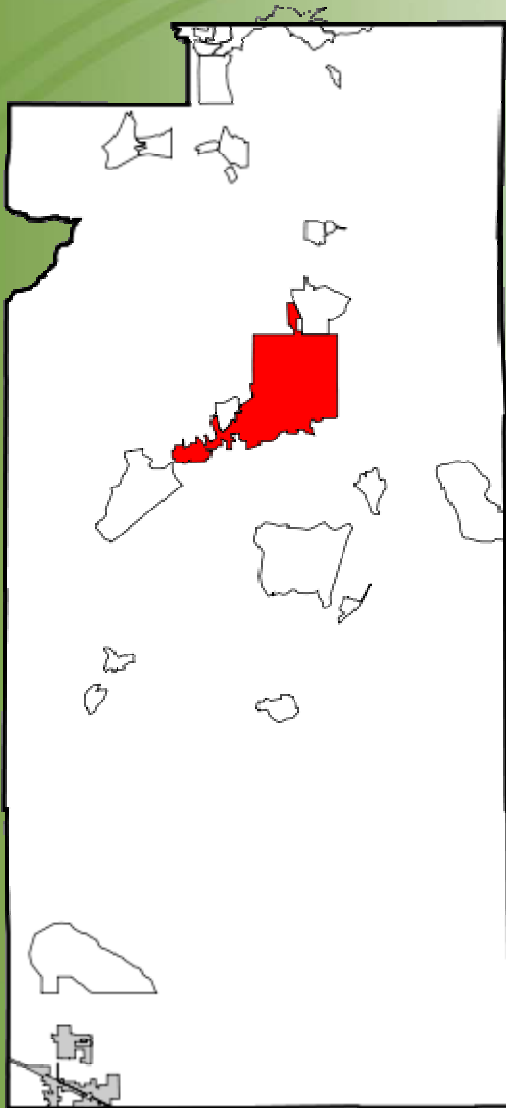
Proposed

vs.

Current



Santa Fe Region and ES --Borders Two Zones



Current North Central
Energy Star Zone—
Minimum: U-Value .40;
SHGC .55

Big Jump—
Going North to Join
New ES Zone 4

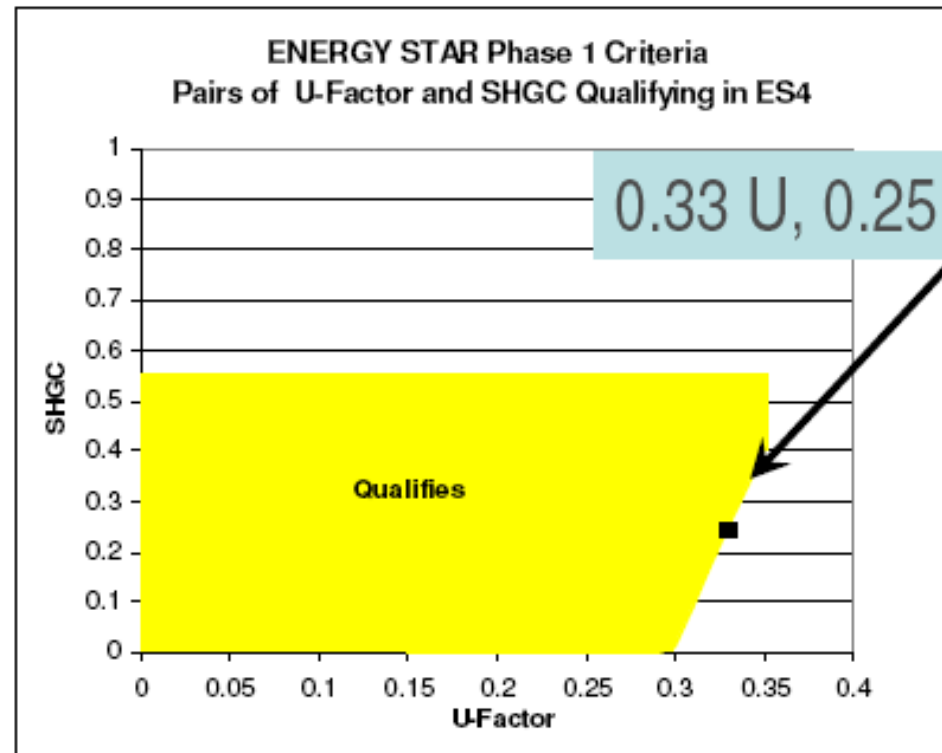


2009/2010 Draft Phase 1



Phase 1: ES4

U-factor	SHGC
	($\geq X$ and < 0.55)
	X
0.35	0.41
0.34	0.33
0.33	0.25
0.32	0.17
0.31	0.09
0.30	0.01
0.29	0.00
0.28	0.00
0.27	0.00
0.26	0.00
0.25	0.00
0.24	0.00
0.23	0.00
0.22	0.00
0.21	0.00
0.20	0.00
0.19	0.00
0.18	0.00
0.17	0.00
0.16	0.00
0.15	0.00



Trade-off -0.01 U = +0.08 SHGC

2013 - 15 (a/k/a Draft Phase 2)

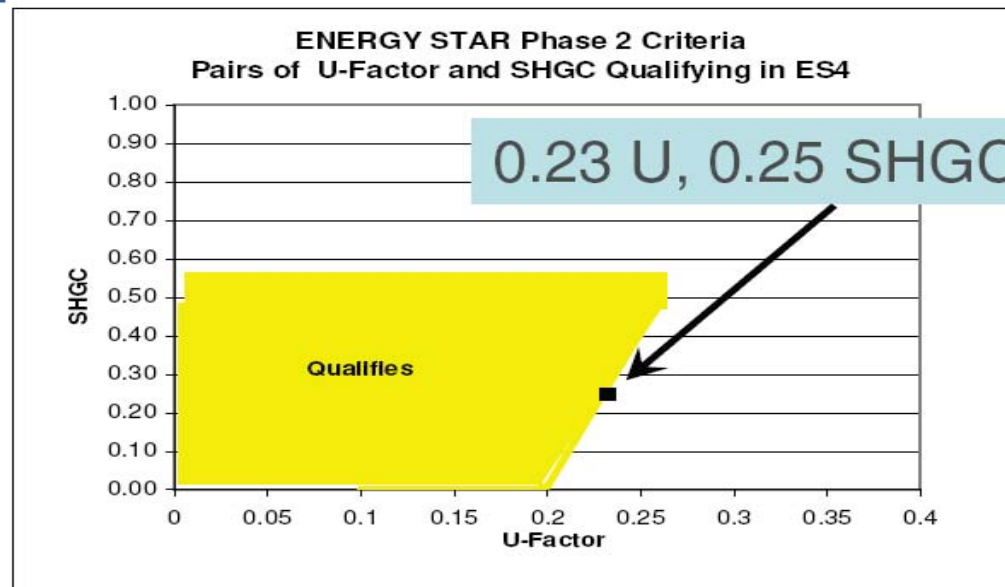


Phase 2, ES4



Phase 2: ES4

U-factor	SHGC $\geq X$ and ≤ 0.55
0.26	0.49
0.25	0.41
0.24	0.33
0.23	0.25
0.22	0.17
0.21	0.09
0.20	0.01
0.19	0.00
0.18	0.00
0.17	0.00
0.16	0.00
0.15	0.00
0.14	0.00
0.13	0.00
0.12	0.00
0.11	0.00
0.10	0.00

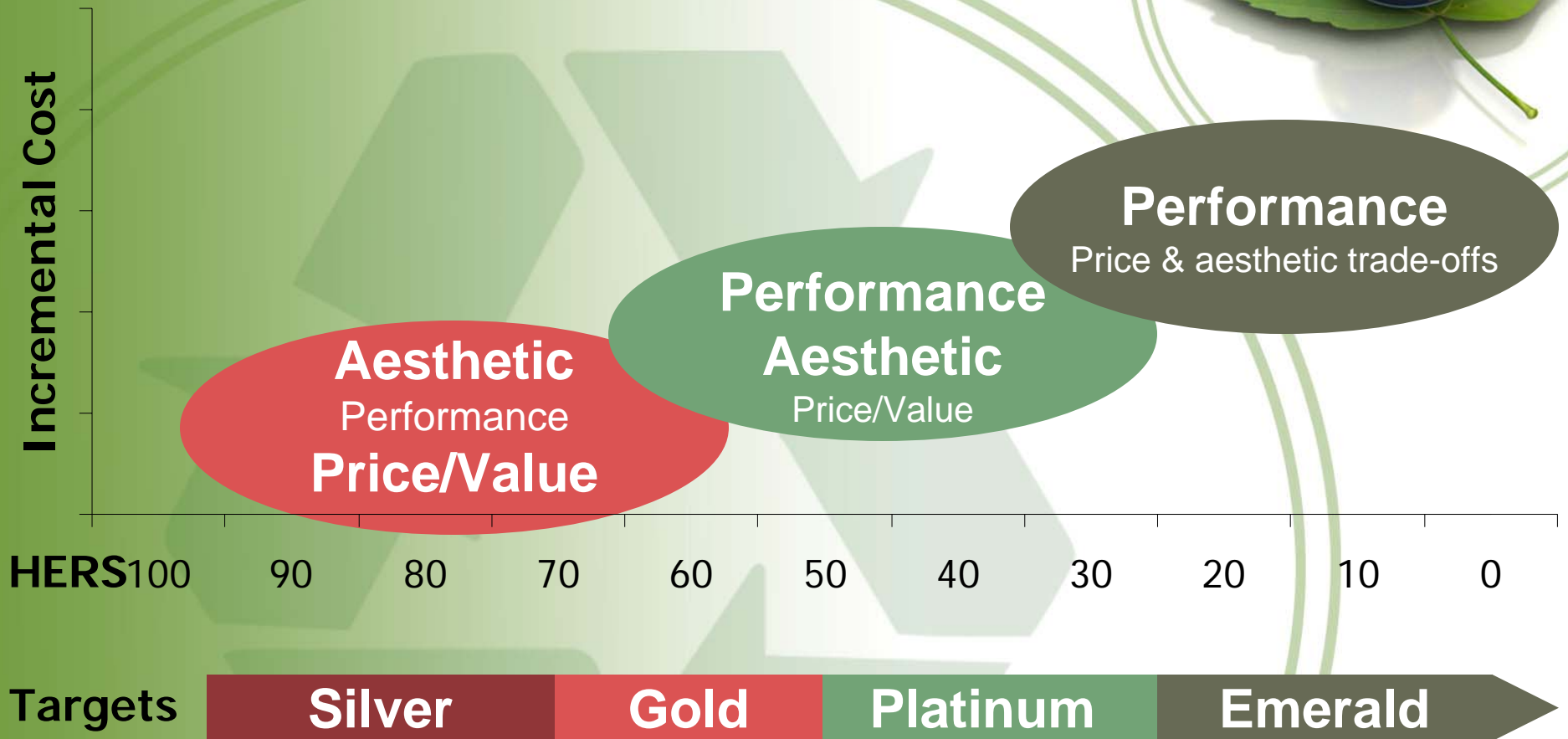


Trade-off -0.01 U = +0.08 SHGC

Windows and HERS Scores



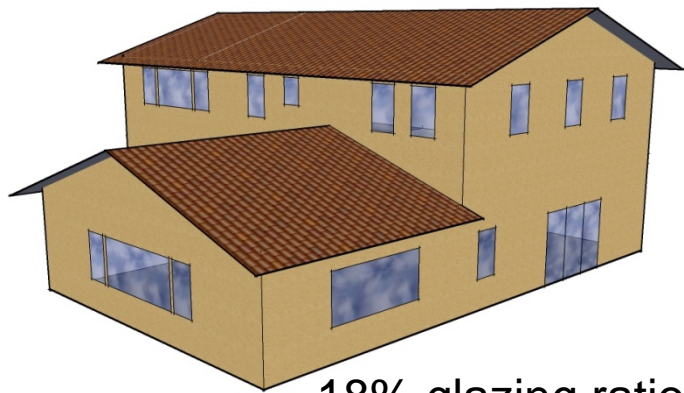
Windows and HERS



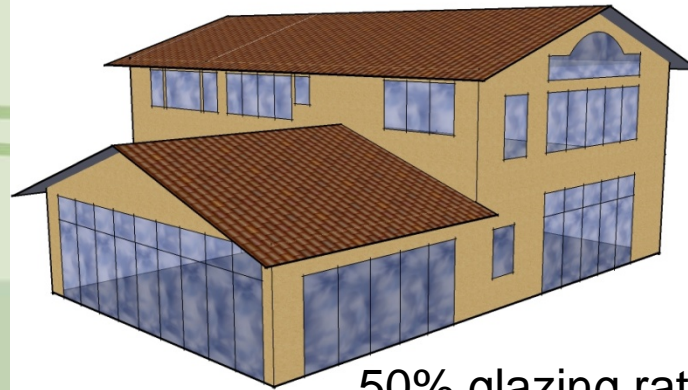
Key Variables: G/FAR, Sq. Ft., Glazing orientation, Performance targets

HERS Examples





18% glazing ratio



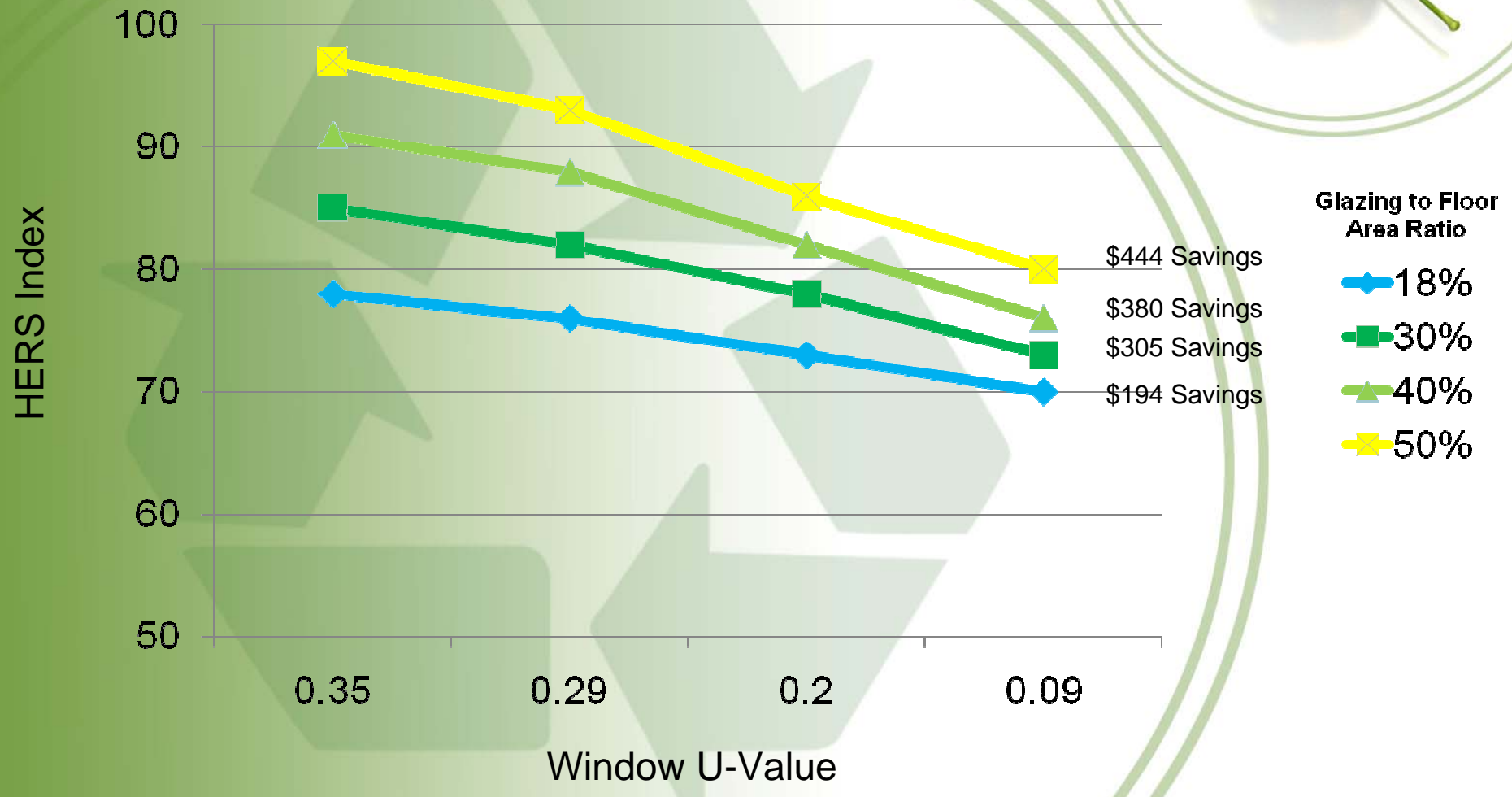
50% glazing ratio



Base model specifications

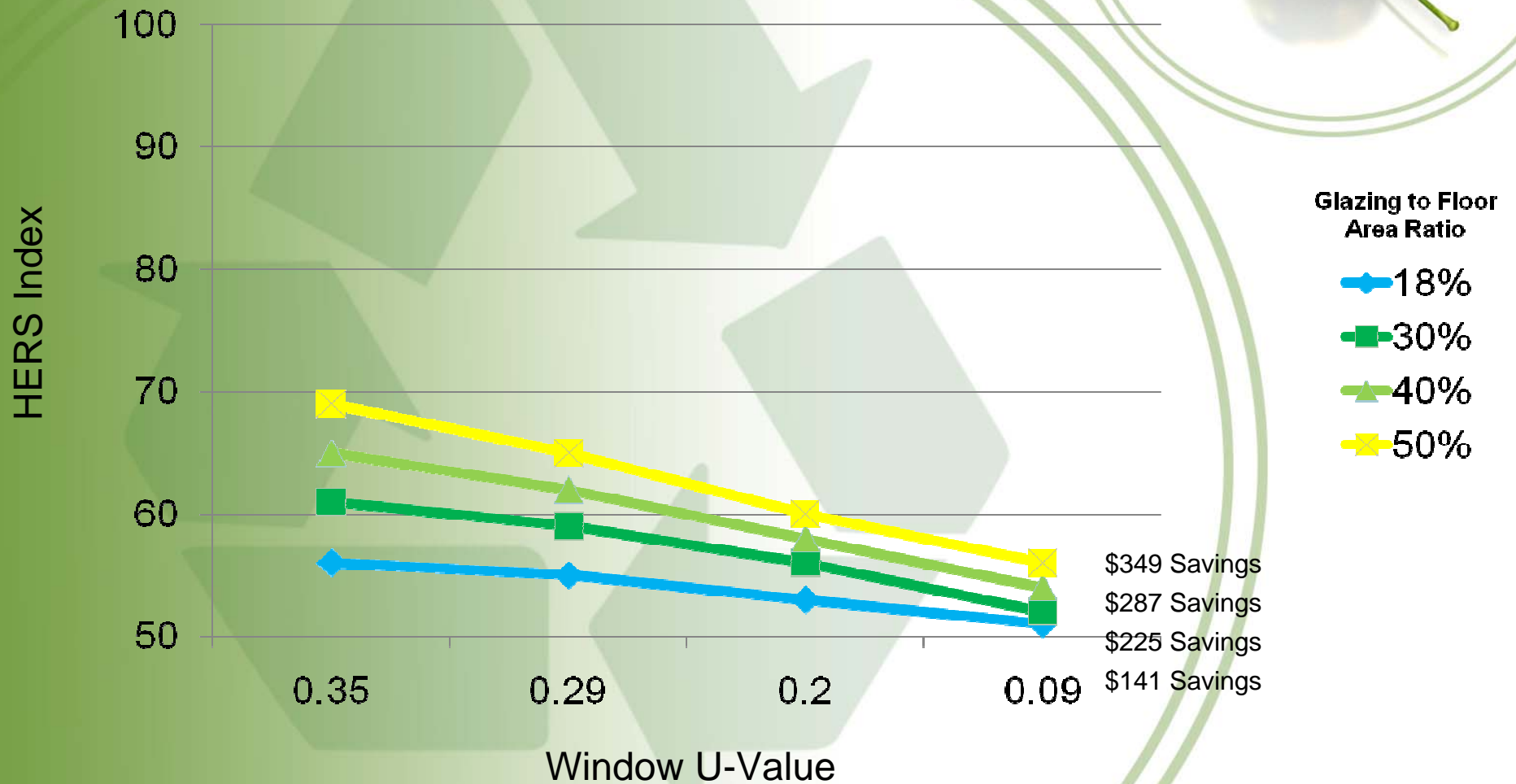
- 3,000 square foot home
- Slab-on-grade with R-10 perimeter insulation (Eco-Block)
- R-30 insulation in floors over unconditioned space
- R-19 rim and band joist insulation
- R-19 cavity insulation (no insulated sheathing)
- R-38 insulation at flat (trussed) and vaulted (stick-framed) ceilings
- Ducts 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

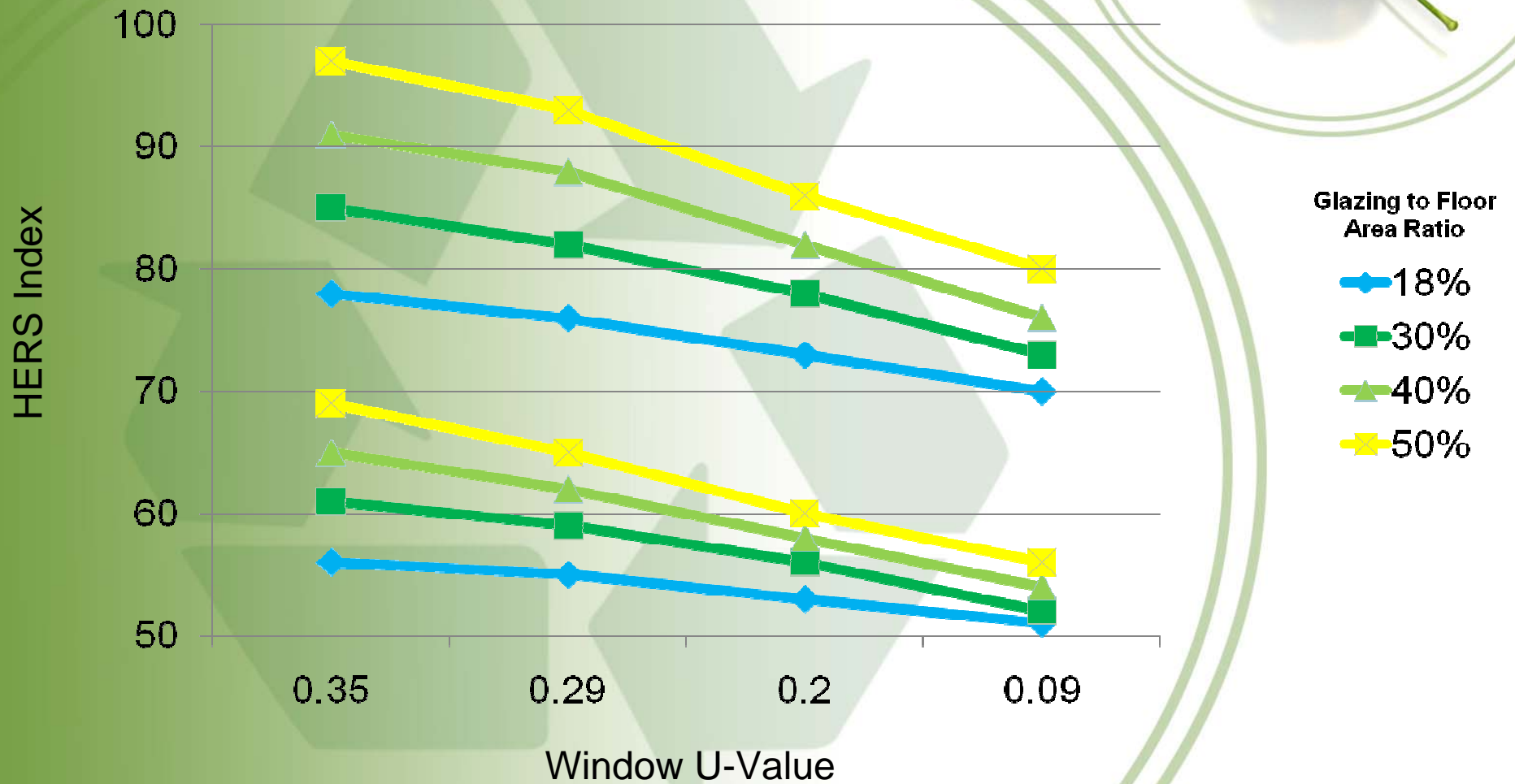


3,000 Square Foot Residence Ground Source Heat Pump

EER 14.6, COP 3.4



Glazing Performance vs. Overall System Performance

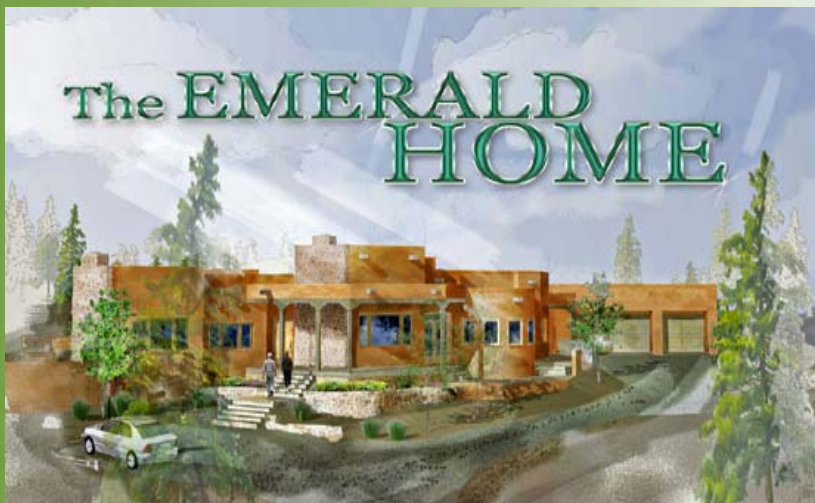




Build Green
New Mexico GOLD
HERS 57
Projected Utility
Costs \$922/yr



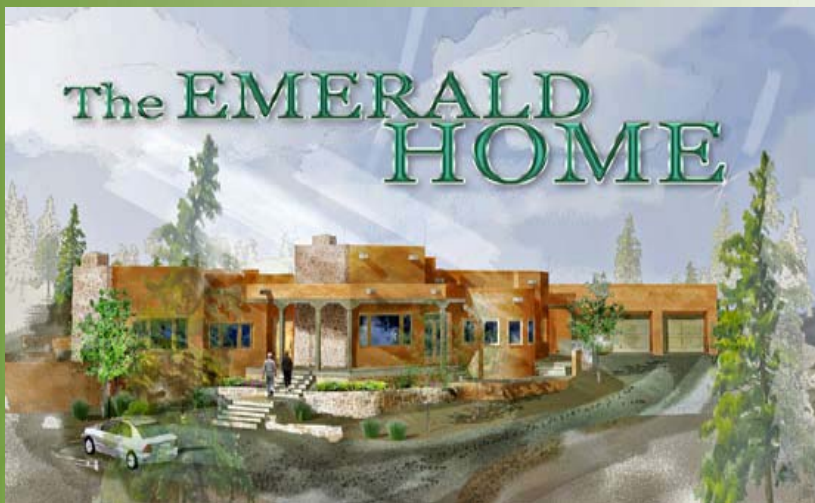
- 1,888 square foot home
- Slab-on-grade with R-22 perimeter insulation (Eco-Block)
- R-20.4 cellulose cavity insulation with insulated sheathing (R-3.6 to R-7.2)
- ENERGY STAR windows (U-value of 0.35 to 0.33; SHGC 0.28 to 0.30)
- R-56 blown cellulose insulation in attic
- 95.1% efficient boiler with side-arm for DHW
- Whole-house infiltration - 0.29 NACH heating / 0.21 NACH cooling
- Exhaust-only infiltration
- All incandescent lighting
- ENERGY STAR refrigerator
- Solar thermal (domestic hot water only) 2 panels, 80 gallon storage tank
- No solar photovoltaics



The Emerald Home
LEED Platinum
HERS -2
Projected Utility
Costs \$-311/yr



- 3,940 square foot home
- 10 KW solar photovoltaic array with sun tracking technology
- Slab-on-grade with R-42 perimeter insulation
- 11.25" double frame exterior wall system
- Serious Materials fiberglass frame windows; sashes and frames insulated
 - Glazing tuned to elevation; quad glazed N,E and W; suspended films
 - East and North elevations focused on insulation/moderate solar control (U-value of .13 to .18; SHGC of .29 to .33)
 - West elevation focused on solar control objective (U-value of .14 to .18; SHGC of .19 to .21)
 - South elevation focused optimized for passive solar control (U-value of .21 to .24; SHGC of .41 to .47)



The Emerald Home
LEED Platinum
HERS -2
Projected Utility
Costs \$-311/yr



If all else remains equal, changing this spec:

- High-performance windows tuned to elevation

to this spec:

- ENERGY STAR Compliant windows

results in a HERS Index increase of 2 points and an increase in projected annual utility costs of \$182.

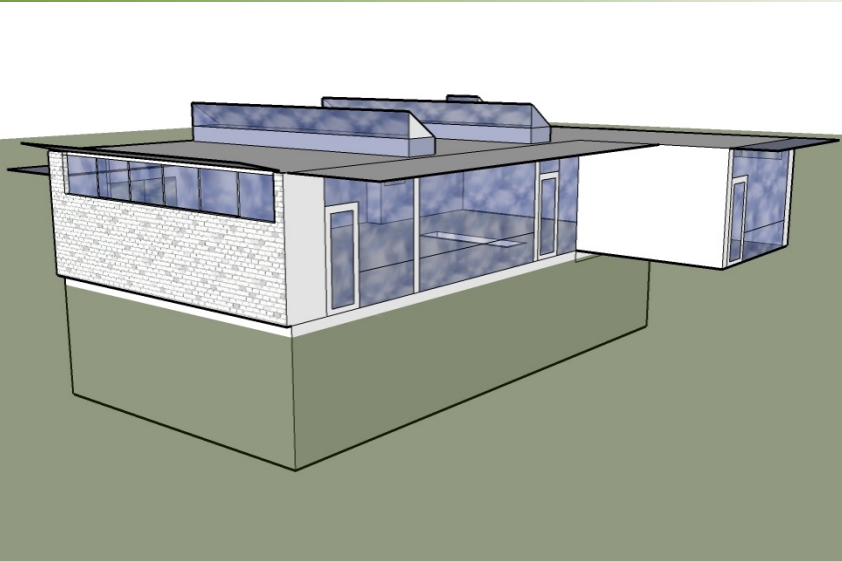
Taking all mechanical systems to code only, the HERS scores would go from 9 to 13.



- 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
Platinum
HERS -4
Projected Utility Costs -\$26/yr





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:

- 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.

Contact Us



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2009 and 2013-ES4



Phase 2 Draft ENERGY STAR Criteria Windows and Sliding Glass Doors



Climate Zone	Proposed 2009 IECC Levels		Draft Phase 2 Criteria		
	U-Factor	SHGC	U-Factor	SHGC	Energy Performance
ES5	≤ 0.35	NR	-	-	See Slide 26
ES4	≤ 0.35	NR	-	-	See Slide 27
ES3	≤ 0.35	NR	≤ 0.30	≤ 0.40	-
ES2	≤ 0.40	≤ 0.30	≤ 0.30	≤ 0.30	-
ES1	≤ 0.50	≤ 0.30	≤ 0.45	≤ 0.20	-