

Energy Code Trade-Offs vs. Window Comfort

Jim Larsen
Cardinal Glass Industries

Common Window Trade-Offs

UA

- Reduce window area
- Increase insulation elsewhere

Equipment Efficiency

- AFUE vs. window U
- SEER vs. window SHGC
- Lighting or Water heating vs. windows

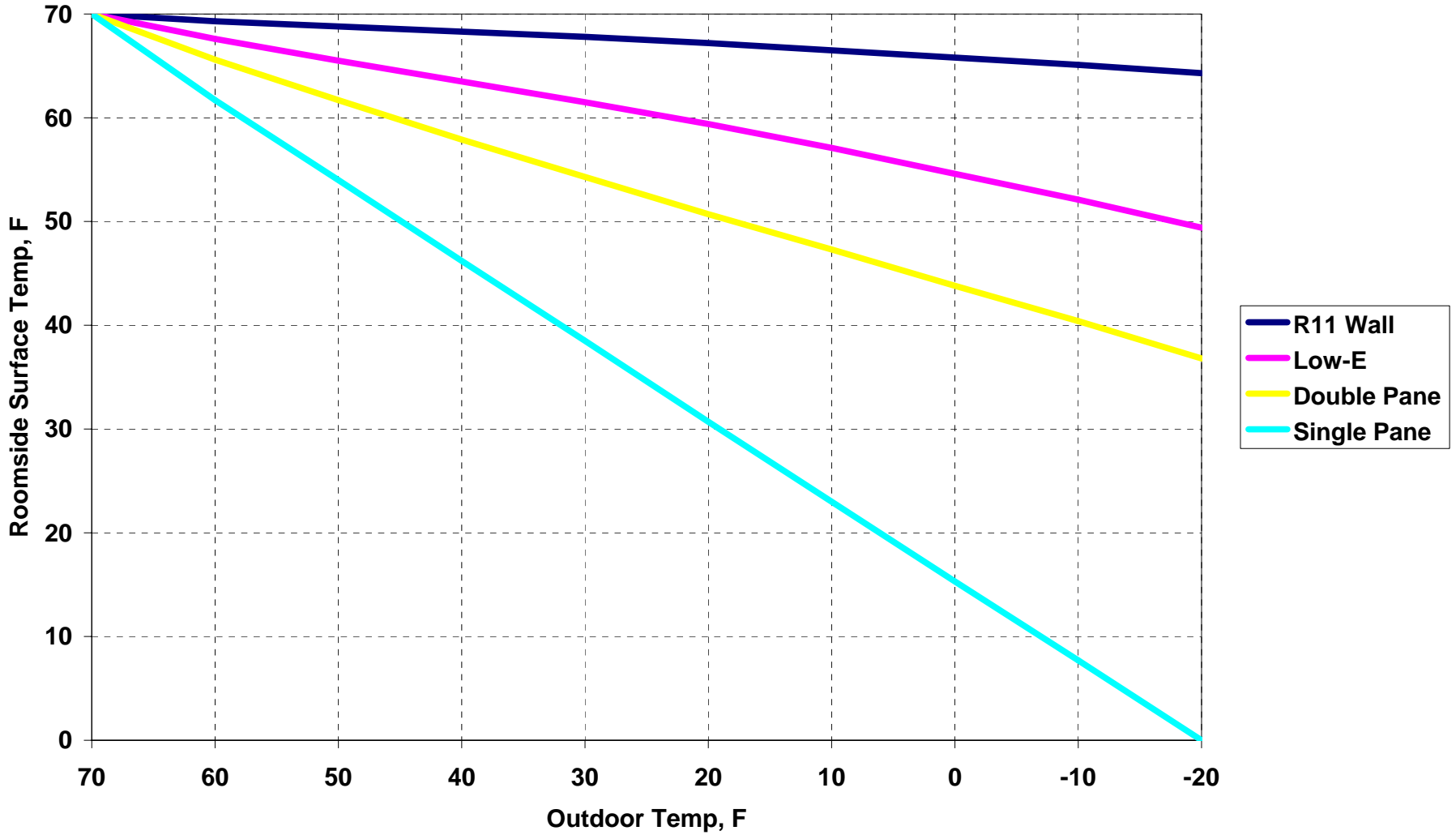
AFUE Trade-Off in Zone 5

- R38 Ceiling
- R19 Wall
- R10 Basement
- **U0.35** Window
- **78%** AFUE
Furnace

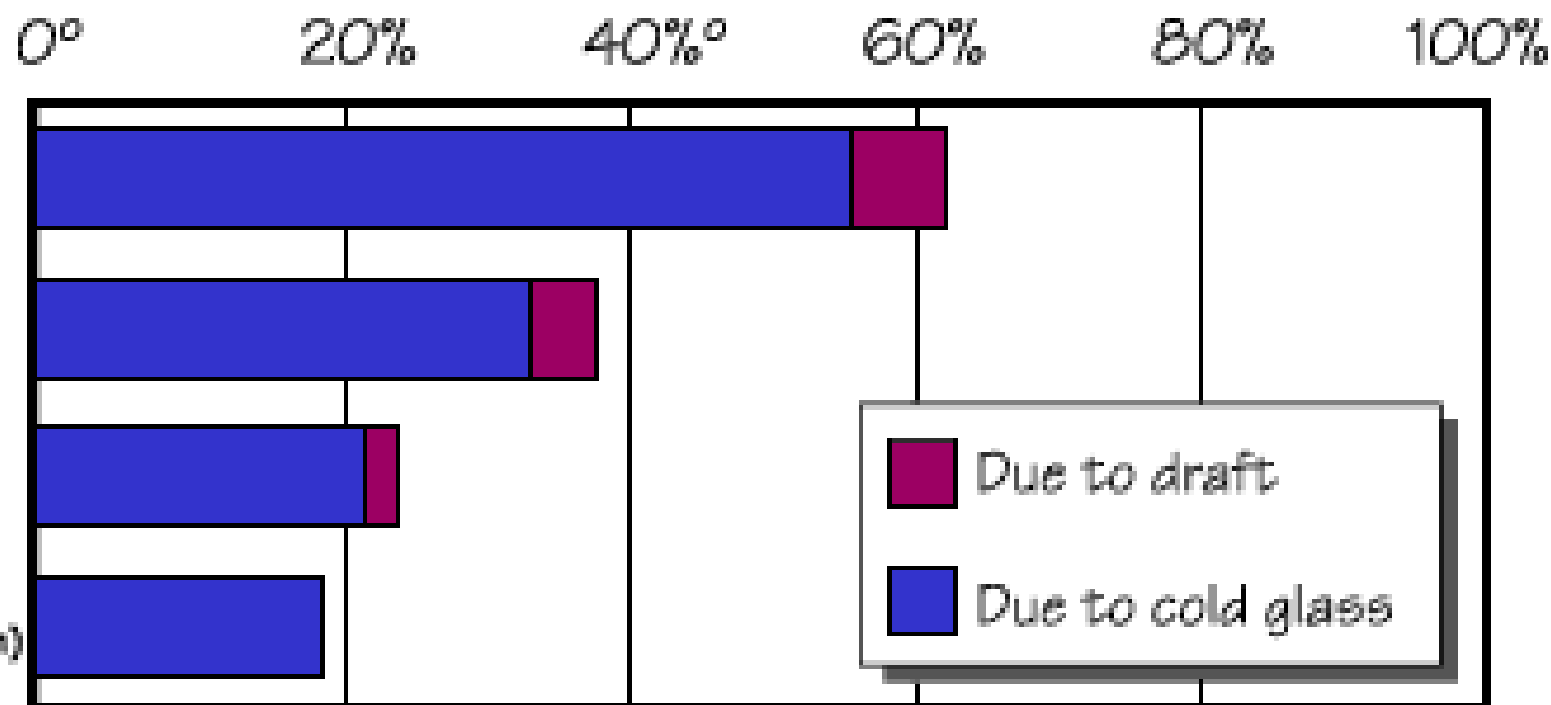
=

- R38 Ceiling
- R19 Wall
- R10 Basement
- **U0.55** Window
- **90%** AFUE
Furnace

Glass/Wall Temperatures vs. Weather Conditions



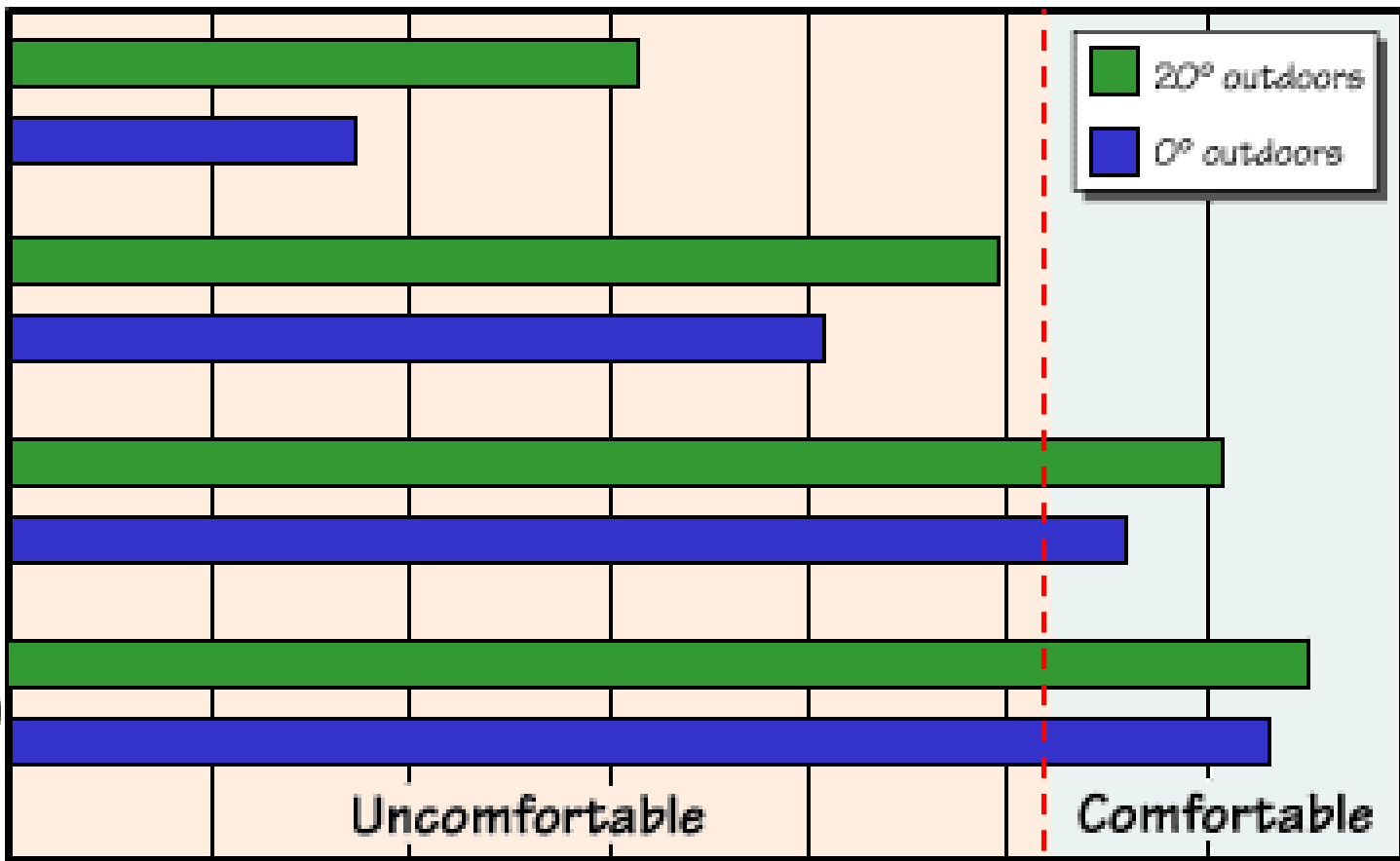
Probability of Discomfort



Inside Glass Surface Temperature (deg F)

0° 10° 20° 30° 40° 50° 60° 70°

single clear



20° outdoors
0° outdoors

double clear

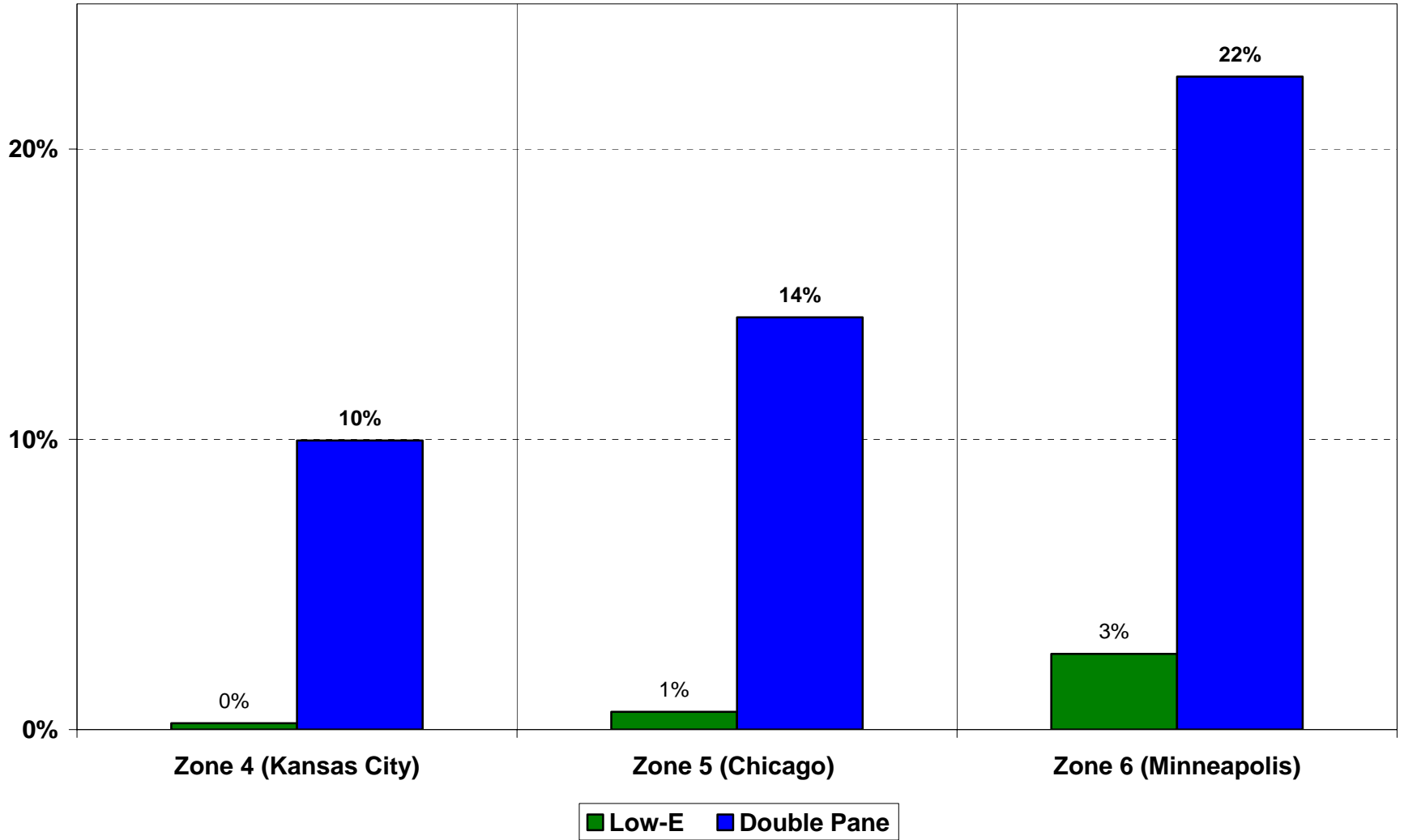
double low-E
(low solar gain)
argon gas

quad 2 low-E
(moderate solar gain)
krypton gas

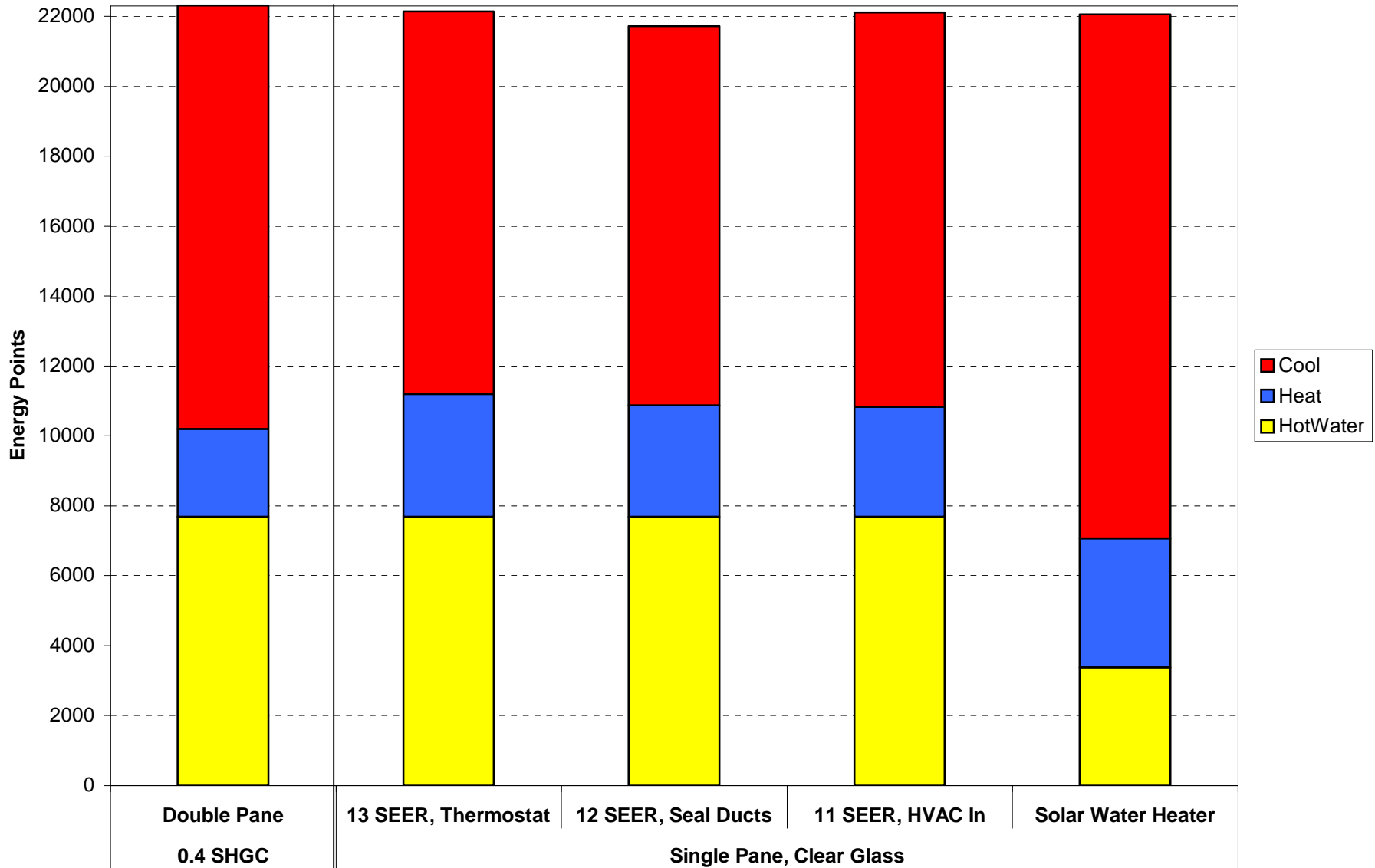
Uncomfortable

Comfortable

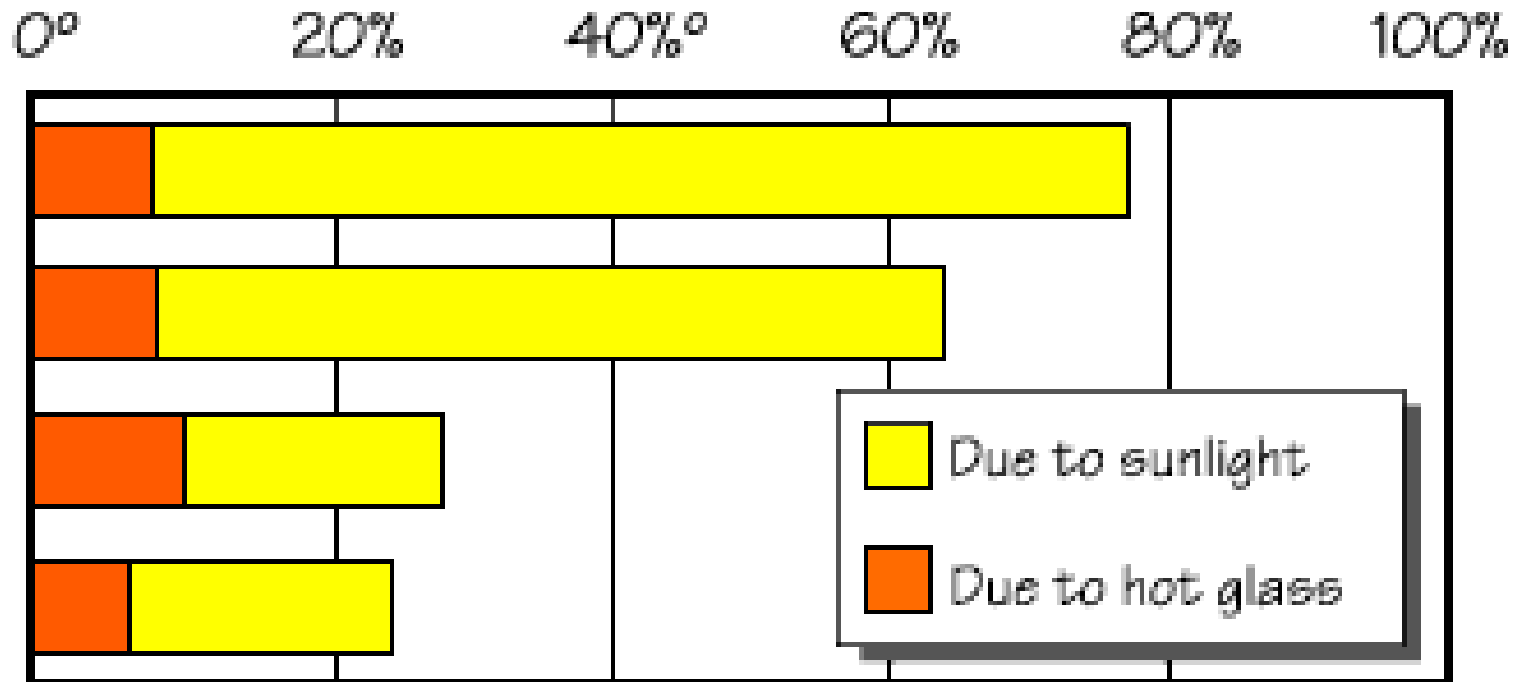
Night Hours where Glass Temp < 52F



Florida SHGC Trade-Off Examples



Probability of Discomfort



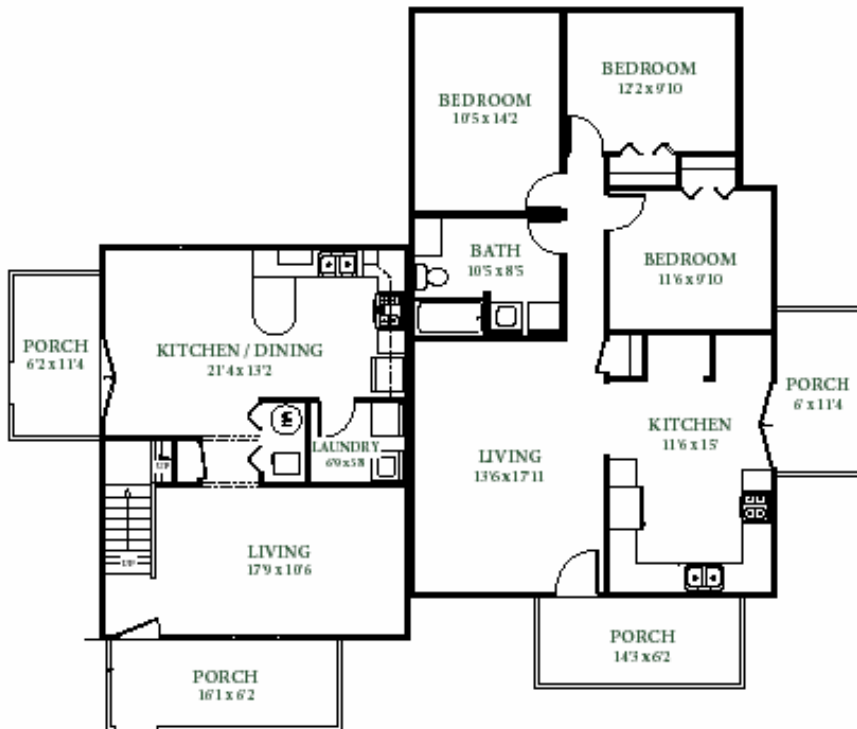
They Might Be Equal.....

But They're Not the Same!!

Comfort Example: Chicago Duplex



Building America Design

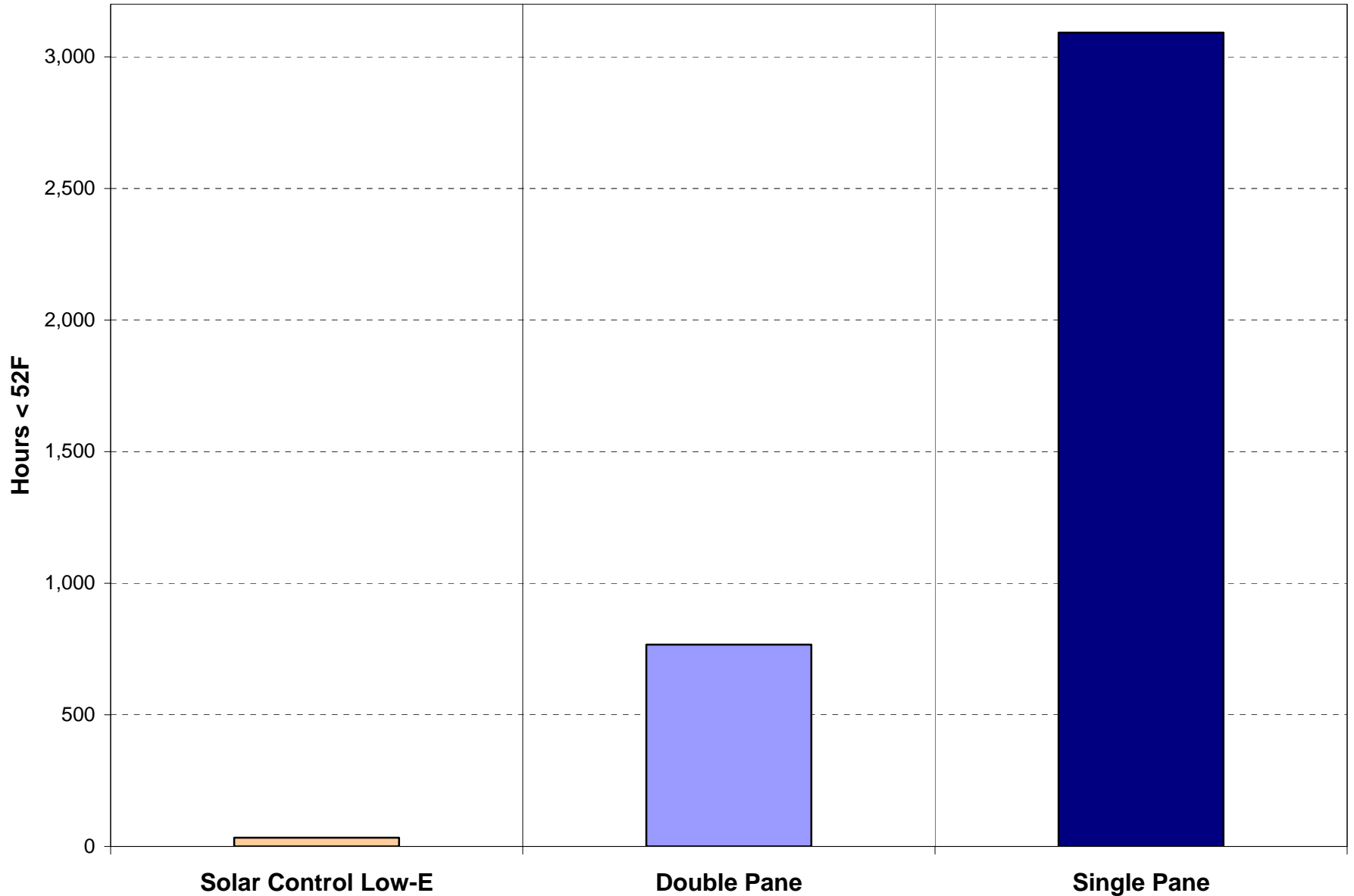


- Low Solar Gain Low-E Windows
- Conditioned basements
- Vented attic
- Mechanicals and ducts in conditioned space
- 87 HERS Score

Trade-Off Examples

	Solar Control Low-E	Double Pane	Single Pane
Window U	0.35	0.55	1.20
AFUE	78%	90%	90%
Window SHGC	0.35	0.60	0.70
SEER	10	10	12
HERS Score	87	87	86

Are These Equal Designs?



Response to Cold Glass

- Tuff it out
- Get off the sofa
- Leave the room
- Move away from the window
- Add clothing
- Raise the thermostat

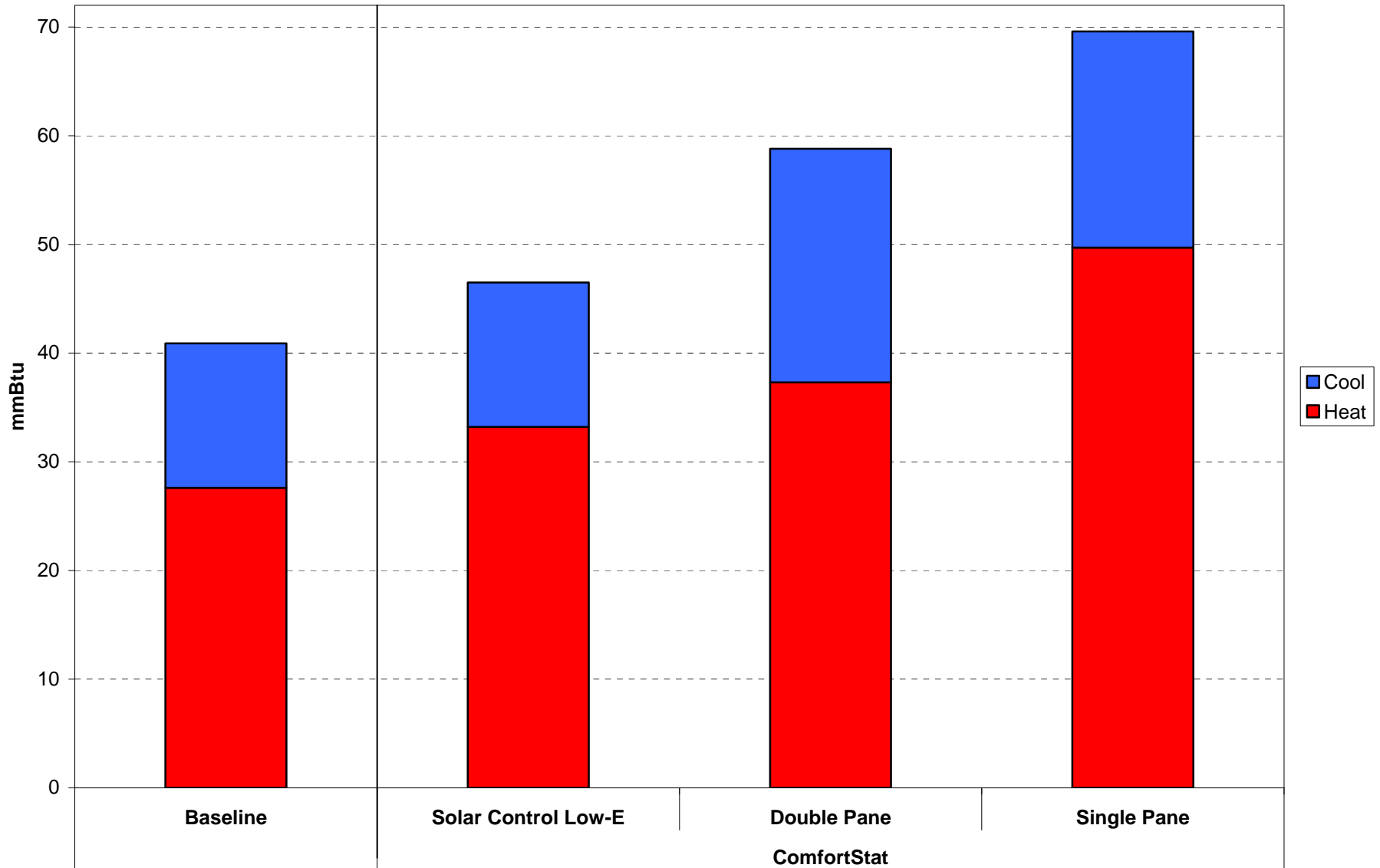
Response to Hot Glass

- Remove clothing
- Get out of the direct sun
- Close the blinds
- Lower the thermostat

Adjust Thermostat for Equal Comfort

	Heat	Cool
Wall	68°F	78°F
Low Solar Low-E	72°F	78°F
Double Pane	74°F	74°F
Single Pane	75°F	73°F

Energy Impact of Thermostat Change



Summary

Degradation of the “thermal” envelope can be overcome with equipment efficiency.

Degradation of the window “comfort” envelope will be overcome with:

- Comfort complaints
- Customer dissatisfaction
- Increased energy expense and pollution